# Global State of Young Scientists (GloSYS) in Africa

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ACADEMY

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# Main Research Report

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**About the Global Young Academy**

The vision of the GYA is science for all; science for the future, and its mission is to give a voice to young scientists and researchers around the world. The GYA, founded in 2010, is an independent science academy of 200 outstanding early- to mid-career researchers from six continents who are selected from across disciplines based on their academic excellence and commitment to engage with society. GYA members serve five-year terms, and the GYA presently counts members and alumni from more than 100 countries. The GYA administrative Office is publicly funded and hosted at the German National Academy of Sciences Leopoldina. The wide array of GYA activities are supported by a range of international public and private funders.

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# Acknowledgements

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Anna Coussens, Abdeslam Badre, Fridah Kanana Erastus, Abidemi Akindele and Mona Khoury
GYA GloSYS-Africa Champions, on behalf of the GloSYS working group

# Statement of contributions

The GloSYS Africa study design and implementation was co-led by GYA members (now alumni) Abdeslam Badre (AB), Anna K Coussens (AKC), Fridah Kanana Erastus (FKE), Abidemi Akindele (AA) and Mona Khoury (MKK). GloSYS Africa Researchers Johannes Geffers (JG) and Marie L Neumann (MLN) also contributed to study design and implementation, and managed project coordination and reporting, while Matt Keane (MK) contributed to study coordination, reporting, data handing and analyses.

The previous GloSYS ASEAN quantitative survey was revised and extended by MLN, AKC, AB, FKE, AA, MKK, JG, and GYA alumni Hsin-Chou Yang (HCY). MLN created and managed the online survey. Research ethics approvals were coordinated by AKC, MLN, AB and African research partners Yamina El Kirat El Allame (YEK), Felix Maringe (FM), Emmanuel Ojo (EO), and Jean Uwamahoro (JU). HCY and Yin-Chun Lin (YCL) performed the statistical analyses and generated results figures. Final figures were also created by AKC and MK, who also synthesised and integrated multivariate results. MK performed study size calculations.

The GloSYS ASEAN qualitative interview questions were revised by MN, AB, AKC, MKK, FKE, AA and research advisor Lynn McAlpine (University of Oxford, UK and McGill University, Canada) who designed the narrative methodology and trained the research assistants to perform interviews and code qualitative data, with AB and MN. Research assistant Otilia Chiramba (OC) performed the majority of interviews, coded data and contributed to qualitative analyses. GloSYS Africa Research Partners YEK, FM, EO, JU, Ibrahim Oanda Ogachi (IOO) and Uchenna Udeani (UU) contributed to quantitative survey design and supervised research assistants (OC, Hamza Saidi, Judith Nagasha, Martin Wasike, Raphael Yewande and Irenee Ndayambaje) during the collection of regional indicator data, and drafted regional indicator reports. MK collected and integrated the indicator data for the comparative regional report.

The GloSYS Africa Lead Team, along with HCY, MK, JG and OC contributed to interpretation of the results. The Executive Summary was drafted by JG and AKC. Chapter 1 was drafted by AB. Chapter 2 was drafted by JG and AB . Chapter 3 was drafted by MK, MKK, HCY and AKC. GYA members Roula Inglesi-Lotz and John Ganle integrated regional indicator reports prepared by YEK, FM, EO, JU , IOO, and drafted the regional comparison in Chapter 4. MKK, MK and AKC drafted Chapter 5. JG performed literature reviews and drafted introductions and conclusions for Chapters 6-11. FKE, MK, AB and AKC drafted results for Chapter 6. AKC and MK drafted results for Chapter 7. MKK, AB, MK and AKC drafted results for Chapter 8. FKE, MK and AB drafted results for Chapter 9. AA and MK drafted results for Chapter 10. AKC and MK drafted results for Chapter 11. JG drafted the Conclusion. JG and AKC revised all chapters to address reviewers' comments. All editors contributed to chapter reviewing, developing the recommendations and approving the final version.

Project governance was managed by GYA Managing Directors Beate Wagner and Heidi Wedel and supported by GYA Co-Chairs Prof Tolu Oni and Dr Connie Nshemereirwe. Editorial and typesetting oversight was carried out by GYA Senior Communication Officer James Curtiss.

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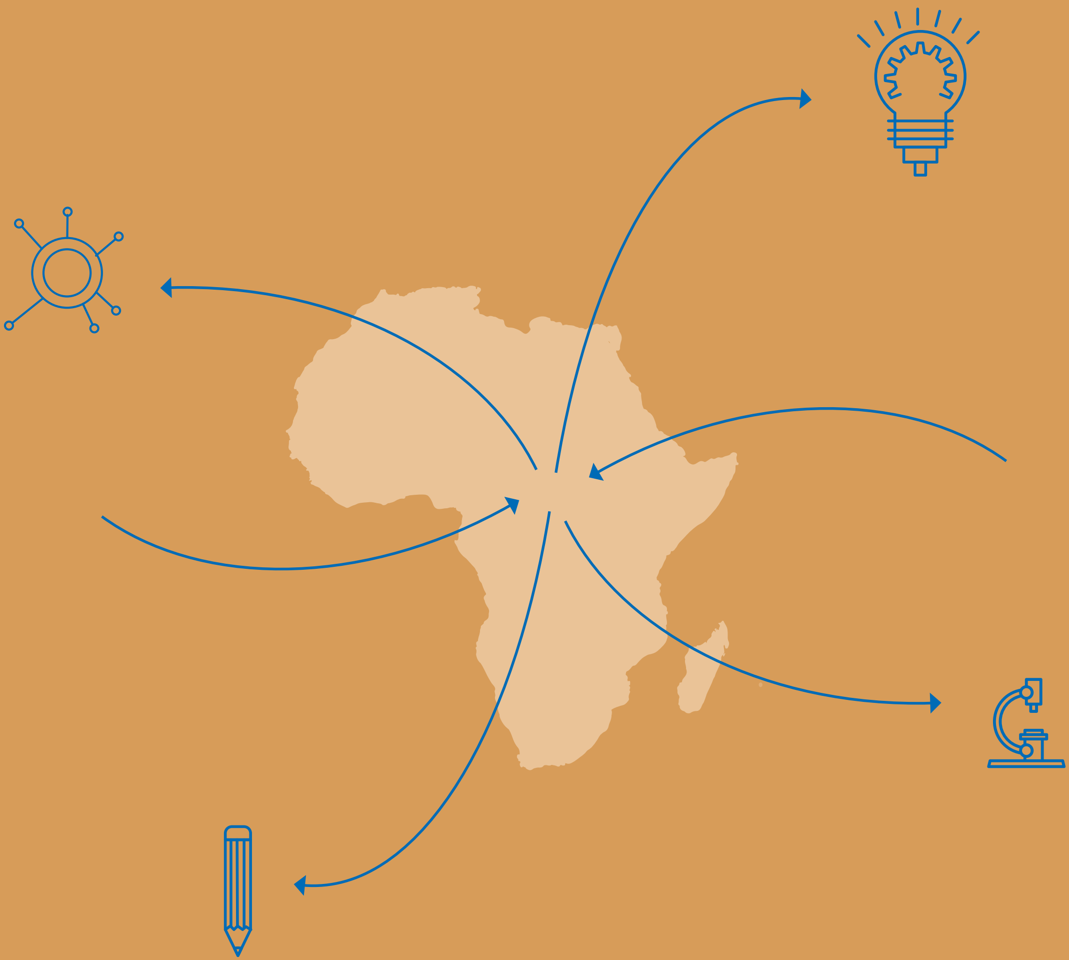


# Executive Summary

Young scientists and scholars from all fields of research have been widely acknowledged as particularly relevant to the creation and diffusion of knowledge, both for research and for teaching the next generation of highly qualified human resources. Given the demographic development and the growing demand for advanced higher education training in Africa, African countries depend on the successful development of highly trained academic staff to deliver to these needs. Shortages in academic and research staff directly translate to barriers to the expansion of higher education institutions (HEIs) and a loss of quality of education, and therefore impede the transformation of African countries to knowledge economies with sustainable labour markets and research and innovation systems that can deliver on the needs of societies in Africa, including confronting health and environmental challenges.

Yet, young scientists and scholars – or early career researchers (ECRs) – in Africa are facing persistent challenges and barriers, often causing them to abandon their research careers or leave their countries to pursue their careers abroad. Even those wishing to return to their home countries often face insufficient infrastructure and regulations, or organisational cultures that make them consider leaving again.

Monitoring of ECRs and research on their formation and career development has gained much attention in recent years in many economically strong countries with mature higher education systems – particularly in Europe and North America – with results from the analyses feeding into dedicated programmes for their development. Taking note of the lack or insufficiency of knowledge in other regions of the world, in Africa, Asia and Latin America in particular, the GYA has made it a strategic aim to improve the knowledge on ECRs in these regions, to provide evidence-based recommendations, and to include these regions in ongoing scholarly discussions on changes of the higher education and science systems.

The Global State of Young Scientists (GloSYS) projects are strategic flagship projects of the GYA that aim to connect with local researchers, National Young Academies and other regional and international stakeholders to deliver excellent research and evidence-based policy recommendations that connect to international trends, while at the same time paying attention to current regional needs and the history of the science and education systems in the respective countries under examination.

## Study design and sample

GloSYS regional studies including GloSYS Africa, the completed GloSYS Association of Southeast Asian Nations (ASEAN), and the planned GloSYS LAC (Latin America and the Caribbean) share a common methodological framework: a shared definition of the target group, a mixed methods approach including the use of data from statistical sources on country related indicators, a core set of questions as part of an online survey administered to ECRs, and a semi-structured interview. While a core set of data is collected throughout all studies to allow for international comparisons, as well as their changes over time, necessary adaptions and additional questions specific to the regional context allow to focus on topics of particular relevance for the regional study.

The target group of GloSYS studies are young scientists or scholars defined as postgraduates who have earned their Doctor of Philosophy (PhD) or an equivalent advanced research qualification in the last 10 years, and are usually between 30 and 40 years old. Respondents can work in any sector where research is conducted, including higher education, private/public funded research organisations, business enterprises or non-governmental organisations (NGOs). For the purpose of GloSYS Africa, ECRs with a Master's degree as their highest qualification were also included to account for the fact that many professionals in the field without a PhD are making relevant contributions to research, as well as academic teaching. Earning a PhD in Africa is a challenge in itself that this study aims to explore. GloSYS Africa also included responses from ECRs not currently working, either due to long-term leave or unemployment, in order to document the full diversity of experiences and career trajectories of African ECRs.

Survey responses were eligible from any researcher currently working in one of the 54 African countries, irrespective of country of birth, as well as African nationals currently working in any country outside Africa. To enable regional comparisons, data collected from 14 pre-specified focal countries (Cameroon, Egypt, Ghana, Kenya, Mauritius, Morocco, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tunisia, Uganda and Zimbabwe) were grouped into 4 regions (Northern, Eastern, Western, and Southern), not based on politically-defined regions but relative geographical closeness. During regional comparisons, additional responses from individuals not corresponding to one of these regions were categorised as "non-focal Africa" or "outside Africa".

We received 1,157 eligible responses to our online survey, with the majority of respondents (1,106) born in 42 of the 54 African nations, and a further 51 respondents born in one of 18 countries outside Africa. Of the 1,106 African nationals, the majority were living somewhere in Africa, whilst 94 were currently living in one of 32 countries outside Africa. From the participants of our online survey, 61 ECRs born or living in one of the 14 focal countries were interviewed, the instruments transcribed verbatim and analysed. Results from this qualitative part of the study were used for the interpretation of the findings from the survey, and the core results were also published separately.[1]

1 McAlpine, L., Chiramba, O., Keane, M., Badre, A., and Kareem, F. (2020). Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective. https://globalyoungacademy.net/wp-content/uploads/2021/04/Voices_of_Early_Career_Researchers_in_and_out_of_the_Academy.pdf

## Main findings

### Motivations and realities of pursuing a research career

- Our findings portray a highly motivated group with a passion for research and learning, and a motivation to apply newly generated knowledge to improve society. Further core motivational strands were the desire to work internationally and to train the next generation of students.
- The main barriers identified by ECRs that inhibit their professional development are a lack of funding and support in attaining funding, limited access to adequate training, mentorship and supervision, and high teaching loads combined with insufficient infrastructure and organisational support.

### Career satisfaction, workload and promotion

- About half of the ECRs (54 % to 58 %, varying by employment sector) that participated in our study were generally or very satisfied with their current position. This finding is similar to previous research on junior academic staff within the Changing Academic Profession study published in 2013, which indicated a share of 59 % who were satisfied or very satisfied junior academics.
- Satisfaction with job security was reported by 54 % of our respondents from higher education, 49 % in research organisations, and 34 % in other employment sectors. Across the same employment sectors, satisfaction with income levels was much lower: 24 % in higher education, 38 % in research organisations and 33 % in other employment sectors.
- In sum, the tension between a strong motivation to continue their careers and the limited resources available, coupled with poor remuneration, resulted in a decrease in career confidence since graduation, with two out of three ECRs considering or having considered leaving their employment sector for a different one.
- In alignment with previous studies, insufficiencies in research and teaching infrastructure were a major reason for dissatisfaction, although there were considerable regional differences with those working in the West, North and East Africa being most dissatisfied with research infrastructure.
- Our findings indicate that ECRs work an average of 40 hours per week, except for those living in the South Africa region, who reported a significantly higher median of 45hr/week. The highest 25 % of respondents in all regions reported working an average of 45–50hr/week.
- Our data on the allocation of time across different tasks indicate a desire to spend more time pursuing research and applying for funding, and a desire to reduce time spent on administrative tasks and teaching. Higher shares of time allocated to teaching for young scientists and scholars in emerging countries compared to those in economically more advanced countries has been found in previous international comparative studies. High teaching loads not only impede the development of a research agenda during this crucial career phase, it also decreases research productivity, placing African ECRs at a disadvantage when competing for international funding.
- The predominant focus on (research) metrics (e. g. number of publications, PhDs and Master's graduated) in the assessment of the achievements of ECRs' work is considered inadequate for an evaluation of their teaching and research. Our respondents do not argue against evaluations in general, yet the focus on quantity is perceived as potentially detrimental to the quality of teaching, and the recognition of insufficient resources and administrative support to the pursuit of quality research.

### Inequities in research

- Inequitable hiring practises (59.4 %), racial discrimination (51.8 %) and restrictions on geographical mobility (51.7 %) were the most reported perceived hinderances to career success.
- The experience of inequality was associated with decreased job satisfaction, productivity and working hours.

- Linguistic barriers increased difficulties in funding success for African researchers for whom English was not their first language, as well as those in the diaspora where they did not speak the primary language.
- Compared to their male peers, female researchers were significantly more likely to report gender-based harassment. Our data also indicates a negative association between the experience of gender-based harassment and both job satisfaction and the number of journal articles published. Identifying a causal relation between productivity and unequal treatment was beyond the scope of our study, and would require further investigation.
- More male than female respondents reported having children (62.4 % vs 47 %), and of those with children, more males also reported having lived, worked, or studied internationally in the last 10 years (68.8 % vs. 54.6 %). Given the importance of mobility on increased publication and funding success, increasing female accessibility to mobility may increase opportunity equity.
- Harassment based on power and inequitable hiring practices were explored as mechanisms enabling inequalities. Harassment based on power, such as superiors using the work of young scientists or scholars without adequately acknowledgment, was significantly more often reported by females (roughly one in six) than by their male peers (about one in eight).
- Unequal treatment based on race/ethnicity was reported by about one in five of our respondents. A common theme in our interviews related to this topic was the preconception that African young scientists and scholars were often not considered as competent as their non-African peers and therefore had to spend additional time proving themselves.

### Mentorship and support

- Our findings indicate a lack of mentorship and administrative support. Though a majority of survey participants stated that they had a mentor, there was considerable regional variation: this was highest for those born in the Western Africa region (86.2 %) and lowest for those born in the North Africa region (63.2 %).
- Whilst the majority of those with a mentor agreed that their mentors had the required skills, the general picture of our combined data from the survey and the interviews was of insufficient support. Our interpretation, which converges with findings from a similar study on African young scientists, is that ECRs are formally connected to a mentor, but their availability is insufficient for the demand.
- In our data, families and communities have emerged as a strong source of support for ECRs in Africa. This highlights the fact that careers in science are highly demanding, often requiring long hours and a general expectation to be mobile. In particular, ECRs with children highlight the importance of support from their partners and families. Females were also more likely to have a father who completed a PhD than one having no formal education, and were more likely to have a mother with a secondary or non-academic post-secondary education, than male respondents
- Four out of five respondents did not see themselves only in a receiving role, but stated a desire to train the next generation of students and researchers. One in five of those young scientists and scholars already in a mentoring position stated that they would benefit from further training to better support their mentees.

### Funding for research

- Whilst a full-time permanent position is sought after in any career, only 53.5 % of our respondents had such a position. Approximately one-third (30.7 %) of respondents' positions were "soft-funded", meaning they relied on funding from grants for the continuation of their positions and their salary was not covered by their employing institution.
- The lack or insufficiency of funding to conduct excellent research is a severe impediment for young scientists and scholars in Africa. Fully 42.3 % of our respondents in need of funding had not been able to acquire funding in the three years prior to the survey. Of those who have received funding, almost half (44.6 %) stated that the funding was not sufficient to account for expenses (research, travel and salary).

- Amongst all respondents, those born in the Western Africa region were less likely to have received funding than those born in either East and South Africa regions, as well as those born outside Africa.
- Not having access to funding for research in the prior 3 years significantly correlated with lower rates of published outputs and conference presentations over the same time period.
- More than three out of 10 respondents (31.1 %) acquired funding from an international organisation based outside Africa, highlighting the still considerable dependency on foreign funding for research conducted in Africa. Further sources for funding were international organisations within Africa (10.4 %), the respondents' own institution (27.4 %), or government institutions within their own country (23.2 %).
- Almost two out five (37.4 %) ECRs stated that the availability of funding had a strong impact on their research topics and agenda. Compared to previous studies on how scientists adapted their research to different funding sources, our findings indicate that international mobility is a strategy particularly relevant for African ECRs. Completing a Master's outside Africa associated with increased recent funding success.
- A further finding is a lack of support reported by ECRs in identifying sources for funding and applying for funds in an efficient way. Almost six out of ten (57.9 %) of those responding to our survey "agreed" or "strongly agreed" that this had a negative impact on their careers. An increase in grant administrative support and application feedback were noted as desired improvements to aid success.

**International mobility and collaborations**

- African ECRs are highly mobile. Only 74 % of respondents are citizens where they are currently based. Most (64.5 %) African-born respondents had moved countries at least once in their life, while about half (53.3 %) had moved at least twice and 20.1 % had moved counties three or more times.
- Almost half of our respondents (45.9 %) earned their PhD abroad, and roughly 3 in 10 (29.3 %) moved to another country from the one they were born for their Master's degree.
- The most common form of recent mobility were trips with a duration of less than one year. Even such short stays abroad were reported to be highly valuable, enabling ECRs to conduct and complete research that would have taken considerably longer in their home countries.
- Strong motivators contributing to higher international mobility included access to equipment, better facilities in general, opportunities for networking, topical expertise, as well as economic factors and better opportunities for publishing.
- Strong barriers to international mobility were language differences as well as discrimination and unfair treatment. Unfair treatment and experiences of discrimination were experienced by both those who travelled within and outside of Africa. Our findings on discrimination and unfair treatment within Africa align with similar findings of recent studies, attributing the negative experiences to xenophobia, racism and increasing neo-nationalism.
- Further factors contributing to lower rates of mobility are family obligations and other social circumstances.
- Factors such as a sense of duty or family ties have a strong influence on the desire to return home.
- Four out of five (80 %) respondents indicated that they were considering leaving Africa at some point in their career, with no difference between those who already had left and those who had not.

The most common motivations for leaving Africa were related to career development opportunities (34.7 %) such as better access to collaboration networks, the opportunity to create their own research team or new research areas, or acquisition of new skills. An additional 28.4 % identified moving to a more prestigious institution and/or having better prospects for career advancement, whilst 15.2 % indicated they had moved for better salary or employment benefits.

## Recommendations

Our study provides a thorough review of the main factors facilitating and inhibiting successful careers of young scientists and scholars in Africa. African institutions at the continental, regional and national levels have recognised the importance of ECRs and have engaged in improving the state of science and higher education systems in general, and many have also started to directly focus on improving the state of young scientists and scholars in Africa. However, the state of play is still insufficient for the next generation of ECRs to take on their designated role outlined in the respective agendas for the continued transformation of African societies into knowledge-based societies. Considering our findings, we suggest the following overarching recommendations.

1. **Allocate policies and approaches to availability, access, and integrity of regionally comparable data.** This includes policies and measures such as enabling and supporting HEIs, research organisations and statistical agencies to collect, collate and archive their data, as well as adopting and implementing open data legislation.

2. **Facilitate the retention of African ECRs in research-oriented careers.** This includes policies and measures such as different stakeholders collaboratively implementing existing policies for improving the working conditions of ECRs and partaking in further monitoring and research on the state of ECRs at the national and regional levels to guide further interventions.

3. **Implement promotion standards and guidelines that are based on quality of work to enable ECRs to conduct impactful research.** This includes policies and measures such as implementing and maintaining structured student evaluations of teaching and graduate supervision, recognising the graduate students' supervisory work done by ECRs, increasing staff-to-student-ratio to reduce teaching and evaluation burdens, or investing in infrastructure or research hubs with trained support staff to run and maintain the equipment.

4. **Remove inequities in the policies and practices of institutions and government bodies.** This includes policies and measures such as designing, implementing and monitoring policies on equity in hiring and selection guidelines and application assessments; improving the provision of reasonable support for ECRs that have children; designing tailored international scholarships and fellowships to provide supplemental funding for childcare and travel.

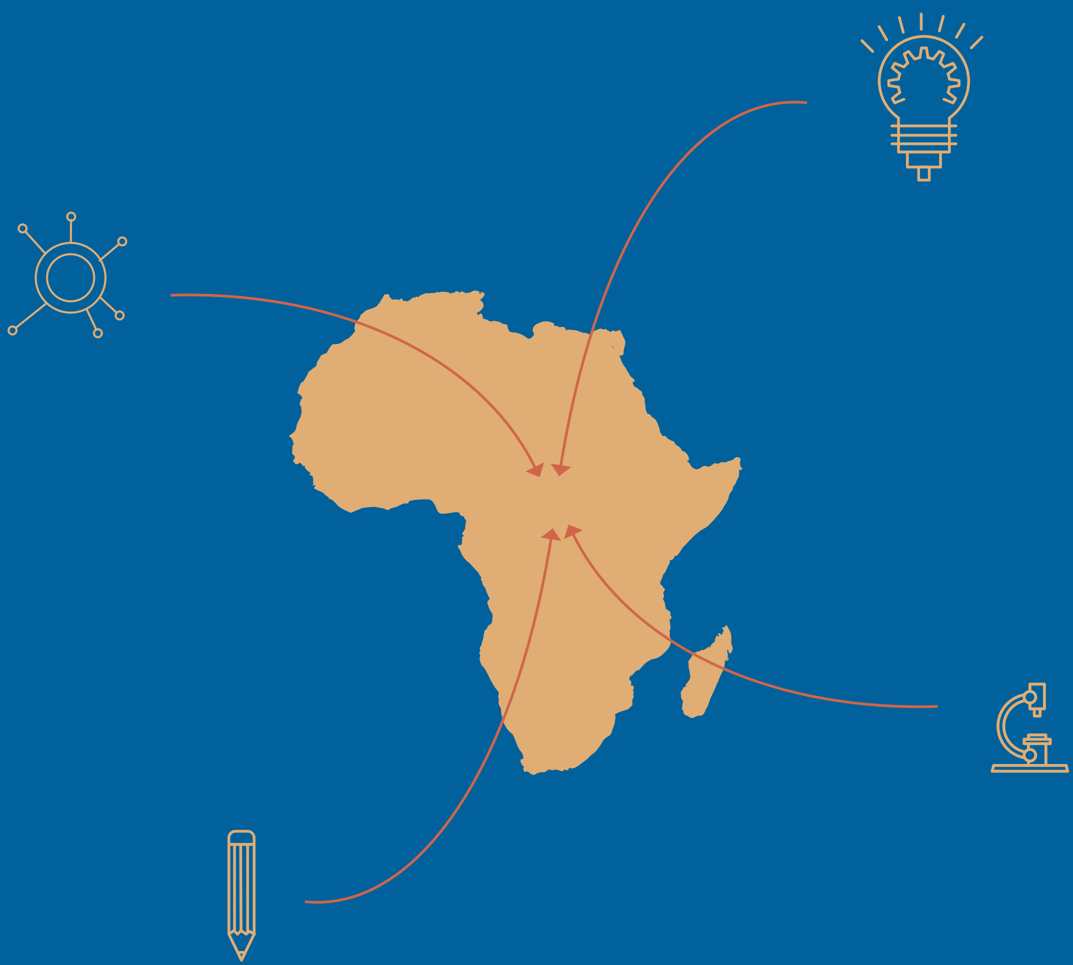
5. **Improve the provision of mentoring, supervision and capacity-building programmes to support the professional development and research skills for ECRs at all levels.** This includes policies and measures such as: reducing the load of mentorship and supervision on the current generation of senior researchers and diversifying support structures; training mentors and supervisors on how to successfully share their knowledge and experience; supporting short training fellowships for skills development; and establishing public-private partnerships and internships for ECRs to gain experience in other research-related fields and contexts.

6. **Increase local, regional and private investments in research and development, configure contextualised funding schemes to the various life and career stages of ECRs, and institutionalise research grant management and application support.** This includes policies and measures such as: increasing local and regional investment in higher education and research systems to ensure that their focus aligns with agendas set by local and national stakeholders; investing in emerging fields and interdisciplinary research; increasing salaries for ECRs in higher education and research to the level of their peers in industry-based roles; establishing local and national funding schemes to non-resident scholars in recognition of the high mobility of ECRs; providing training opportunities for writing grant and fellowship applications.

7. **Foster bilateral and regional international mobility and collaboration.** This includes policies and measures such as turning brain drain into brain gain by providing reintegration, seed and catalyst grants; establishing an African scholar visa to enable movement and collaboration within Africa and abroad; supporting and facilitating the establishment of research networks and academies, including a diaspora network of African ECRs as well as supporting the inclusion of ECRs in existing networks and academies; increasing the availability of funding for national/African collaborative research projects, as well as the number of smaller travel grants for 1–6 months to increase ECRs' access to research infrastructure abroad and future collaboration possibilities.

Please refer to the respective chapters of this report for the full list of recommendations, details and suggestions for particular stakeholders.

Abdeslam Badre



# 1 Introduction

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| AU | African Union |
| ECR(s) | Early-career researcher(s) |
| GDP | Gross domestic product |
| GloSYS | Global State of Young Scientists |
| HE | Higher education |
| PhD | Doctor of Philosophy |
| R&D | Research and development |
| STISA-2024 | Science Technology and Innovation Strategy for Africa 2024 |
| UN | United Nations |

## 1.1 General introduction

The Global State of Young Scientists (GloSYS) Africa project was motivated by three specific objectives, aside from the continuous intention of the project's leaders to improve the academic and professional situations for early-career researchers (ECRs) globally, and particularly in Africa.[2] To start with, in many African countries the insufficiency, and sometimes complete absence, of data about factors influencing the careers of ECRs, including labour markets, funding, gender equity policies, mobility barriers and data on the "Doctor of Philosophy (PhD) pipeline" makes it difficult to conduct systematic and comparable national andcross-regional studies that would offer evidence-based recommendations for policy developments. Thus, the GloSYS Africa project attempts to collect and make available first-hand data about issues that are central to careers in science and higher education (HE) (e. g., scientific productivity, work satisfaction, career motives and expectations, international and continental mobility, and gender inequalities), as well as contextual factors that have a bearing on the career prospects of ECRs and scholars, and to present recommendations for the immediate future.

2 Throughout the text, the term "early-career researchers (ECRs)" is used interchangeably with similar terms such as "young scientists" or "young scholars". Though the terms have different connotations – focusing on the research aspect of a career or fields of research and teaching – neither would adequately capture the target group of the GloSYS project. The main focus of the project are persons pursuing a research-oriented career, no matter if they work in academia, public- or private-funded research organisations, industry or other organisations.

Aside from contributing to the knowledge on ECRs in Africa, the study seeks to engage with key stakeholders, including ECRs, international experts on HE, and decision makers from a broad range of local institutions with the intention of devising policies and application measures in response to the expressed concerns of ECRs in Africa. Finally, we aim to disseminate our results and recommendations to key stakeholders at the regional, sub-regional and country levels, with a view towards improving the state of ECRs and researchers in the continent and beyond.

The project, which is empirical in nature, is dedicated to collecting first-hand data about work environment, motivators, and challenges faced by African ECRs in 14 African countries and the diaspora. Designed within a mixed-methods approach, the study quantitatively amalgamated publicly available national indicators on the selected countries' HE systems and research infrastructure, then collected and analysed ECRs' responses to the obstacles and barriers they face in their career progression. To put these quantitative analyses into context, the numerical data was paired with qualitative accounts, obtained from interviews with a selected pool of surveyed respondents.

## 1.2 African HE and Research Systems in Transition

Africa is a continent of 54 countries, many of which are young democracies characterised by cultural, religious and linguistic diversity. Africa is also home to the world's six fastest-growing economies (IMF 2018). The African Union (AU) launched the African Continental Free Trade Area in March 2018, which envisions a single market expected to generate a combined gross domestic product (GDP) of more than $3.4 trillion and benefit over 1 billion people. Demographically, the population is expected to witness unprecedented evolution, with an upcoming youth bulge that will have transformational implications on the continental and global economic and societal outlooks.

According to a United Nations (UN) report (UN 2015 revised), Africa's share of the working age population will continue to increase, jumping from 54 % in 2010 to about 64 % in 2090, thanks to the decline in mortality and increase in fertility. This means that the share of the global working age population is projected to increase from 12.6 % (recorded in 2010) to over 41 % by 2100, which will likely optimise the continent's productive capacities at a time when economies of OECD states and other developed countries face an ageing demographic profile (ibid.).

These dynamics entail substantial investments in competitive HE systems, incentivising research environment, and adequate career development and training opportunities for oncoming/upcoming generations of ECRs. Today, the pursuit of investing in HE preoccupies the science, technology, and innovation policies in many, if not all, African countries. This is explicitly stated in the AU's mission, which emphasises the enhancement of the capacity of "our Institution and our Member States to utilize scientific research and innovation outcome to build a knowledge economy" (AU STRC n.d.). Also, within the framework of the Science Technology and Innovation Strategy for Africa 2024 (STISA-2024),[3] the Scientific, Technical,

3 The STISA-2024 – also called the bible of the AU science policy – is a medium-term framework set forth by the Scientific, Technical and Research commission (STRC) of the AU, which is considered to be the vanguard of promotion of science and technology since 1965 at continental level. The STISA-2024 was introduced as a successor for the Consolidated Plan of Action; thus, positioning the STRC at the crossroad vis-à-vis the transition in science, technology, and innovation at the level of continent. Sourse: Africa Union website, www.austr.org, consulted on 27 January 2017.

and Research Commission of the African Union is tasked to implement specific programmes to enhance the contribution of science and technology for the development of the continent.

Moreover, "Agenda 2063 – The Africa We Want" clearly aspires to have the human capital "fully developed as its most precious resource, through sustained investments in HE, science, technology, research and innovation, and the elimination of gender disparities at all levels of education. Access to post-graduate education will be expanded and strengthened to ensure world-class infrastructure for learning and research and support scientific reforms that underpin the transformation of the continent" (AU Commission 2015, p. 3). These policies are witness to how HE, scientific research and development (R&D), and training are being put at the heart of human empowerment, inclusive prosperity and progressive development for the continent.

However, using the powerful agency of HE to support the transition of African economies and societies requires transnational and multi-sectorial synergic collaborations for upgrading general infrastructures, for example: physical research facilities; funding frameworks; quality control mechanisms; efficient resources distribution systems; and good governance, among others. The goals set forth are not impossible to reach, especially in light of the current progress, especially with the growing belief among African leaders that investing in HE can only benefit the youth as well as their communities, and drive the continent toward knowledge-based economies. For instance, since 2014, the World Bank has been collaborating with a number of national governments to establish 22 Centres of Excellence in Western and Central Africa, 22 hubs in East Africa; and a grassroots initiative to found 46 education and research centres across 17 countries. The tangibility of initiatives like these is unquestionable; but the challenges still ahead remain hard to overlook.

The scarcity of R&D resources and the continent's socioeconomic challenges pose major obstacles. Africa accounts for 15.5 % of the world's population; but actual R&D expenditures account for only 1.3 % of global expenditures (UNESCO 2015, revised). Additionally, the current demographic trends in Africa have seen the expansion of education systems without necessarily having the concurrent enhancement of productivity and efficiency, particularly with regard to improved outcomes in quality and equity in learning opportunities. Furthermore, according to estimates by the International Monetary Fund (IMF 2018), the continent faces the challenge of creating 18 million jobs per year until 2035 to absorb youthful labour market entrants. Brain drain is yet another challenge, as an annual average of 70,000 Africans continue emigrating away from the continent to pursue research elsewhere (AU 2018).

Moreover, with the persistent gender gap, due to purely cultural practices, women remain underrepresented in science, comprising only 30 % of the researchers in all subject areas in the continent (African Development Bank 2015). Scientific findings strongly influence how the world is perceived and understood not only by policy makers, but billions of people, and gender inequalities – intersecting with other disparities such as ethnicity and race – in HE and science therefore have an impact on gender relations in societies (Fox, Whittington and Linková 2017). Finally, alignments and conflicts between global requirements of scientific research and local characteristic and the needs for indigenous science deprive many of Africa's brightest minds from international visibility. These challenges indicate a need for capturing how Africa's ECRs perceive and experience actually being ECRs in such a transitory period.

The impetus to carry out research on the state of ECRs in Africa is further motivated by the lack of systematically updated national indicators and limited evidence-based data in many countries. Efforts to catch up with the lack of data are growing in both number and depth. For instance, the work of Beaudry, Mouton and Prozesky (2018), based on their study on the factors which impact on the career development and the scientific productivity of young scientists in Africa, is relevant to the present project. These authors' findings offer an enriching perspective on the past and current state of Africa's ECRs. There is also plenty of literature about access and enrolment rates (Mohamedbhai 2014); funding (Gaillard and van Lill 2013); research output and brain drain (NEPAD 2014); quality assurance (Mohamedbhai 2014); gender policies, mobility, and PhD pipeline (e. g., ASSAf 2010).

While those previously investigated themes are among the burning topics that need in-depth scrutiny in the African HE landscape, very little data is available about them, especially from the perspective of ECRs. The GloSYS Africa study is an attempt to shed more light on some of these themes, and create first-hand comparable data from the young scientists' point of view. The GloSYS Africa project is not a stand-alone project, but rather continues and expands the work of the GYA's previous GloSYS studies, the GloSYS Precursor study and the GloSYS Association of Southeast Asian Nations (ASEAN) project. Thus, findings from the GloSYS Africa project can be put into an international comparative perspective. The next section provides a brief summary on previously completed GloSYS Projects.

## 1.3 Previous GloSYS studies

The GYA considers ECRs to be an invaluable group that stands to change the geography of knowledge in fundamental ways in order to respond to the exigencies of a fast-changing globe. It also believes that the necessity of nurturing and promoting those young creative researchers seems more urgent than ever. Realizing the scarcity of research dedicated to this social group and the lack of knowledge on the strategies to best support them, especially in developing economies in many parts of Africa, Southeast Asia, and Latin America, the GYA has dedicated itself since its foundation to assessing the challenges facing ECRs around the world – hence the GloSYS initiative.

The GloSYS working group (WG) was initiated by founding members of the GYA in 2013 and continues to be constituted by GYA members and alumni. The GloSYS project has two major goals: 1) it seeks to sketch a snapshot of the state of young scholars globally in such a way that would help identify global trends, challenges and models for the improvement of the situation of young scholars and scientists everywhere, and across academic disciplines. GloSYS is a strategic project of the GYA that provides knowledge about the state of ECRs worldwide, and currently focuses on world regions with no or limited information on the working conditions, mobility trends, and career perspectives of ECRs. The first GloSYS report was a precursor assessment in 2014 (Friesenhahn and Beaudry 2014), the GloSYS ASEAN Report was finished in 2017 (Geffers et al. 2017), and the GloSYS Africa Report was completed in 2021.

### 1.3.1 Precursor study (2014)

The GloSYS precursor study set out to examine key indicator areas such as motivations, working conditions, scientific productivity, and career expectations of young scientists and scholars as identified by the GloSYS WG and the GYA. With data collected from 650 ECRs around the world, this pilot study adopted a global view and identified regional differences to various barriers and facilitators to the career trajectories of ECRs. In Africa, the data were only collected from the three highest GDP countries in Africa (South Africa, Egypt, and Nigeria), but they still shed light on issues pertinent to African scientists and scholars at large, and informed some of the questions that motivated the present study.

The GloSYS precursor study highlighted global similarities as well as regional differences among ECRs worldwide. The findings suggest that young scholars throughout the world share a common understanding of what academia entails, as well as a passion for doing research. However, underneath this idealistic conception, the study also reveals significant challenges for the community of young scholars all over the world, particularly a lack of: a) a systematic and constructive mentoring and support structure; b) training opportunities for educational and professional development of skills and knowledge acquisition; c) transparency and fairness, especially in the context of evaluations, promotion criteria, as well as academic standards in research and teaching; and d) a lack of work-life-balance between professional and family responsibilities.

Based on these results, programmatic policy recommendations were developed and disseminated in the first GloSYS report in 2014 (Friesenhahn and Beaudry 2014). More importantly, the key findings of the precursor study warranted further in-depth study to better appreciate the regional differences showing up in the findings, leading to a follow-up GloSYS ASEAN, which focused on Southeast Asia. The full report is available at the GYA's website.

### 1.3.2 GloSYS ASEAN (2017)

Following up on the experiences of the precursor study, GloSYS ASEAN was set to investigate the ways in which ECRs can succeed in and contribute to the knowledge landscape, as well as the obstacles they encounter in the process across their home institutes in four ASEAN countries, namely Indonesia, Malaysia, Singapore, and Thailand. Continuing and expanding the approach of the GloSYS precursor study, the GloSYS ASEAN study continued most of the core topics, refined the research instruments and drew more substantially on existing statistical data from international sources, literature, and on its own empirical data integrating the regionally comparative results from 444 survey respondents with young scholars gathered in 18 semi-structured interviews. The findings shed valuable light not only on the state of HE and R&D in the four countries, but also on factors such as a) career and work environment; b) internationalisation and mobility; c) productivity and creativity; and d) discrimination and unfair treatment. Those findings were integrated and formulated into policy recommendations, which were published under the GloSYS ASEAN report in 2017 (Geffers et al. 2017).

## 1.4 GloSYS Africa: bridging gaps and informing policies

The GloSYS Africa study is a continuation of the GloSYS project, with the intent of adding new geographical, as well as ECR experiences and perspectives to the literature about early-career professional aspirations in academic and research landscapes. Embarking on the assessment of the states of African young scientists and researchers comes at a timely moment, particularly in light of all the socio-economic, demographic and technological turning points taking place within the continent. Given the scarcity (if not non-existence) of national data on the career environment of young scholars, the present study makes available first-hand data about ECRs from 14 African counties, which makes the study an unprecedented project for the continent. Furthermore, the availability of the data will make it possible, and for the first time, to set up comparative studies across other economically and demographically similar regions, including the ASEAN and Latin American regions (upon completion of similar research in Latin America).

In addition to this report, the qualitative analysis team for the project has released a publication titled "Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective," (McAlpine et al. 2020).[4] The book offers qualitative accounts and narratives of 61 ECRs from African countries, and highlights the experiences of African ECRs who are trying to navigate their careers while dealing with personal and work challenges and affordances. Whereas the GloSYS Africa Report includes a range of findings based on different types of data – from administrative sources, survey data, and short passages from the interviews – the narratives publication is based on the interviews conducted within this project and delivers a different approach to the experiences of ECRs from Africa. As such, it may expand the understanding that statistical reports may not carry, and that this report cannot encompass.

The project leaders have presented preliminary findings of the GloSYS Africa project in international and regional scientific conferences and meetings. In March 2018, members of the GloSYS Africa WG held a "Breakfast Session" during the 2nd Global Gathering of Next Einstein Forum in Kigali, Rwanda. Young and senior scientists, policy and decision makers, and heads of international science organisations attended the session and interactively suggested elaborated recommendations. In March 2019, the project's results were presented at the DAAD Alumni Conference "Young Scholars in Africa – Challenges and Opportunities", in Nairobi, Kenya. The AU's 12th Extraordinary Summit on AfCFTA, which was held in July 2019 in Niamey, Niger, was another unique international platform where the GloSYS team presented the project and interacted with African leaders of states and Africa ERCs. Finally, the team also presented their preliminary findings at the 28th World Economic Forum on Africa, under the theme "Shaping Inclusive Growth and Shared Futures in the 4th Industrial Revolution", in September 2019 in Cape Town, South Africa. Prior to these events on the African continent, there were dozens of other meetings, workshops, and conferences in which the project leaders were involved during the project's period (2015–2019). In almost all of those meetings, the project gained the attention and encouragement of renowned scientists and politicians alike.[5]

## 1.5 Report structure

This report comprises 11 chapters, an Executive Summary and Conclusions. Chapter 1 is an introductory chapter that contextualises the circumstances under which the needs for such a study developed, along with its main objectives. Chapter 2 outlines the theoretical context and conceptual framework, positioning the GloSYS project's research with the aim of contributing evidence for policy as well as data and analyses for ongoing discussions in the fields of HE research and science studies. Chapter 3 details the design of the study and describes the research tools and analytical methods of the study. Chapter 4 lays down the background, trends, regional and national indicators on HE for the selected 14 countries across Africa, highlighting major historical temporalities and the current developments that the HE and R&D sectors are witnessing. Chapter 5 embarks on profiling the sample of young African scientists and scholars in terms of their academic, geographical and experiential diversities.

Chapters 6 to 11 present the major findings of the study, representing six main themes. Chapter 6 is dedicated to the motivations behind why young Africans choose to build careers in academia, and the

4 The qualitative team was led by Lynn McAlpine, Abdeslam Badre, and included Fatima Kareem, Matt Keane, and Otilia Chiramba.

5 Further information on the project, including publications and opportunities to connect, can be found on the project website https://glosys.globalyoungacademy.net/africa/.

experienced reality of pursuing a research career. Chapter 7 describes the structural elements that impact a successful research career, including factors which influence career satisfaction, the realities of research and teaching pressures on task prioritisation, research outputs and promotion. Chapter 8 discusses the issue of inequalities in research. Notably, the theme of gender and equity is recognised as a crosscutting theme that directly and indirectly affects and influences all the other themes in the study, and therefore receives a substantial space of discussion in this chapter. Chapter 9 addresses the topic of support structures and mentorship, followed by Chapter 10, which is devoted to funding, which is an issue frequently cited as one of the most prominent factors within the African research support system. International mobility and collaboration are the final themes and are discussed in Chapter 11.

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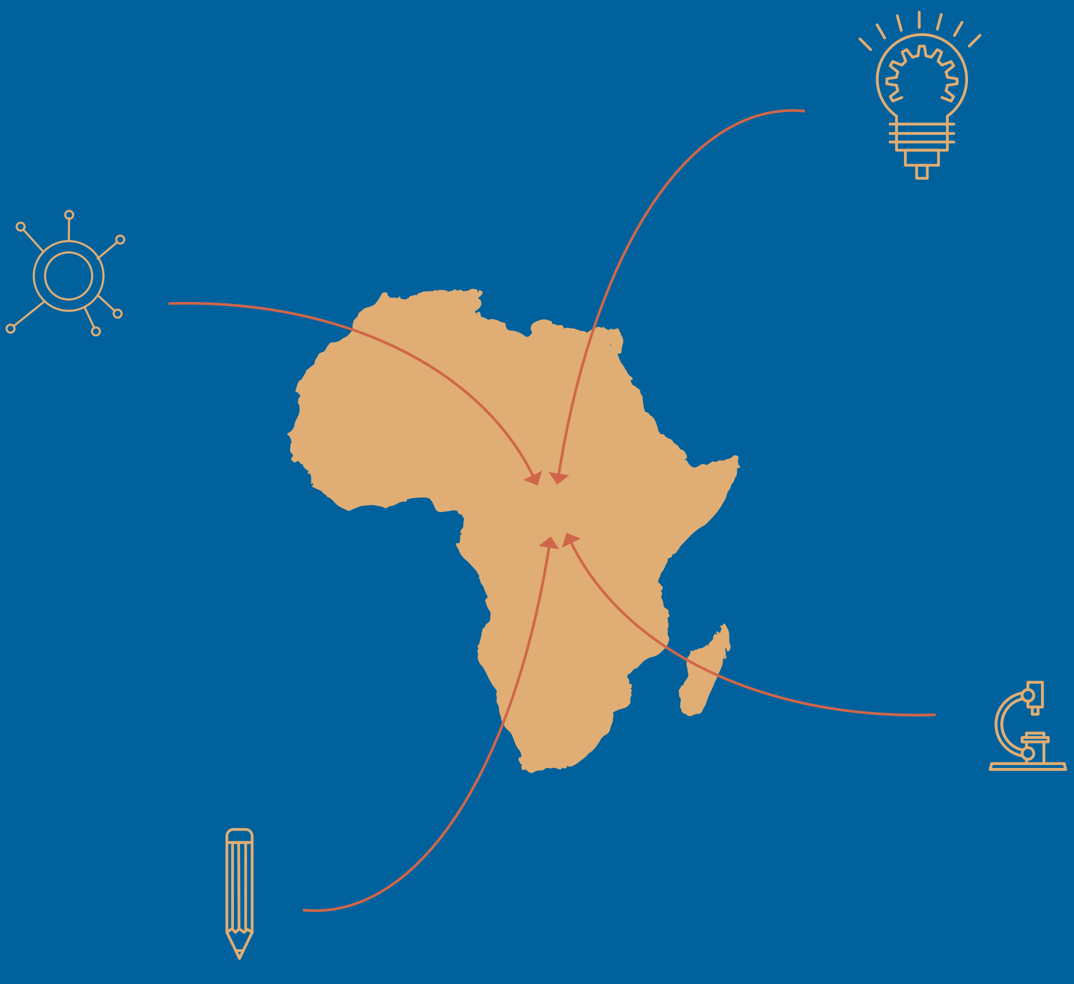

# 2 Context and conceptual framework of the GloSYS project

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| CAP | Changing Academic Profession |
| CDH | Careers of Doctorate Holders |
| ECR | Early-career researcher(s) |
| EU | European Union |
| HE | Higher education |
| HEI | Higher education institution |
| LAC | Latin America and the Caribbean |
| NSB | National Science Board |
| OECD | Organisation for Economic Co-operation and Development |
| PhD | Doctor of Philosophy |

## 2.1 Introduction

In the introduction to this study, we outlined the need for African societies to build competitive higher education (HE) and research systems. These systems should be able to provide quality education as well as training and build a highly trained labour force, which is required within academia as well as research and other economic sectors. This primarily policy-oriented view is essentially a supply-and-demand perspective that focuses on input, output and processual factors with an impact on the development of the academic workforce. The most prominent concept related to this perspective is the "academic pipeline". A second, scholarly perspective on academics and researchers is offered by the fields of HE research and science studies. Research in these fields draws on a wide range of theoretical and methodological sources from various academic disciplines. Commonly adopting a less functional stance than more policy-oriented studies, research in these fields connects developments in HE and science with social contexts and societal trends.

The Global State of Young Scientists (GloSYS) project aims to provide relevant information for policy making, and to contribute to ongoing scholarly discussions in HE research and science studies.

This chapter briefly outlines major international empirical studies of the aforementioned perspectives without reporting on their detailed findings, which we will relate throughout our results chapters 6 to 11. We will also discuss the still very prominent concept of the "academic pipeline" and its relevance for the African context and our research.

## 2.2 Academics and early-career researchers in the focus of international science policy, HE research and science studies

From the science policy perspective, two international comparative data collections on early-career researchers (ECRs) stand out: The Careers of Doctorate Holders (CDH) project of the Organisation for Economic Co-operation and Development (OECD) and the MORE2 and MORE3 studies funded by the European Commission.

Noting the steady increase of doctoral degrees awarded in OECD member states and acknowledging the importance of this particular group of the workforce for the creation of new knowledge, as well as their diffusion and transfer to industry and society in general, the project was dedicated to providing more in-depth information on their employment and mobility patterns in particular (e. g., Auriol 2010; Auriol, Schaaper and Felix 2012; Auriol, Misu and Freeman 2013). The latest CDH-data collection was conducted in 2017, the data feeding into reports such as the OECD report on "Benchmarking Higher Education System Performance" (OECD 2019), which provides baseline information on indicators such as job stability, job satisfaction, or salaries in selected OECD member states and only related to HE staff.

The second international comparative data collection on ECRs carried out by the MORE2 and MORE3 projects was mostly conducted in European countries (IDEA Consult et al. 2013; IDEA Consult, WIFO and Technopolis 2017). These studies focus on topics such as working conditions, career paths, mobility – international, interdisciplinary and intersectoral – collaboration and the attractiveness of the European Research Area for European Union (EU) and non-EU researchers. The MORE studies not only present extensive empirical findings on the state of researchers in 2013 and 2017, they also relate these findings to policy initiatives and provide valuable empirical evidence for science and HE policy in the EU.

Both of the aforementioned international comparative studies target ECRs in mostly economically strong countries, many with mature HE and research systems. Low-income countries and even those countries with emerging economies who usually have less mature HE and research systems are notably absent in these policy-oriented studies or not investigated in detail.

In the field of HE research, international comparative research has gained ground in the last decades. The most relevant research project in our context is the Changing Academic Profession (CAP) project. Building on the experiences of its predecessor, the Carnegie Study (Boyer, Altbach and Whitelaw 1994; Altbach 1996), the CAP project originally collected data from 18 countries, most of them economically advanced with mature HE systems, with South Africa being the only African country involved in the first data collection (Teichler, Arimoto and Cummings 2013). The initial report presents results of analyses of several aspects of the academic career such as international mobility, employment conditions, work situation, time budgets for teaching and research, commitment to discipline and institution, and job satisfaction. Where possible, comparisons to the findings of the Carnegie Study were drawn to identify how the academic profession reacted to changes of higher education institutions (HEI) and the science system. These major international trends include the following: the massive expansion and differentiation of HE; its internationalisation, globalisation and regionalisation; the marketisation of HE and introduction of new forms of governance; shifts in the relevance of different types of research; and changes in the roles of gender in HE and research (e. g., Zgaga et al. 2019; Felt et al. 2017). Since the first publication of the main findings of the CAP project, various books have been published in the series "The Changing Academy – The Changing Academic Profession in International Comparative

Perspective”,[6] which present analyses of the effects of the aforementioned trends on the academic profession, focusing on specific topics such as the internationalisation of the academy (Huang, Finkelstein and Rostan 2014; Huang and Welch 2021), the changing role of women in academia (Eggins 2017) or developments in specific regions or countries (e. g., Machado-Taylor, Meira Soares and Teichler 2017).

The international comparative research within the context of the CAP project has been a valuable source of inspiration for the GloSYS project, yet its target group differs from the GloSYS project as the CAP project analyses academics, that is, members of HEI . This is a (major) subgroup of the GloSYS target group, but is wider as it also includes ECRs pursuing research-oriented careers in public- or privately-funded research organisations or other employment sectors.

A notable international comparative study on young scientists in Africa that falls between the primarily policy-oriented research and HE research is the study conducted by Beaudry, Mouton and Prozesky (2018), covering research topics and a target group similar to the GloSYS Africa project.

All of the outlined studies and their findings will be considered more in-depth in chapters 6 to 11 within the context of the presentation of our empirical results.

## 2.3 The “Academic Pipeline”

From the policy perspective, the academic “pipeline model” has been the dominant framework for predictions on shortages of workforces, describing the extent to which, and causes for, women and minority groups “dropping out” of the pipeline for almost 40 years (Berryman 1983; Pawley and Hoegh 2011). A major point of reference for the pipeline model was established by the U. S. STEM workforce studies, introduced in the 1970s to inform policies and formulate long-term projections (Berryman 1983; Metcalf 2010). Central to this model are the concepts of supply-side economics, flow modelling, and social engineering (Metcalf 2010). The model is further based on the assumption of a linear career sequence of steps and stages required to become a scientist or scholar. The sequence often begins with a pool of students who receive an undergraduate or Master’s degree, then continue on to earn a Doctor of Philosophy (PhD), move on to attain postdoctoral and pre-tenure positions, and finally earn tenure in a research-oriented institute. This sequence allows thorough measurement, identification and analysis of flows and leaks, if any. The model continues to be referred to in diversity-oriented studies focused on the underrepresentation of women, minorities/people of colour, or scientists with disabilities (e. g., Goulden, Mason and Frasch 2011; Carr 2013; Booksh 2018). This pipeline is also present in policy-oriented literature on doctoral education in Africa (e. g., ASSAf 2010).

Even though the model has been dominant for decades, it has also been criticised for having a broad range of methodological flaws (Metcalf 2010; Pawley and Hoegh 2011; Fox, Whittington and Linková 2017). Some of this critique – primarily that related to normative classifications of gender and race/ethnicity – is not directly attributable to the pipeline model per se, but is inherited from the data sources that these kinds of studies usually build on, that is, administrative and survey data. Other aspects, such as the definition of a successful career limited to a very small range of positions at the end of the pipeline and the linearity of the model, are central to the pipeline model. In 2015, the US National Science

6 Series website is available here: https://www.springer.com/series/8668.

Board (NSB) stated, "[beyond] primary and secondary schooling, the pipeline metaphor is less useful and even misleading" (NSB 2015, p. 14). Thus, the NSB decided to abandon the pipeline model in favour of a "pathways approach" to acknowledge a broader range of careers as well as more accurately represent non-linear careers.

For the African context, however, the narrower focus of pipeline-related workforce studies on careers in HE should be considered, particularly in light of the current state of HE systems (e. g., ASSAf 2010), which generates the need to develop academic staff with advanced research qualifications quickly, to both engage in cutting-edge research as well as teach the next generation of highly qualified workers needed in other sectors of the society (e. g., Mohamedbhai 2014; Teferra 2016; Breier and Hermann 2017; Breetzke and Hedding 2018; Bloom et al. 2014; ASSAf 2010). A specific challenge or "stumbling block" that Breier and Hermann (2017) note is that PhD-qualified staff are needed to supervise and mentor doctorate candidates, while it is exactly this qualified staff many HEI are lacking in the first place. By outlining some of the limitations of the "pipeline model" we do not deny that a focus on the question, why ECRs are not continuing their careers in academia may have stronger arguments in its favour here than in other regions of the world, or that it has been helpful for raising awareness on the experiences of women and minorities, and why these groups are underrepresented in academia in general, and leading positions in particular. Still, given the origin of the pipeline metaphor and its rhetoric power, it seemed important to recall some of the limitations of this analytical framework in the context of the GloSYS study.

## 2.4 GloSYS projects – research with policy orientation and contributions to scholarly discussion

GloSYS deliberately focuses on research-oriented careers, without limiting itself to academia, publicly-funded research organisations, business enterprises or not-for-profit organisations. In other words, GloSYS does not consider this focus as a normative statement on what constitutes a "successful" career, but rather as a pragmatic limitation of our research. Within this scope, the career stages and the related transitions between them can be considered an adequate framework for most, but not all, of our respondents. The sequence of stages (i.e., Master's, PhD, postdoc, pre-tenure and tenure) is relevant for all ECRs in academia and is a point of reference for careers in most public-funded research institutes, as mobility between these two types of institutions is rather common in comparison to research careers in industry. Given that these stages are commonly related to formal requirements (e. g., eligibility to apply for funding, supervision of students or the permanency of positions), advancing through them should have an impact on most, if not all, relevant aspects for research-oriented occupations and careers. As our sample includes both respondents with a Master's and a PhD, we are able to highlight differences and commonalities related to different career stages. For those ECRs who – voluntarily or by necessity – have further affiliations outside of public-funded HE and research sectors, the phases and transitions may not have the relevance outlined above and a blurring of boundaries or a diversification of requirements may be observed. Furthermore, the Global Young Academy's regional GloSYS projects, including GloSYS Association of Southeast Asian Nations (ASEAN) (Geffers et al. 2017) and the GloSYS Africa project, as well as the foreseen GloSYS Latin America and the Caribbean (LAC) project (GloSYS LAC) specifically aim to collect data on ECRs in parts of the world where it is scarce, non-existents or not connected to international comparative studies such as those mentioned above.

Loosely connected to the formal stages that ECRs progress through, as well as any training that they receive during their studies, is the necessary career and personal development that can be framed as identity-trajectories (McAlpine and Amundsen 2018). This development involves both professional aspects – from doing research, to managing research and becoming a principal investigator (McAlpine 2016; McAlpine et al. 2016) – as well as negotiating the demands of an academic career with private demands and responsibilities. For the primarily work-related aspects of careers in academia, Gläser and Laudel (2015) propose a model of three interconnected careers: a cognitive career related to the research the academic is conducting over time, a scientific community encompassing different work roles and status positions, and an organisational career that focuses on the progression through different positions within an organisation. Among other concepts, this model of "The Three Careers of an Academic" serves as a valuable heuristic throughout the research process on primarily academic careers. As the concept focuses only on one of the sectors of employment of our target group, it does not elaborate substantially on the broader life-course. The aforementioned concept of identity-trajectories may not deliver such specific heuristics, but it is more open to different employment sectors and career pathways as it incorporates the development of abilities, emotions, perceptions and knowledge of ECRs, actively negotiating their lives in the face of often insecure employment, uncertain career perspectives and frequent relocations – be they geographical, institutional, cultural, or in their private lives (McAlpine 2012). Focusing on the agency of ECRs, their motivations and how they perceive opportunity structures and barriers ahead is not identical with the policy perspective outlined above, which is focused on making the supply meet the demand. Nonetheless, these perspectives are intertwined; interests will overlap at times, but may differ on other issues.

In the following chapter we will outline how our approach translates into the methodology and data collection of the GloSYS Africa project. In the results chapters, our findings will be discussed in light of previous scholarly research and policy-oriented reports.

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# 3 Study design and methodology

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| ECR | Early-career researcher(s) |
| GloSYS | Global State of Young Scientists |
| GYA | Global Young Academy |
| HE | Higher education |
| OECD | Organisation for Economic Co-operation and Development |
| PhD | Doctor of Philosophy |
| UNESCO | United Nations Educational, Scientific and Cultural Organisation |

## 3.1 Introduction

The Global State of Young Scientists (GloSYS) project is targeted at capturing the career trajectories of early-career researchers (ECRs) that have completed their postgraduate degree (Master's) or Doctor of Philosophy (PhD) or an equivalent advanced research qualification within the previous ten years, and are currently or have been previously employed in higher education (HE), research organisations, business enterprises and other sectors of the economy that engage in research activities (Geffers et al. 2017). The online survey targeted ECRs either born in or living in any country in Africa that have a Master's or PhD degree earned within the ten years prior to the survey (2008 to 2017). A detailed analysis of results focuses on the following 14 African countries selected to represent the regional, educational and cultural diversity of the continent: Cameroon, Egypt, Ghana, Kenya, Mauritius, Morocco, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tunisia, Uganda and Zimbabwe. Detailed interviews were conducted in a representative selection of survey respondents born in or living in one of the 14 focal African nations.

In this chapter, we discuss the study design and methodology, including some of the challenges of conducting this research. We first present the research focus (section 3.2), then the eligibility for participation in the study (section 3.3), the study design (section 3.4), sampling techniques (section 3.5), and the various data sources that we used to form this research (section 3.6). For the purpose of brevity, we defer the discussion of the demographics of our sample and discussion of the sample size and sample representativeness to Chapter 5.

## 3.2 Research focus

The focus of our research was guided by two overarching research questions:

(1) What are the opportunities and challenges that ECRs in Africa face in pursuing a career in research?
(2) Do these differ by region, discipline, employment sector, highest qualification, gender, and/or academy membership?

To provide some background to these research questions, in Chapter 4 we provide an overview of the HE and research systems in the 14 focal countries from the view of the information and data available in internationally important databases (for example, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) Institute for Statistics) and reports published by relevant regional bodies (for example, the South African Universities Association).

Following this, and in complement to this chapter, in Chapter 5 we provide a comprehensive overview of the demographic of our survey sample. We include in this chapter the discussion of our survey and interview sample representativeness, and any resulting limitations these have on the interpretation of results.

Finally, given the breadth of the first research question outlined above, we established a set of six themes to guide our research process and the remaining structure of this report. Each of the six results chapters of this report are dedicated to one of the research themes, and at the beginning of each of these chapters we introduce the research questions we used specific to the theme. Furthermore, we include in each chapter a comprehensive review of literature pertaining to the theme in both the African and global contexts; we include the globally-oriented literature because it provides some context for the results, particularly where limited sources are available in the African context. This also opens the opportunity to make comparisons, but only where we feel such comparisons are genuinely informative.

The six themes that guided our research were:

(1) Motivations and the realities of pursuing a research career (see results Chapter 6);
(2) Career satisfaction, workload and promotion (see results Chapter 7);
(3) Inequities in research (see results Chapter 8);
(4) Mentorship and support (see results Chapter 9);
(5) Funding for research (see results Chapter 10);
(6) International mobility and collaboration (see results Chapter 11);

This form of research naturally includes intersections of each of these themes, and so where possible we have provided references between chapters.

## 3.3 Eligibility for participation in the study

To be eligible to participate in the research, two broad conditions had to be met by the prospective participant: (1) they had to meet our definition of an ECR, and (2) they had to be meaningfully connected to HE and/or research in Africa (in any field).

To guide implementation of the first condition, we defined an ECR following the definition adopted by GloSYS Association of Southeast Asian Nations (ASEAN): "[A] Young Scientist or Scholar is defined as a postgraduate or ECRs who has earned her/his PhD or an equivalent advanced research qualification up to 10 years ago and who is working in the following employment sectors: HE, private / public research organisations, business enterprise or other sectors where research is conducted (e.g. NGOs). He/she will usually be between 30 and 40 years old," (Geffers et al. 2017, p. 30).

We discuss the applicability of this definition in Chapter 5 (section 5.1), and considering research within the African context, we broadened the definition to include Master's degree holders in addition to PhD holders. Our decision was justified by the fact that many science professionals are young researchers who have contributed significantly to their professional fields. These people may not necessarily hold a PhD degree, and have acquired significant professional experience that makes them worthy of consideration. Moreover: Master's degree holders cannot be left out of a study to investigate the ECR landscape in Africa because a relatively low number of PhDs in many institutions of higher learning means that many of them are in positions of research leadership and student advice. Thus, we believe that capturing their experiences and perspective within this study would optimise the inclusivity of the project and offer an added value to the findings. This inclusion also allows a comparison between the experiences of those in a research career with differing higher degree status as well as those currently on the PhD journey.

To guide the implementation of the second condition, we considered people that were born in Africa or living there at the time of completing the survey as being meaningfully connected to HE and/or research in Africa. The outmigration of African-born academics is a constant loss to African HE and research systems as well as societies in general; including African ECRs in the non-African diaspora was intended to gain a better understanding of the barriers they encountered in Africa and why they finally decided to leave. Similarly, understanding why non-African researchers choose to move to Africa, at least temporarily, seemed equally important to investigate. GloSYS Africa also included responses from ECRs not currently working, either due to long-term leave (including parental and medical leave) or unemployment, in order to document the full diversity of experiences and barriers to career success for African ECRs. We introduced the following controls into the online survey platform to operationalise the conditions for eligibility discussed above, such that a person was eligible to complete the survey if:

(1) They had been granted their Master's or PhD degree in the 10 years preceding the year they were completing the survey; and
(2) They indicated that they were born in or living in Africa at the time of survey; and
(3) They indicated that they consider themselves to be a researcher (if they only held a Master's degree, or if they were not currently employed or on long-term leave).

## 3.4 Study design

In the GloSYS Africa project, we used a mixed-methods research process that respects our aim to collect internationally-comparative data across our completed studies, as well as future regional GloSYS studies. Therefore, our core research instrument, the survey, needed to remain largely unchanged compared to the GloSYS ASEAN study to allow for comparative data to be collected. Nonetheless, the survey was improved based on theoretical assumptions, experiences from the GloSYS ASEAN project, and was also adapted to the African context based on pilot surveys conducted with members of National Young Academies (NYAs) in Africa, members of the Global Young Academy (GYA) and GloSYS Africa research partners and advisors. A key concern for the development of the interview guideline was to build on preliminary results of the survey data (McAlpine et al. 2020). For the final analyses, we combined survey and interview data in conjunction with secondary data sources during the phase of data analysis to build an understanding of African countries' HE and research systems through the lens of ECRs that work within and constitute part of the workforce underpinning these systems.

The research process we have adopted provides a novel insight into the development of HE and research in Africa because it is one of very few studies in the region that combine survey and interview data from researchers with administrative and organisational data published by institutions, governments and other stakeholders (e. g., UNESCO Institute for Statistics, the World Bank, etc.). We also depart from the method used by many other studies by focussing on ECRs specifically. This was a strategic choice because ECRs represent the present and future of HE and research in Africa. This was also a methodological choice because prior research conducted by the GYA indicated that the experiences of ECRs in developing parts of the world – including Africa – are critically under-researched and thus poorly represented in policy, development and research discussions pertaining to HE and research systems (Friesenhahn and Beaudry 2014).

## 3.5 Sampling techniques

We used a number of techniques to reach our target population within and beyond Africa with our online survey. These included the following:

- Convenient snowball sampling using networks and individuals known to the GYA and NYAs.
- Online social media, via the GloSYS Africa Facebook page: https://www.facebook.com/GYA.GloSYS/.

Media articles to promote the GloSYS Africa project, including in The Conversation and University World News.

- Direct contact with institutions in the 14 focal countries, with the specific request to disseminate the survey to their relevant PhD candidates and staff.
- Direct contact with ECRs in the 14 focal countries, identified in public forums, such as at the Next Einstein Forum in Africa (2018), and using publicly available enrolment data from institutions in the 14 focal countries.
- We chose against sourcing contact data in the Web of Science and SCOPUS databases. Our early results indicated that respondents, including interviewees, had some challenges having their research publications accepted by international journals more likely to be indexed in these databases. As such, it was prudent not to rely on this sample technique as it could have diluted the experiences of these researchers within our sample. In future research, we would consider using this sample technique if we were able to implement adequate control to identify respondents reached via this method. This should include the ability to conduct the multiple regression analysis of the survey responses using groups delineated by respondents that had published in indexed journals and those that had not (or some other proxy variable for this concern).

## 3.6 Data sources

In this section we briefly discuss the three main types of data collection and analysis methods, that is, indicator data (section 3.6.1), quantitative survey data (section 3.6.3) and qualitative interview data (section 3.6.4), as well as the governing human research ethics approval (section 3.6.2).

### 3.6.1 Indicator data

Secondary data were explored to provide information about each country/region. The data focuses on indicators that describe the current state of HE and research systems in the 14 focal countries at the country and regional levels. The data provided covers general country indicators and descriptions of the research population. In addition, data was collected on the five themes of this study, which consist of the research environment, mentorship and academic pipeline, funding, international mobility and collaborations, as well as gender and equity policies (including promotion).

#### *3.6.1.1 Sources of indicator data*

The primary source of the secondary data was the UNESCO database, which is the primary provider of educational statistics for a large number of countries at the international level. Data on country size come from the Central Intelligence Agency database, and economic statistics were mainly taken from the World Bank. Migration data of highly educated persons were sourced from the Organisation for Economic Cooperation and Development (OECD). Data on labour statistics were sourced from the ILO database. Some of the statistics were underreported or not entirely reported in the UNESCO database, and thus we supplemented these statistics with those available at the country-level database, where available.

#### *3.6.1.2 Quality control of indicator data*

The secondary datasets that we accessed had many instances of missing or underreported data. Where we identified gaps in the data available in UNESCO, for example, we could have used institutional data as a supplement; however, this created three concerns: (1) very early on, we were not overly successful in our attempts to obtain reliable data from institutions (see section 4.2 of this report); (2) were we still to persist on this path, we would have needed to contact every relevant institution in the country to seek the data we required, but we did not have the resources to initiate such a comprehensive data collection process; and (3) it was clear that for whichever data source we used, it would be incomplete.

Given these three issues, we decided to rely on the data published by the UNESCO Institute for Statistics, the International Labour Organisation, the World Bank and the OECD because they are generally considered reliable sources of data (or estimations), they are functional to comparative analysis and they are freely accessible to everyone. Still, to control for quality concerns, we did not include data for any metric that did not have at least two years of values reported in the last 15 years (2004 to 2018).

### 3.6.2 Human Research Ethical approvals

Our research involves human participants and their personal data, which necessitate ethical approvals to ensure data privacy and informed consent during the research. Human Research Ethics Committee approval governing all data collected via the online survey and interviews was obtained from University of Cape Town, Faculty of Health Sciences, South Africa (HREC 425/2017). Secondary ethics approvals were obtained from the University of Witwatersrand (South Africa), Mohammed V University (Morocco) and the Rwanda Educational Commission (Rwanda). These approvals demonstrate our adherence to ethical standards, particularly those regarding human participants and sensitive personal data.

Informed consent was provided by all online survey participants at the start of the survey, following a description of the project and how their personal details and responses would be stored and used for research purposes. Participation in the online survey was voluntary, and participants were given the possibility to decline answering any question or withdraw from the study at any time without any consequences. At the end of the survey, participants were asked to indicate if they would be willing to be contacted in the future to participate in the interview component of the study. Participants were asked to provide their email address if they wanted to be contacted for an interview and/or if they would like to receive a copy of the final report.

### 3.6.3 Quantitative survey data

An online survey was distributed to ECRs throughout Africa, and ECRs born in Africa but living elsewhere.

The online survey was hosted by the Typeform platform and was offered in both English and French. We were unable to offer a version in Arabic because of language limitations with the platform. A Portuguese version (the primary language of six African nations, including Mozambique, a focal country) was not developed. We included questions in the online survey related to a number of different issues and items in order to collect information relevant to the six themes of our research and the two overarching research questions (see section 3.2), including:

- Personal characteristics and demographics
- Education (e.g., Master's and PhD with corresponding academic discipline / field of research, and country where degree was obtained)
- Employment (e.g., employment status, sector of employment, additional sources of income)
- Motivation (e.g., factors that influenced respondents to enter an academic or research-oriented career)
- Funding (e.g., funding from own organisation and other sources, kind of research pursued)
- Working conditions (e.g., working hours, work-related satisfaction)
- International mobility (e.g., country of residence, history of international mobility, intention to leave country, preferred destinations, funding for mobility)
- Productivity (e.g., publications, contribution to conferences, patents)
- Collaboration (e.g., on projects and publications)
- Challenges (e.g., lack of mentoring, financial resources, discrimination)
- Support and mentoring (e.g., importance of different types of mentoring and support)
- Career development and prospects (e.g., prospects, career changes).

A full copy of the interview protocol is available upon request from the GYA by contacting info@globalyoungacademy.net.

#### *3.6.3.1 Method of data analysis for quantitative survey data*

Survey data was first cleaned according to inclusion/exclusion criteria, logic checks, and skip checks. Cleaned data was analysed using descriptive and inferential statistics. For descriptive statistics, statistical tables and graphs were prepared according to data types. For nominal and ordinal data, contingency tables were prepared to provide sample counts and percentages of subcategories. For continuous variables, summary tables were prepared to provide number of respondents, mean, and standard deviation. All statistical tables and statistical graphs were further stratified by each of five transversal variables (highest degree, discipline, employment sector, gender, and membership in a Young Academy). Proportions of participants were displayed in pie charts in demographic maps according to each of the five transversal variables. Two additional demographic maps were prepared according to "living in born country" and according to "born in living country" for investigating "migrator to non-birth countries" and "newcomer", respectively.

For inferential statistics, regression-type analyses were performed to examine the association between a dependent variable and an independent variable with a concomitant covariate adjustment for the five transversal variables. Linear regression (with permutations), ordinal regression, and multinomial logistic regression were applied for continuous, ordinal, and nominal dependent variables, respectively. Regression coefficients and p-values of the association tests were calculated. Bonferroni correction was performed to adjust for multiple testing. Once statistical significance was found (adjusted $p < 0.05$), a post hoc pairwise comparison analysis was performed to confirm which subgroups reached a statistically significant difference (adjusted $p < 0.05$) and conclusions were drawn. With respect to multiple regression analysis involving regions, we used six regions as the basis (Northern, Eastern, Southern, Western, Non-focal and Outside Africa) and applied this to respondents' birth, living, Master's and PhD locations. However, in this report, all multiple regression analysis results are reported on the basis of where respondents were living at the time of survey, unless otherwise stated.

All of the analyses were done by public R functions and packages or by R codes developed by the research team of Dr. Hsin-Chou Yang, including team members Mr. Yin-Chun Lin, Dr. Mei-Chu Huang, and Mr. Chia-Wei Chen. Group-level mobility plots were generated by using R package "Gmisc" (Gordon 2016).

#### *3.6.3.2 Structure of the regional analysis for quantitative survey data*

To simplify the multivariate regression analysis above, we grouped the 14 focal countries into four "regions" primarily based on geographical proximity, which partly overlap with regional collaborations in HE, within-African research-collaboration patterns as well as cultural proximity or common languages (refer to Chapter 4 for regional profiles and Chapter 11 for respective literature and our findings on international mobility and collaboration patterns). Nonetheless, the groups include countries with partly different HE and research systems, and further investigation at the national level is advised to confirm the respective findings . The regions were comprised of the following countries:

- Northern Africa Region: Egypt, Morocco, and Tunisia.
- Eastern Africa Region: Kenya, Rwanda, and Uganda.
- Western Africa Region: Cameroon, Ghana, Nigeria and Senegal.
- Southern Africa Region: Mauritius, Mozambique, South Africa and Zimbabwe.
- Non-focal Africa Region: any African countries that were not included in the list of 14 focal countries.
- Outside Africa: any country outside of Africa.

### 3.6.4 Qualitative interview data

The study collected qualitative data from a subset of the online survey respondents through follow-up interviews. The qualitative data provide more in-depth insight into the results revealed in the survey. Participants for interview were selected from those who indicated they were willing to be contacted for interview at the end of the online survey. Interview participation was voluntary and was conducted only with the consent of all the interviewees, indicated by them signing an emailed digital consent form prior to participating in the interview and confirming verbal consent at the start of the interview. Selection and invitation to interview occurred by reference to eligible survey responses. We specifically sought interviewees who were either born or living in one of the 14 African focal countries and who held a PhD. Selection also prioritised balancing gender, discipline, employment status and inclusion of those living in the diaspora. A representative comparison between the full survey cohort and those who completed the interviews is described in chapter 5.

#### *3.6.4.1 Data collection for qualitative interview data*

Qualitative data was collected from 61 respondents in structured interviews that were recorded and then professionally transcribed verbatim. Each of the interviewees were assigned alias names to ensure they remain anonymous, and then the transcript segments were coded using seven predetermined themes in MaxQDA software (version 12.0); these themes were work environment, workload and promotion, funding, mobility, academic pipeline, mentorship, and equity. The interviews were conducted between May 2018 and November 2018 in English using an interview protocol developed with the intent of gaining a deeper understanding of some of the key themes emerging as issues from within the survey, including:

- Current job and career development
- Productivity, creativity and innovation
- Performance evaluation
- International mobility
- Career goals and support.

A full copy of the interview protocol is available upon request from the GYA.

#### *3.6.4.2 Method of data analysis for qualitative interview data*

We used thematic analysis to analyse the data generated in the interviews. Upon coding of the data segments, this method allows the researcher to identify patterns, relationships or trends and make meaning of the information (c.f. Grbich 2007; Patton 2002).

## 3.7 References

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# 4 Regional profiles, background, trends and indicators of higher education in Africa

**List of Acronyms and Abbreviations**

| | |
|---|---|
| AU | African Union |
| EAC | East African community |
| FTE | Full-time employed |
| GDP | Gross domestic product |
| GERD | Gross expenditure on research and Development |
| GloSYS | Global State of Young Scientists |
| HE | Higher education |
| ILO | International Labour Organisation |
| ISCED | International Standard Classification of Education |
| IUCEA | Inter-University Council for East Africa |
| LMD | License, Master, Doctorate |
| MrAs | Mutual recognition Agreements |
| NRF | National Research Foundation |
| OECD | Organisation for Economic Co-operation and Development |
| PhD | Doctor of Philosophy |
| PPP | Purchasing power parity |
| R&D | Research and development |
| STI | Science, technology and innovation |
| TWF | The World Factbook |
| UIS | UNESCO Institute for Statistics |
| UNESCO | United Nations Educational, Scientific and Cultural Organisation |

*Noch einbauen: ICT*

## 4.1 Introduction

This chapter aims to provide an overview of higher education (HE) and research systems in Africa, with a view to identifying contextual factors that impact the career development and working conditions of ECRs. A multilevel assessment of trends in HE and research in Africa at this point in the continent's development is important for several reasons.

The quality of a country's human capital is directly determined by the quality of its HE. HE and research are widely recognised to have broad positive effects on economic and social development, as they produce a skilled workforce, generate knowledge, stimulate international cooperation and increase competitiveness in the global knowledge economy (United Nations Educational, Scientific and Cultural Organisation (UNESCO) 2016; Auriol, Schaaper and Felix 2012; Kimenyi 2011; Toakley 2004). Higher education institutions (HEI), particularly universities and research institutions, play a crucial role in producing the requisite human capital in key areas such as research, education, health, and technology. Within the current literature, however, there is a recognition that many HEI and research systems in Africa have only just started to recover after decades of crisis and under-funding (Mouton 2008; Mohamedbhai 2011). Consequently, many still face major challenges as well as opportunities.

The most important trends and challenges include low but rapidly increasing enrolment rates, underfunding and gross inefficiency, very low research output, and insufficient quality assurance (Mohamedbhai 2011). Though the enrolment ratio in tertiary education in Sub-Saharan Africa has doubled from 4 % in 2000 to 8 % in 2011 (Mohamedbhai 2014, p. 63), accessibility and participation gaps linked to type of HEI, students' socio-economic status, gender, regions of origin/residence, and type and location of HE have been documented (Atuahene and Owusu-Ansah 2013a; Arthur and Arthur 2016). Other challenges include the following: inadequate research capacities; limited information; communication and technology (ICT) infrastructure to enhance instruction and curriculum delivery; and inadequate facilities to support science and technology education (ibid.). Indeed, the need to improve on science, technology, engineering and mathematics participation of young people in Africa is both a key national and international policy concern (Archer and DeWitt 2016).

The challenge of massification of HE means that an increasing number of private institutions in HE are based on a commercial consideration where the quality of education is questionable (Mohamedbhai 2014). There also exists the issue of lacking (or of poor quality) mentorship provided by HEI (Mudhovozi, Manganye and Mashamba 2013; Ndebele, van Heerden and Chabaya 2013; Owusu-Mensah 2015; Chissamatanga, Rembe and Shumba 2018; Lescano et al. 2018). The lack of quality in HE has a direct relationship with graduate unemployment in the continent (Owusu-Mensah 2015). Related challenges are those of limited research capacity, innovation, research quality, research uptake and translation. While the promotion of knowledge for the benefit of the wider society is one of the critical mandates of most HEI, this mandate has often been undermined by a combination of poor research and knowledge translation infrastructure, limited capacity among faculty members to conduct independent research, and a lack of a supportive mentorship environment to promote knowledge and skills transfer from senior faculty members to junior faculty and graduate students.

Indeed, the low research output of Africa as a whole, and particularly across Sub-Saharan Africa, has been well reported (Mouton 2008; Mohamedbhai 2011; NEPAD 2014). Low salaries and poor working conditions have culminated in many talents, especially those of ECRs, leaving their home countries (Mohamedbhai 2011). Also, insufficient national public funding for research results in scientists turning to external funders who do not necessarily supply resources for research with direct relevance to national development, further adding to a disconnect between society and the HE system. A challenge that not only applies to African countries, but rather worldwide, is the inclusion of women in HE and research. According to UNESCO (2012), female researchers in Africa constitute 34.5 % of the population of researchers, with wide variability between countries, ranging from 5.8 % in Guinea to 52.3 % in Cape Verde. As in other parts of the world, women in Africa are still underrepresented in academia as a whole and in specific fields of science in particular.

Africa is a heterogeneous continent, and this heterogeneity could bring about significant differences in HE and research systems on the continent. A more accurate assessment of the state of HE and research systems in Africa therefore requires a consideration of the history and present state of the HE and research systems in different contexts: their colonial past (Afoláyan 2007; Zeleza and Olukoshi 2004; Devarajan, Monga and Zongo 2011; Woldegiorgis and Doevenspeck 2013; Mohamedbhai 2011, 2014), recent developments (Mohammedbhai 2011, 2014; Woldegiorgis and Doevenspeck 2013), and current discussions around the internationalisation or regionalisation of HE in Africa (Sehoole and de Wit 2014; Dzvimbo and Moloi 2013).

In this chapter, we discuss the state of HE and research in four sub-regional blocks covered in the Global State of Young Scientists (GloSYS) Africa regional study, namely the Northern region (Morocco, Tunisia and Egypt), the Southern region (Mauritius, Mozambique, South Africa and Zimbabwe), the Western region (Cameroon, Ghana, Nigeria and Senegal), and the Eastern region (Kenya, Uganda and Rwanda). The implications of the historical structuring and current trends in HE and research for ECRs' career mobility and progression in these regions are also considered in the chapter. Quantitative secondary indicator data from key national institutions including universities and multilateral institutions such as The World Bank (2018), World Economic Forum (2018) and UNESCO (2012, 2015, 2016, 2018), are used to indicate the state of HE and research systems in each sub-region. In addition, evidence from the literature is reviewed and used to support claims where such quantitative, secondary data is missing from the databases examined.

The rest of the chapter proceeds as follows. The challenges of assembling a comparative HE and research indicator data set relevant for a Pan-African context are highlighted next. This is followed by a discussion on each of the four sub-regions, focusing on the state of HE and research. A regional comparison of current challenges and best practises in the HE and research systems are then presented. The final section concludes with some policy recommendations.

## 4.2 The challenge of assembling a comparative indicator data set relevant in a Pan-African context

In writing this chapter, a number of challenges emerged in relation to compiling relevant comparative indicator data for the different regions and countries of Africa. A major challenge was the nonexistence of up-to-date comparable data. The required data needed to correspond to the UNESCO classification system. Many of the countries did not have the relevant data in ways that were complete, up-to-date and comprehensive in a time series. Where data were available in the UNESCO format, the most complete data ended around 2010 in many countries, and more recent data was not complete. This does not tell much about what countries were spending in HE and research. For example, in the Eastern Africa region, data on enrolment at the undergraduate level was complete but that of subsequent levels (post-graduate) was not, nor was it comprehensive by fields of study. Gross expenditure on research and development (GERD) by field of science was only available in Kenya and Uganda up to 2012, and missing in Rwanda.

GERD as a percentage of public expenditure and by source of funds was available in Kenya and Uganda up to 2011, but was missing in Rwanda entirely. This means that the data for Eastern Africa does not speak much of the policy initiatives in recent times, neither will the data show many achievements even where countries have had improvements.

A second challenge was the existence of multiple data sets that gave different figures for the same indicators. For example, in cases when budget estimates and data published by government agencies (e.g., Ministries of Education and Treasury/Ministries of Finance) relating to expenditures in HE and research were current, then different agencies and countries tended to report different data on the same indicator. Additionally, most of these data types were not recorded in the UNESCO system, so it was difficult to use because of its limited comparison across countries.

The third challenge was technical and revolved around access to credible data and the skills available to collect, collate and report the data. In many countries, the first level of access to the data was online, including on the websites of universities, UNESCO and the World Bank. The other source for data was from government agencies and archives. Again, access to such data, especially in the Eastern and Western Africa regions, was sometimes complicated, often requiring long waiting times for gaining access to credible data. In some other countries, the credibility of the data reported by international organisations was undermined by government interference, leading to statistical data sets that were conflicting.

A final challenge was related to language barriers. For instance, data from non-English-speaking countries such as Mozambique, Cameroon and Senegal were difficult to source because of language barriers. Overall, the difficulties in accessing data, the lack of certain data, the inconsistent data collection methods between countries, and the inconsistent timing of data collection made inter-country comparisons difficult. These challenges are themselves very revealing: they show the value given to information, and the place of research and researchers in these countries. The issue of language barrier also highlights potential challenges for international and inter-regional collaboration among ECRs.

## 4.3 Northern region

### 4.3.1 Overview of the region and the development of HE and research

Morocco, Tunisia and Egypt are the representatives of the Northern region of the African continent in this study. The region boasts a long history in the field of HE. A bright example is the Al-Qarawiyyin University in Morocco, the first ever institute established worldwide that is still operational. The Zaytouna University in Tunisia and the Al-Azhar in Egypt were also established before European-model HEI started in the region.

### 4.3.2 General country indicators

With increasing populations and at the same time decreasing growth rates since 2005 (see figure 4.1), these three countries of the Northern African region face demographic and economic challenges similar to those of most developing countries globally. The young populations of these countries have shown significant increases recently; the anticipated positive impact due to increases in human capital availability comes with an important demand for education and skill attainment.


*Figure 4.1 – Northern region economic growth (year-on-year % change) 2001–2016*
*Source: World Bank (2018).*

Table 4.1 presents the three countries' size in km², showing that Egypt is the largest, followed by Morocco and Tunisia (TWF 2018). The population size follows the same ranking and the UNESCO data show that total population has increased almost by 40 % for the period from 2001 to 2017 for Egypt, 24 % for Morocco, and 19 % for Tunisia. The gross enrolment ratio (tertiary) in 2016 ranged from 32.0 % in Morocco to 34.4 % in Egypt (UIS 2018), which was underpinned by a 207 % increase from 2001 to 2016 for Morocco. The economies of Egypt and Tunisia present similar GDP per capita numbers. However, economic growth in Egypt was 3.52 % in 2016, while it was 1.3 % in Tunisia (year-on-year levels for 2016; World Bank 2018).

*Table 4.1 – Northern Africa region country indicators (country size, population and GDP per capita)*

| | Egypt | Morocco | Tunisia | Source |
|---|---|---|---|---|
| **Country size (km²)** | 995,450 | 446,300 | 155,360 | TWF |
| **Total population (2017) (in '000 people)**<br>**% Change 2001–2017** | 97,553.2<br><br>39.5 % | 35,739.6<br><br>23.9 % | 11,532.1<br><br>18.9 % | UNESCO |
| **Gross enrolment ratio, tertiary (2016)**<br>**% Change 2001–2016** | 34.4 %<br>18 % | 32.0 %<br>207 % | 32.6 %<br>50 % | UNESCO |
| **GDP per capita, (2016) PPP (current international $)**<br>**Economic growth % (year-on-year; 2016)** | 11,128.8<br><br>3.52 % | 7,857.5<br><br>1.12 % | 11,595.5<br><br>1.30 % | World Bank |

Sources: The World Factbook (TWF) 2018; UNESCO Institute for Statistics (UIS) 2018; World Bank 2018.

## 4.3.3 Higher education in the region

For decades, the HE sector in these countries focused mainly on theology, philosophy, mathematics, and other fields, and teaching was based mainly on traditional methods. With the rise of the French and British colonial powers in the region, modern systems and approaches to teaching were introduced, and new school concepts were established in various parts of each country. After the respective countries' independence, HE was funded primarily by the state. The lack of continuity in policy development and implementation with the changes in elected government was the main challenge of the sector. Recently, the Bologna Process ensuring standards in higher-education qualifications (e.g., Bachelor's, Master's, and Doctor of Philosophy (PhD); LMD) was adopted by Morocco in 2003/04 and Tunisia in 2008. Egypt prepared and launched the HE Enhancement Program for all its HEI in 2002. Both Morocco and Egypt implemented these reforms with sponsorship from the World Bank.

Like other parts of Africa, the region's university system is characterised by a diversity of offers and institutional models, ranging from public universities to private HEI and schools offering professional training. Morocco, for instance, has 16 public universities, over 200 private institutions (which include universities and specialised institutions), and 61 schools that offer specialised professional training in a wide range of state-structured sectors (e. g., teachers, judges, notaries, nurses, translators, and architects). Tunisia has 13 universities, almost 200 public HEIs, 46 private university levels, 24 higher institutes of technical studies and 6 higher institutes for teacher training. Egypt has 24 state-owned universities, 51 institutions of technical education; and 105 private HEIs, 16 of which have university status.

## 4.3.4 Description of the research population

Scientific research in Northern Africa in general and Egypt, Morocco and Tunisia in particular is still very limited and viewed as a luxury, although it is witnessing a progressive increase. While the research environment suffers structural and political handicaps, its population is nevertheless increasing. There has been a noticeable increase since 2010 in the number of researchers per million inhabitants data, especially in Morocco, with 725.1 in 2010 increasing to 1,032.5 for the year 2014 (UIS 2018; see table 4.2).

*Table 4.2 – Northern region mapping of research population*

| | Egypt | Morocco | Tunisia | Source |
|---|---|---|---|---|
| **GERD; % of GDP; 2015)*** | 0.7 % | 0.7 % | 0.6 % | UNESCO |
| **Researchers per million people (2015)*<br>% Change 2001–2017** | 679.8<br>63.9 % | 1032.5<br>58.7 % | 1787.3<br>64.2 % | UNESCO |
| **Researchers in the HE sector (%) (2014)** | 58.2 % | 89.7 % | 89.7 % | UNESCO |
| **Researchers full-time employed (FTE) – % Female (2015)** | 42.6 % | 35.2 % | 58.9 % | UNESCO |

Note: * For Morocco 2014.
Data source: UIS (2018).

The proportion of researchers in HE in Egypt has experienced some fluctuations over the years, and was 58.2 % in 2014, while in both Morocco and Tunisia, almost 90 % of the countries' researchers worked in the HE sector (ibid.). In 2015, the number of female researchers stood far below half in Egypt and Morocco (42.6 % and 35.2 %, respectively), while in Tunisia almost 59 % of the total number of researchers were female (ibid.).

### 4.3.5 Academic pipeline

Northern Africa remains one of the regions in which the presence of females in HE is very low, especially beyond the bachelor's degree. In terms of female gross enrolment ratio in tertiary education in 2016, Tunisia once again leads with 41.2 %, followed by Egypt at 34.8 %, and Morocco at 30.7 % (ibid.). Notably, the enrolment rate of females in Morocco seems to have doubled since 2008, when it was only 12.7 % (ibid.). The rates for the gender parity index for gross enrolment in tertiary education has been relatively constant over the period between 2008 and 2016; it ranged between 0.9 to 1.0 for Egypt and Morocco over the period, and from 1.5 to 1.7 for Tunisia (ibid.). Data on gross graduation ratio from Bachelor's and Master's degree programmes (International Standard Classification of Education (ISCED) 6 and 7) for females are not available for all time periods; however, the rate decreased in Egypt from 25.5 % in 2008 to 18.8 % in 2016 (UIS 2018). The information available for Morocco concerns only the years 2015 and 2016, with ratios of 12.2 % and 14.6 %, respectively. Figure 4.2 shows the ratio of male to female graduates from Master's (ISCED level 7) and PhD (ISCED level 8) programmes for 2016; among PhD graduates, the dominance of males is obvious, especially in Morocco, where females account for under one-third of the total.

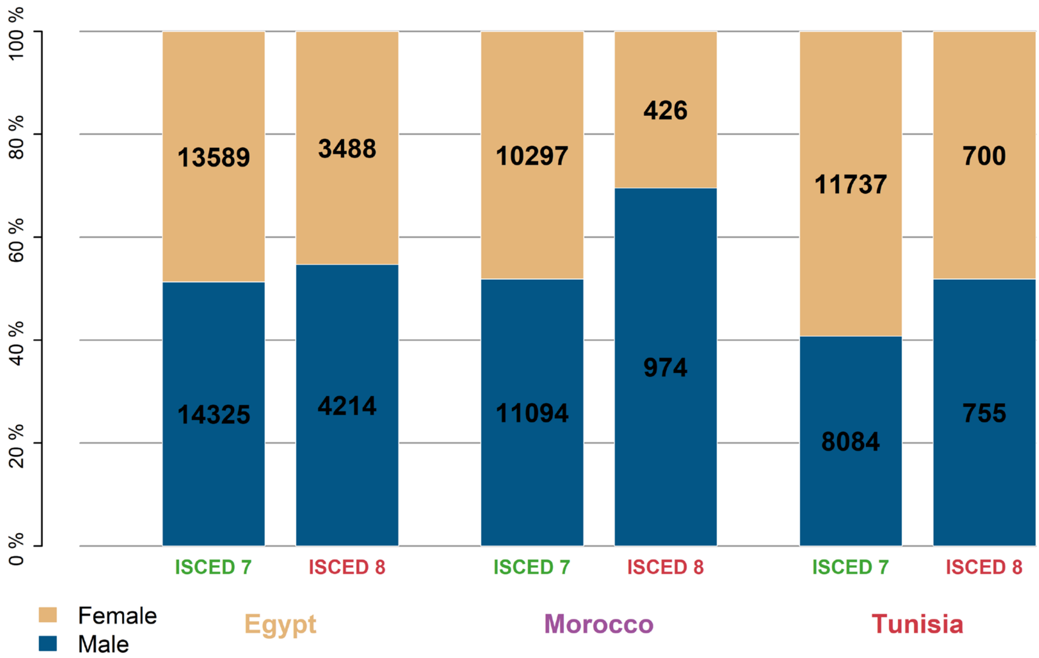



*Figure 4.2 – Northern region graduates from ISCED level 7 and 8 programmes*
*Data source: UIS (2018).*

The percentage of female researchers in HE is more encouraging, with 46.2 % in Egypt and 61.5 % in Tunisia in 2015, though this was considerably lower in Morocco in 2012 (35.5 %; ibid.). Similarly, female researchers remain underrepresented in government compared to their male counterparts, with 41.0 % in Egypt and 42.0 % in Tunisia (ibid.). In Morocco, the presence of female scientists in the governmental sector has decreased from 30.1 % in 2008 to 26.4 % in 2014 (ibid.).

### 4.3.6 Research environment and equity policies

In terms of research impact as indicated by the number of published technical and journal articles as a percentage of global publications, the data reveals negligible impact. According to the World Bank (2018), in 2016 a very modest proportion of global journal article contributions were made by researchers in Nigeria (0.166 %), Ghana (0.043 %), Cameroon (0.029 %) and Uganda (0.015 %).[7]

The unemployment rates for all three countries for highly educated individuals were high and range from 20.6 % in Egypt in 2016 to 30.3 % in Tunisia in 2013 (see table 4.3; International Labour Organisation (ILO) 2018). The unemployment rates of females in all countries were approximately double that of males, which shows that in these countries even highly skilled females have a lower probability of obtaining employment (compared to similarly educated males).

7 These percentages only reflect articles classified in the natural sciences, engineering and technology, and medicine.

*Table 4.3 – Northern region unemployment rates of advanced or highly educated (%)*

| | Egypt (2016) | Morocco (2003) | Tunisia (2013) |
|---|---|---|---|
| **Unemployment rate of advanced or highly educated (%)** | 20.6 % | 30.3 % | 30.3 % |
| **Unemployment rate of advanced or highly educated, female (% of total labour force)** | 30.8 % | 41.3 % | 42 % |
| **Unemployment rate of advanced or highly educated, male (% of total labour force)** | 14.8 % | 24.4 % | 20.1 % |

Data source: ILO (2018).

Looking further at the share of female researchers in specific research sectors (see table 4.4), in Egypt the majority of the fields show almost an even share between males and females, while the lowest shares are found in business enterprises (11.6 %) and engineering and technology (27.2 %; UIS 2018). In the case of Morocco, the share of female researchers is closer to 30 %, on average, with medical and health sciences having the highest share (46.9 %), with the lowest being in agricultural and veterinary sciences (22.9 %; ibid.). For Tunisia, the lack of data does not allow for further investigation, although it is reported that in HE the share of female researchers was 61.5 % in 2015 (ibid.).

*Table 4.4 – Northern region female researchers as a percentage of total researchers (FTE)*

| | Egypt (2015) | Morocco | Tunisia (2015) |
|---|---|---|---|
| **Business Enterprise** | 11.6 % | 23.8 % (2008) | 30.0 % |
| **Government** | 41.0 % | 26.4 % (2014) | 42 % |
| **HE** | 46.2 % | 35.5 % (2012) | 61.5 % |
| **Natural Sciences** | 40.4 % | 34.2 % | No data |
| **Engineering and Technology** | 27.2 % | 27.8 % | No data |
| **Medical and Health Sciences** | 48.1 % | 46.9 % | No data |
| **Agricultural and Veterinary Sciences** | 34.7 % | 22.9 % | No data |
| **Social Sciences** | 52 % | 27.1 % | No data |
| **Humanities and The Arts** | 51.5 % | 29 % | No data |

Data source: UIS (2018).

### 4.3.7 Mentorship and support

There is an absence of systematic and comparable indictor data on the state of mentorship in the region. Lack of mentorship is among the main challenges ECRs face in the three countries. The absence of infrastructure and applicable logistics discourage senior researchers from devoting time to mentorship of junior researchers. Besides the lack of funds, the heavy teaching loads most university teachers have to cope with does not leave them with time for such tasks. Most of the institutions lack the environments (e. g., laboratory space and equipment, reagents, etc.) that would motivate the mentors to get involved in the task. Most of the universities lack a formal mentoring programme for ECRs. The non-existence of the appropriate environment and infrastructure for research does not motivate senior professors to get involved in mentorship.

### 4.3.8 Funding

There is a concerning lack of data available regarding government expenditures on education in the Northern region, and particularly in Egypt and Morocco. The latest data available indicates that government expenditures on tertiary education as a percentage of GDP was 1.6 % in Tunisia (2015) and 1.1 % in Morocco (2009) (UIS 2018). This has remained relatively constant in Tunisia since 2009, when it was 1.8 % (ibid.). In 2015, government expenditure on tertiary education in Tunisia accounted for 23.9 % of all expenditure on education (ibid.).

Egypt and Tunisia's GERD as a percentage of GDP have been similar since 2011, reaching 0.7 % and 0.6 %, respectively, in 2015 (ibid.). The latest data available for Morocco indicates a similar level (0.7 %) in 2010 (ibid.). In Egypt, almost all of the recent GERD are from government sources (93.7 %, 2015), which is similar in Tunisia (77.1 %, 2015) (ibid.); this indicates the reliance the HE and research systems have on government funding in these countries. Data for the allocation of the GERD by discipline was not available in any of the countries.

Lack of funding is, indeed, one of the key factors that hinder research in general and in the Northern African region in particular. While education is free in the three countries and all the funding is provided by the State, the annually allocated budget for research is very limited. In Egypt, Morocco and Tunisia, the grants allocated to researchers are very limited and are not generalised. Often, government budget is mismanaged; or not well prioritised. There exists a national research centre in each of the three countries. This institution is the one responsible for designing academic research agendas and distributing research funds and grants. However, working mechanisms remain tightly bureaucratic and traditional. They do not invest much attention to ECRs; and still have not managed to design innovative funding methods and mechanisms. Furthermore, the private sector is still not very much convinced of investing in research.

### 4.3.9 International mobility and collaborations

Since its adoption of the LMD reforms, Morocco, for instance, has been an active partner in the European Union (EU) TEMPUS and Erasmus Mundus programmes. Owing to these programmes, students' and researchers' mobility have significantly increased. Table 4.5 presents some information for the three countries with regard to the inflow and outflow of skills. In Egypt, 50 % of the emigrant population was highly educated, while these percentages were much lower in Morocco (17.1 %) and Tunisia (20.6 %) in 2011 (Organisation for Economic Co-operation and Development (OECD) 2015). Egypt was a net receiver of students in 2016 (51,162 inbound, 29,453 outbound), which is reflected in the low outbound mobility ratio.[8] On the contrary, Morocco and Tunisia registered a net loss of students in the same year, which is reflected in the increased outbound mobility ratios for each country; 6.6 % for Tunisia in 2016 and 4.7 % in Morocco in the same year (table 4.5).

8 Proportion (in %) of all tertiary students from the host country that move abroad for education.

*Table 4.5 – Northern region information of inbound and outbound skills and students*

| | Egypt | Morocco | Tunisia | Source |
|---|---|---|---|---|
| **% of highly educated persons in the emigrant population (2011; OECD and selected non-OECD, total %)** | 50.3 % | 17.1 % | 20.6 % | OECD |
| **Total outbound internationally mobile students, both sexes, number (2016)** | 29,453 | 45,987 | 19,450 | UNESCO |
| **Total inbound internationally mobile students, number (2016)** | 51,162 | 17,029 | 6,234 | UNESCO |
| **Outbound mobility ratio, all regions, both sexes, % (2016)** | 1.1 % | 4.7 % | 6.6 % | UNESCO |

## 4.4 Data sources: OECD (2015); UIS (2018). Eastern Region

### 4.4.1 Overview of the region and the development of HE and research

Kenya, Uganda and Rwanda constitute the Eastern region of the African continent in this project. Kenya and Uganda's HE systems originated from the Federal University of Eastern Africa, established during the colonial period. Rwanda, however, was a colony of Belgium and university-level education from the University of Burundi was established by the Belgians in the 1950s. It was only after independence in 1963 that Rwanda established a national university, the National University of Rwanda in Butare, with the support of the French-Canadian Dominican Fathers. Although the systems have been relatively different between the three countries, there has been movement towards more convergence in HE following the revival of the East African Community (EAC) in 2000, and more specifically in science, technology and innovation (STI) policies.

### 4.4.2 General country indicators

Below, Table 4.6 presents selected economic and HE country indicators. Kenya is the largest country in terms of both land size and economic conditions measured in GDP per capita. Although Uganda is less than half the size of Kenya, the population sizes of the two countries are close: approximately 50 million for Kenya and 43 million for Uganda (TWF 2018). The economic growth of the countries shows significant fluctuations (figure 4.3), but overall the trends are constant – with a general decreasing trend after 2008. Rwanda, the smallest of the three in terms of size, population and GDP, had the highest gross enrolment ratio in tertiary education of 6.9%, having risen from 3% in 2005 - and almost double the other two countries (UIS 2018).

*Table 4.6 – Eastern region country indicators (country size, population and GDP per capita)*

| | Kenya | Rwanda | Uganda | Source |
|---|---|---|---|---|
| Country size (km²) | 569,140 | 24,668 | 197,100 | TWF |
| Total population, 2017<br>(in million people)<br>% Change 2000–2017 | 49.7<br><br>58.0 % | 12.2<br><br>52.1 % | 429,<br><br>78.3 % | UNESCO |
| Gross enrolment ratio, tertiary, 2016<br>% Change 2000–2016 (or latest available) | 4.0 % *<br>46 % | 8.0 %<br>523 % | 4.6 %*<br>79 % | UNESCO |
| GDP per capita, 2016<br>PPP (current international $)<br>Economic growth % (year-on-year), 2016 | 3,155<br><br>4.49 % | 1,912<br><br>4.69 % | 1,819<br><br>2.56 % | World Bank |

Note: * Kenya: latest data from 2009; Uganda 2014.
Data sources: TWF (2018); UIS (2018); World Bank (2018).


*Figure 4.3 – Eastern region economic growth (year-on-year % change) 2001–2016*
*Data source: UIS (2018).*

### 4.4.3 Higher education in the region

The EAC is the regional intergovernmental organisation of the republics of Burundi, Kenya, Rwanda, Uganda and the United Republic of Tanzania, established by a treaty signed on 30 November 1999 and entered into force on 7 July 2000. Following the ratification of the treaty by the three original partner states, Kenya, Uganda and Tanzania, the Republic of Burundi and the Republic of Rwanda acceded to it on 18 June 2007 and became full members of the community on 1 July 2007.

In 2009, the EAC recognised the Inter-University Council for East Africa (IUCEA) as an organ of the EAC for purposes of coordinating HE and training for member countries. Articles 5 and 102 of the EAC Treaty require the partner states, through the IUCEA, to foster co-operation in education and training within the community. This is done through the harmonisation of curricula, examination, certification and accreditation of education and training institutions in the partner states through the joint action of their relevant national bodies charged with the preparation of such curricula. These actions include the following: supporting the activities of the IUCEA; encouraging and supporting the mobility of students and teachers within the Community; and exchanging information and experience on issues common to the educational systems of the partner states.

The mandate of the IUCEA as an institution of the EAC is to coordinate the development of HE and research in the region and to develop systems for harmonisation HE. This includes reforming HE and training systems, promoting and supporting strategies to raise skills and competence levels, and improving and internationalising qualification systems. Since then, and despite the historical divergences in the structure of HEI in the region, the IUCEA has worked to create greater convergence in HE and training policies for the region.

Besides the IUCEA, the EAC partner states signed the EAC Common Market Protocol in July 2010. The protocol, among other things, designated education services (including HE) among the seven priority sectors in which all five partner states are required to make commitments, including the facilitation of staff and student mobility and labour within the region. Consequently, and as a result of the work of the IUCEA, the summit of the East African Heads of State declared the EAC a common HE area, thereby bringing into force the EAC Common Higher Education Area on 20 May 2017.

The significance of these developments has been in terms of securing a wider regional area in terms of the training of ECRs and an enlarged market for their skills. Article 11.1(a) of the Common Market Protocol requires EAC "partner states to mutually recognise the academic and professional qualifications granted, experience obtained, requirements met, licenses or certificates granted in other Partner States". To operationalise the article, professionals from the EAC partner states have been signing mutual recognition agreements (MrAs) regarding professional qualifications. Kenya, Rwanda, the United Republic of Tanzania, and Uganda have so far signed MrAs for engineering services, accounting, auditing, bookkeeping services, and architectural services (EAC 2016). Other professions such as legal services, veterinarians, nurses, and doctors are negotiating MrAs in their respective professions. The importance of these agreements and frameworks is found in the expanded opportunities that they provide to ECRs for training opportunities within the region, and for offering their skills and opportunities within an expanded market.

### 4.4.4 Description of the research population

Generally, the three countries show a low number of researchers in the population. This is mainly due to low enrolments in postgraduate studies and a lack of comprehensive funding models for postgraduate training. According to the latest data available from the UIS (2018), Rwanda had FTE of 12.3 researchers per million inhabitants in 2009. Female researchers constituted 34.2 % of all researchers in the same period (see table 4.7; UIS 2018). At this time, all of Rwanda's researchers were employed in the HE sector (ibid.). For Uganda, the number of FTE researchers declined from 38.1 per million inhabitants in 2010 (26.3 % were female) to 27.8 researchers per million inhabitants in 2014 (28.1 % were female) (UIS 2018, 2020). Hence, while the FTE percentage of researchers declined, the share of women researchers per million inhabitants improved slightly. Kenya, the largest economy in the region, had an FTE of 230.7 (20.0 % were female) researchers per million inhabitants (UIS 2018).

*Table 4.7 – Eastern region mapping for research population*

| | Kenya | Rwanda | Uganda | Source |
|---|---|---|---|---|
| **GERD (% of GDP) (2010)*** | 0.8 | NA | 0.5 | UNESCO |
| **Researchers per million people (2010)** | 230.7 | 12.3* | 38.1 | UNESCO |
| **Researchers in the HE sector (%) (2010)** | 60.7 % | 100 %* | 25.7 % | UNESCO |
| **Researchers (FTE) – % Female (2010)** | 20 % | 34.2 %* | 26.3 % | UNESCO |

Note: * Latest data available for Rwanda 2009.
Data source: UIS (2018, 2020).

### 4.4.5 Academic pipeline

Tertiary enrolments (see table 4.6 above), especially doctoral studies, constitute a small percentage of enrolments across the three countries. This implies that the academic pipeline is very narrow at the top, and the capacity for supervision and mentorship is lacking in most institutions and academic programmes. HEI within the region generally have limited supervision and mentorship capacity, as well as internal systems for measuring supervision competencies and an enabling departmental or institutional culture to support effective supervision and mentoring. Under the auspices of the IUCEA, universities in the region are trying to develop common standards for postgraduate training in the region as a strategy for increasing the number of Master's and PhD graduates.

The lack of comprehensive data across the countries related to enrolment and graduation rates for Master's (ISCED level 7) and PhD (level 8) programmes in tertiary education and disciplines is an indication of a lack of clear policy and organisation of the programmes at the institutional levels. Hopefully the regional harmonised standards being developed by the IUCEA will enforce some order and clarity for this level of education. In total, 1,513 PhD students graduated in Kenya in 2001 and 1,014 PhDs in Uganda in 2004, which is the latest data available (UIS 2018). Data was only available for Master's graduates in Rwanda: a total of 2,694 students were conferred with a Master's degree in 2016 (ibid.). Figure 4.4 represents this data by gender. For PhD graduates, in Kenya and Uganda, approximately 30 % were females in 2001 and 2004. In 2016, the share of female graduates from Master's programmes in Rwanda was similar (33.9 %).

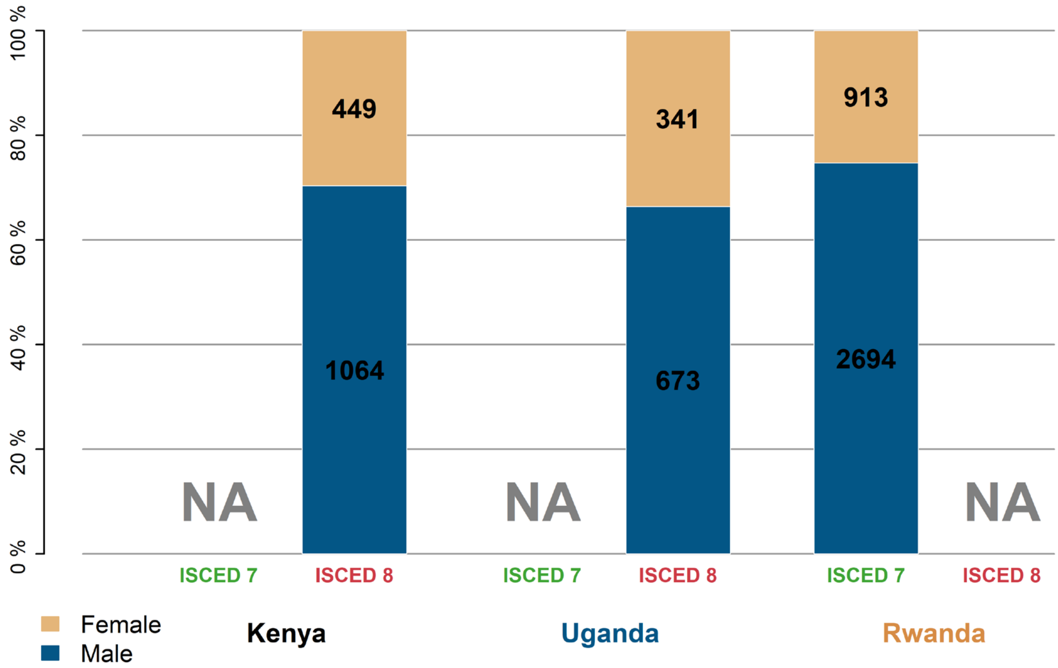



*Figure 4.4 – Eastern region graduates from ISCED level 7 and 8 programmes by gender*
*Data source: UIS (2018).*

### 4.4.6 Research environment

In terms of research impact, indicated by the number of published technical and journal articles as a percentage of global publications, the data reveals negligible impact. According to the World Bank (2018), in 2016, a very limited proportion of the global journal article contributions were made by researchers in Kenya (0.043 %), Uganda (0.023 %) and Rwanda (0.005 %).[9]

The data for the unemployment rates for highly educated individuals in the three countries range from limited to non-existent (as in the case of Kenya). The thirst for highly educated individuals is portrayed by what data does exist: 11.6 % of highly educated individuals were unemployed in Rwanda in 2012, and less in Uganda (8.9 %) in 2014 (table 4.8; ILO 2018).

9 These percentages only reflect articles classified in natural sciences, engineering and technology, and medicine.

*Table 4.8 – Eastern region unemployment rates of advanced or highly educated (%)*

| | Kenya | Rwanda (2012) | Uganda (2014) |
|---|---|---|---|
| **Unemployment rate of advanced degree holders or highly educated (%)** | NA | 11.6 % | 8.9 % |
| **Unemployment rate of advanced degree holders or highly educated, male (% of total labour force)** | NA | 13 % | 14.6 % |
| **Unemployment rate of advanced degree holders or highly educated, female (% of total labour force)** | NA | 10.9 % | 5.1 % |

Data source: ILO (2018).

The distribution of the researchers according to disciplines for Rwanda is not available. For Kenya, researchers were concentrated in agricultural and veterinary sciences (45.8 %), medical and health sciences (25.8 %), and engineering and technology (13.7 %; UIS 2018). For Uganda, researchers were concentrated in social sciences (47.2 %), natural sciences (15.0 %) and agricultural and veterinary sciences (13.0 %; ibid.).

For Kenya, data indicates that 56.6 % of the researchers were located in the universities by 2010 (AIO 2014). However, out of a total research personnel of 61,964 in the country that year, only 1.3 % (826) had doctoral degrees, and their research concentration was mainly in the agricultural sciences (40.5 %) and medical and health Sciences (25.5 %; ibid.).

### 4.4.7 Equity policies

Gender equity policies have been developed at a continental level and have been adopted at the regional (the Eastern African Legislative Assembly), national and institutional levels. All institutions have developed gender equity policies that, among other provisions, call for affirmative action and set gender quotas in admissions, award of research grants, and hiring practices. The national councils for science and technology in all three countries have specific postgraduate grants for female candidates only. However, given that the dynamics of gender inequities emerge at various stages of the education pipeline and are reproduced through labour practices, the development of HE equity policies has not been adequate in redressing past imbalances. For example, though population figures across the countries show that women are now slightly more (Kenya) or almost on par with men, most gender policies including those in HE set just 30 % as the quota reserved for women.

Looking further at the share of female researchers in specific research sectors (see table 4.9), in Kenya, in most of the fields the share of females is below 30 %, with the exception of social sciences, with 38.5 % (latest available data for 2010; UIS 2018). The natural sciences have the lowest share of females at 9.7 % (ibid.). In Uganda, the highest share of females work in the arts and humanities (38.8 %), with the lowest share occurring in the natural sciences (17.3 %; ibid.). In Rwanda, there was only data available for the overall HE sector (34.2 % in 2009; ibid.).

*Table 4.9 – Eastern region female researchers as a percentage of total researchers (FTE)*

| | Kenya (2010) | Rwanda (2009) | Uganda (2010) |
|---|---|---|---|
| **Business Enterprise** | 31.2 % | NA | 25.2 % |
| **Government** | 30.9 % | NA | 28.5 % |
| **HE** | 13.2 % | 34.2 % | 24.9 % |
| **Natural Sciences** | 9.7 % | NA | 17.3 % |
| **Engineering and Technology** | 10.6 % | NA | 19 % |
| **Medical and Health Sciences** | 16.9 % | NA | 21.9 % |
| **Agricultural and Veterinary Sciences** | 23.6 % | NA | 22.5 % |
| **Social Sciences** | 38.5 % | NA | 30.2 % |
| **Humanities and The Arts** | 10.6 % | NA | 38.8 % |

Data source: UIS (2018).

### 4.4.8 Mentorship and support

Since universities are the major employers of doctoral graduates, the past practice was for universities to fund a specific number of Master's and doctoral students as part of their staff development programmes. These arrangements collapsed, however, and universities faced funding constraints and therefore turned to postgraduate enrolments as a source of raising internal university revenues.

Hence, most of the candidates attracted to PhD studies are members of the academic staff, or those working elsewhere who would wish to join the university to teach. Rarely is PhD-level education offered on a full-time basis across the countries. This presents two problems: for the candidates undertaking part-time PhD work, the pressure to work elsewhere means that not enough time is left for strict commitment to one's studies, and most candidates take a long time to finish their degrees. For PhD supervisors who have to contend with heavy institutional workloads and perhaps take on part-time teaching elsewhere to supplement low salaries, close supervision of PhD candidates is not a priority. This affects both throughput rates and quality to such an extent that the capacity for academic reproduction is seriously compromised.

In terms of the infrastructure for offering postgraduate work, universities remain the anchor of the programmes. However, across the examined countries, various research institutions – often linked to ministries and universities – continue to enhance access to graduate programmes. In Kenya, for example, such institutions include the Kenya Agricultural Research Institute, the Kenya Medical Research Institute, International Centre for Insect Physiology and Ecology and the International Livestock Research Institute, among others. These research centres continue to support research and doctoral education across Eastern Africa.

### 4.4.9 Funding

In terms of government expenditure on all levels of education as a percentage of GDP, the share was 5.3 % in Kenya in 2015, 3.5 % in Rwanda in 2016 and 2.3 % in Uganda in 2014 (UIS 2018). Kenya spent the equivalent of 0.7 % of its GDP on tertiary education in 2015, a rate that held relatively constant after 2011; this was higher than for Uganda across a similar period, which ranged between 0.3 % and 0.4 % from 2009 to 2014 (ibid.). This share was also higher than for the latest data for Rwanda, which has trended downward from 1.1 % in 2007 to 0.1 % in 2016 (ibid.). As a percentage of the overall education budget, Uganda and Kenya allocated similar proportions to tertiary education (16.3 % in 2016 and 13.1 % in 2014, respectively), while Rwanda allocated a considerably lower amount in 2016 (1.7 %), which has reduced significantly; from 2010 to 2013 it ranged between 13.3 % and 22.7 % (ibid.).

Uganda's GERD as a percentage of GDP was 0.2 % in 2014 (UIS 2020). The majority of the GERD came from sources outside of Uganda (52.4 %) and government (37.9 %) in the same year. Allocation of the GERD by discipline indicates a majority went to agricultural and veterinary sciences (27.7 %), social sciences (27.3 %) and engineering and technology (20.7 %; UIS 2018). For Kenya, the latest data available indicates that the gross domestic expenditure on R&D was 0.8 % in 2010. The majority of the GERD in that year came from sources outside of Kenya (47.1 %), government (26.0 %) and HE (19.0 %; ibid.). Allocation of the GERD by discipline in the same year indicates that a majority went to agricultural and veterinary sciences (44.8 %), and medical and health sciences (27.5 %; ibid.). Data on these indicators from Rwanda was not available.

### 4.4.10 International mobility and collaborations

Given the low levels for postgraduate graduations across the three countries, coupled with inadequate national and institutional levels for funding for research, student and academic staff mobility from and within the region in search for academic and research opportunities are high. The actual emigration rate of highly educated people was 15.1 % for Kenya, 10.6 % for Rwanda and 8.9 % for Uganda in 2011 (OECD 2015). Looking at this by gender, a higher proportion of highly educated females emigrated from Kenya in 2011 than males (20.3 % compared to 12.2 %); this difference was less pronounced for Rwanda (12.4 % of females compared to 9.2 % of males) and Rwanda (9.5 % of females compared to 8.3 % of males; ibid.). What the data indicates is that while there is some capacity to train highly educated persons in each of these countries, even though Master's and PhD levels are underdeveloped, a considerable proportion of the few that are highly trained emigrate out of the region (at least for a time).

Most of this emigration is linked to the limited capacity and investment in HE training and research, which then forces those seeking opportunities to travel outside of the region. In 2017 for example, 14,017 students from Kenya were classified as outbound, internationally mobile students (UIS 2018). The numbers for Rwanda and Uganda were 5,602 and 4,751, respectively (ibid.). The outbound mobility ratio for Kenya in 2009 was 8.1 %,[10] while the figures for Rwanda (6.8 %, 2016) and Uganda (3.0 %, 2014) were lower (see table 4.10).

10 Proportion (in %) of all tertiary students from the host country that move abroad for education.

*Table 4.10 – Eastern region information of inbound and outbound skills and students*

| | Kenya | Rwanda | Uganda | Source |
|---|---|---|---|---|
| **% of Highly Educated Persons In The Emigrant Population (OECD And Selected Non-OECD), Total (%) (2011)** | 46.1 % | 35.1 % | 35.7 % | OECD |
| **Total outbound mobile tertiary students, Both sexes (Number, 2016)** | 14,009 | 5,599 | 4,756 | UNESCO |
| **Total Inbound Internationally Mobile Students, Both Sexes (Number, 2016)** | NA# | 595 | NA# | UNESCO |
| **Outbound Mobility Ratio, All Regions, Both Sexes (%)** | 8.1 % (2009) | 6.8 % (2016) | 3.0 % (2014) | UNESCO |

Note: The # symbol indicates no or limited data available.
Data sources: OECD (2015); UIS (2018).

## 4.5 Southern region

### 4.5.1 Overview of the region and the development of HE and research

Mauritius, Mozambique, South Africa and Zimbabwe constitute the Southern region of the African continent in this study, but variations in the structure of HE systems in these four countries exist. For example, the entry requirements to HE differ quite markedly. In South Africa, for example, students enter universities after a five-year, post-primary education leading to matriculation-level qualification. In Zimbabwe and Mauritius, students access universities after a six-year post-primary education, which culminates in the "A levels" qualification. Mauritius, perhaps due to the French influence, also has a baccalaureate as a qualifying examination to universities. Mozambique operates a six-year, post-primary education cycle as a pre-qualification for university entry. Across all countries, two types of universities dominate the HE scene: government-funded and private-funded universities.

All the countries' systems operate on the basis of an undergraduate degree system followed by a Master's degree and then a doctoral degree. The majority of the universities in the region are teaching-oriented. However, there is a growing trend in South African and Mauritian universities to become more research-oriented. This in itself has huge implications for the growth of ECRs, especially in terms of research development.

### 4.5.2 General country indicators

Below, Table 4.11 presents selected economic and HE country indicators for the four countries of the region. Considering the populations' growth rates, countries with the highest population growth rates tend to be those with the lowest GDP. While Mauritius has got the smallest population, its GDP per capita is actually the highest. In addition to this, South Africa has the largest labour force in the region amongst the four countries, while Mauritius has the smallest. The gross enrolment ratio in the tertiary HE sector shows vast differences in the four countries – Mozambique and Zimbabwe have very low levels of 7.0 % and 8.5 %, respectively; South Africa has 19.8 %; and Mauritius, although it has the smallest by population among the four, has an enrolment rate of almost 38.8 % in 2017 (UIS 2018).

*Table 4.11 – Southern region country indicators (country size, population and GDP per capita)*

| | Mauritius | Mozambique | South Africa | Zimbabwe | Source |
|---|---|---|---|---|---|
| Country size (km²) | 2,030 | 786,380 | 1,214, 470 | 385,847 | TWF |
| Total population (in '000 people) (2017) | 1,265.1 | 29,668.8 | 56,717.2 | 16,529.9 | UNESCO |
| % Change 2000–2017 | 6.75 % | 64.21 % | 24.03 % | 35.24 % | |
| Gross enrolment ratio, tertiary | 38.8 % (2017) | 7.0 % (2016) | 19.8 % (2014) | 8.5 % (2015) | UNESCO |
| % Change | 252 % (2000–2017) | 5.13 % (2004–2016) | 1.39 % (2012–2014) | 0.398 % (2010–2015) | |
| GDP per capita PPP (current international $) (2016) | 21,102.6 | 1,216.8 | 13,196.8 | 2,027.1 | World Bank |
| Economic growth % (year-on-year) (2016) | 2.19 % | 0.25 % | -0.45 % | -0.49 % | |

Data sources: TWF (2018); UIS (2018); World Bank (2018).

The economic growth of the region has been varied approximately between zero and 10 % for the 20 years, with all countries being affected by international economic events as can be seen in the declines recorded in 2008–2009 in all countries (World Bank 2018). Also, what is even more obvious in figure 4.5 (below) is the dire economic conditions of Zimbabwe.

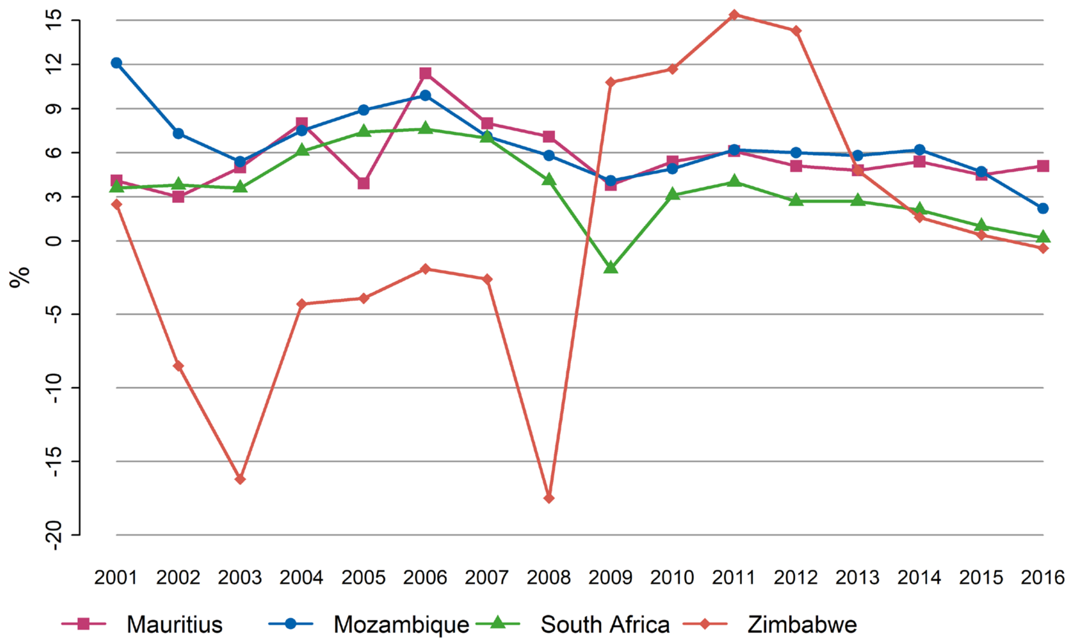



*Figure 4.5 – Southern region economic growth (year-on-year % change) 2001–2016*
*Data source: World Bank (2018).*

### 4.5.3 Higher education in the region

There is much in common characterising the policy framework in HE in the region. However, there are variations still. In South Africa as an example, the policy of free education for all has recently been put in place as a result of student-led protests that took place in 2015 and 2016. In Zimbabwe, university education is largely funded by the parents and or students themselves (Pillay 2008). In the same way that US campus-based institutions have continued to charge escalating high fees (McCowan 2016), private institutions across the region charge relatively high fees and often attract students from the higher socio-economic brackets of society.

### 4.5.4 Description of the research population

The number of researchers per million of inhabitants in the region is relatively low: the most researchers per million can be found in South Africa (437 in 2013), while in Mozambique, only 41 researchers per million people could be found in 2015 (see table 4.12; UIS 2018). With the exception of Mauritius, in the other three countries, more than 65 % of the countries' researchers are employed in the HE sector. Finally, the group of countries can be divided into two subgroups with regard to the percentage of female researchers: in Mauritius and South Africa the share reaches 41.4 % and 43.5 %, respectively, while in Mozambique and Zimbabwe the shares are 28.9 % and 25.5 %, respectively (ibid.).

*Table 4.12 – Southern region mapping for research population*

| | Mauritius (2012) | Mozambique (2015) | South Africa (2013) | Zimbabwe (2012) | Source |
|---|---|---|---|---|---|
| **GERD(% of GDP)** | 0.2 % | 0.3 % | 0.7 % | NA | UNESCO |
| **Researchers per million people** | 181.1 | 41.5 | 437.1 | 89.6 | UNESCO |
| **Researchers in the HE sector (%)** | 34.8 % | 77.3 % | 67.6 % | 89.6 % | UNESCO |
| **Researchers (FTE) – % Female** | 41.4 % | 28.9 % | 43.5 % | 25.5 % | UNESCO |

Data source: UIS (2018).

### 4.5.5 Academic pipeline and mentorship

Many universities in the region have formal mentoring systems designed to pair experienced and less-experienced ECRs. However, there is limited evidence, if any, to show the effectiveness of these arrangements. Secondly, more experienced scientists do not tend to prioritise mentorship as an important role. Thirdly, approaches to mentoring tend to vary from very informal to formal practices. In many universities, a PhD is becoming the minimum requirement for recruitment into the sector. However, a Master's degree appears to be a strong threshold for recruitment or full employment in many universities in the region. There are also some structural issues related to subjects like law, accounting, and other professional disciplines. In view of this, Master's qualification is dominant. In sum, there are structural and subject-specific constraints that limit the effectiveness of mentoring as a strategy for assisting ECRs in the region.

The lack of comprehensive data across the countries related to enrolment and graduation rates for PhD (ISCED level 8) and Master's (level 7) programmes in tertiary education and disciplines is an indication of lacking policy and organisation of the programmes at the institutional levels. Figure 4.6 (below) represents the available data (none available for Mauritius). For PhD programme graduates, in Mozambique there was one female researcher reported in 2014; in South Africa more than 50 % of researchers were males and in Zimbabwe the share surpassed 60 % (UIS 2018). For Master's programme graduates, the share of males was higher than 60 % in both Mozambique and Zimbabwe, and 50 % in South Africa (ibid.).

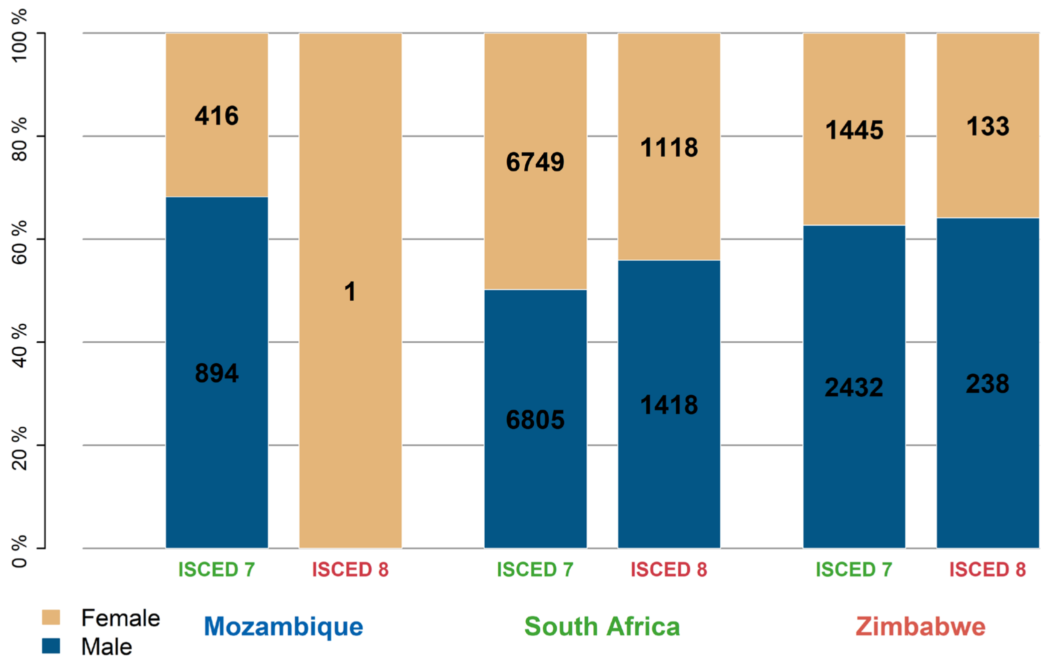



*Figure 4.6 – Southern region graduates from ISCED level 7 and 8 programmes*
*Data source: UIS (2018).*

### 4.5.6 Research environment and equity policies

In terms of research impact as indicated by the number of published technical and journal articles as a percentage of global publications, the data reveals negligible impact. In 2016, a very limited proportion of global journal article contributions were made by researchers in South Africa (0.517 %), Zimbabwe (0.013 %), Mauritius (0.007 %) and Mozambique (0.004 %; World Bank 2018).[11]

Table 4.13 (below) presents information on the unemployment rates of those with advanced degrees for the four countries in the southern African region. All countries have similar total rates: Mauritius (7.9 %), Mozambique (7.3 %) and Zimbabwe (6.7 %), with the exception of South Africa with 13.0 % (ILO 2018). These relatively low rates are an indication that these countries have economies and HE systems that are in need of and can absorb high skills. The unemployment rate of highly educated females is almost double for all countries, with the exception of South Africa, which has 14.6 % compared to 11.2 % of their male counterparts (ibid.).

11 These percentages only reflect articles in the natural sciences, engineering and technology, and medicine.

*Table 4.13 – Southern region unemployment rates of advanced or highly educated (%)*

| | Mauritius (2016) | Mozambique (2015) | South Africa (2017) | Zimbabwe (2011) |
|---|---|---|---|---|
| **Unemployment rate of advanced or highly educated (%)** | 7.9 % | 7.3 % | 13.0 % | 6.7 % |
| **Unemployment rate of advanced or highly educated, male (% of total labour force)** | 5.8 % | 4.6 % | 11.2 % | 5.0 % |
| **Unemployment rate of advanced or highly educated, female (% of total labour force)** | 10.2 % | 13.0 % | 14.6 % | 9.4 % |

Data source: ILO (2018).

While data is unavailable to precisely depict this within the countries, our experience as academics actively involved in HE research confirmed the claim by Butler-Adam (2015) that women are generally marginalised in science in terms of opportunities, access, equity and promotion. This is true despite policies that encourage female participation in the sciences in different countries. These trends are sustained by deep-rooted, structural and cultural drivers of inequality (Baruah 2017; Cornwall and Rivas 2015). Gokulsing and Tandrayen-Ragoobur (2014) drew insights from the situation in Mauritius, and showed that, "… though girls outperform boys at all education levels, starting from primary, secondary and tertiary level, their access to job opportunities are reduced, and female unemployment rate is higher than that of male unemployment," (p. 609). Each of the four countries within the southern region have policies in place to support gender and equity in HE, including for ECRs. While these policies are aspirations of each nation state, what is not clear is how much the implementation of these policies has corrected the imbalances (Akala and Divala 2016; Mayer and Barnard 2015).

In table 4.14, we present information on the proportion of female researchers in particular disciplines. Female participation in the four presented countries varies across the different fields. The highest rate of female participation is in Mauritius in the field of social sciences (56.6 % in 2012). The next highest proportions are in business enterprises in Mozambique (49.9 % in 2015) and in government in South Africa (46.4 % in 2013; UIS 2018). Overall, this data indicates a general underrepresentation of female researchers across all four countries and in most disciplines, which underscores the importance of equity policies and practices to address this situation.

*Table 4.14 – Southern region female researchers as a percentage of total researchers (FTE)*

| | Mauritius (2012) | Mozambique (2015) | South Africa (2013) | Zimbabwe (2012) |
|---|---|---|---|---|
| **Business enterprise** | NA | 49.9 % | 39.3 % | NA |
| **Government** | 38.4 % | 41.0 % | 46.4 % | 37.9 % |
| **HE** | 45.7 % | 25.4 % | 44.0 % | 24.0 % |
| **Natural sciences** | 33.8 % | 27.0 % | NA | 28.6 % |
| **Engineering and technology** | 24.6 % | 24.4 % | NA | 10.8 % |
| **Medical and health sciences** | 44.6 % | 53.6 % | NA | NA |
| **Agricultural and veterinary sciences** | 43.0 % | 25.6 % | NA | 30.2 % |
| **Social sciences** | 56.6 % | 25.2 % | NA | 21.2 % |
| **Humanities and the arts** | 43.5 % | NA | NA | 28.3 % |

Data source: UIS (2018).

### 4.5.7 Funding

Data on funding agencies within the region are provided in Table 4.15 (below). In terms of government expenditure on all levels of education as a percentage of GDP, the latest data available indicates 7.5 % in Zimbabwe in 2014, 6.5 % in Mozambique in 2013, 5.9 % in South Africa in 2016, and 5.1 % in Mauritius in 2017; this last level was up from 3.4 % in 2012 (UIS 2018). Zimbabwe spent the equivalent of 1.3 % of its GDP on tertiary education in 2014, which was relatively constant since 2012; this was higher than for Mozambique and South Africa across a similar period, each ranging between 0.7 % and 0.9 % from 2012 to 2014 (ibid.). This rate was also higher than for the latest data for Mauritius, which consistently fell by around 0.3 % per year since 2008. As a percentage of the overall education budget in the same period, Zimbabwe stood out with 16.8 % in 2014 (though this was down from 19.7 % in 2012). South Africa and Mozambique allocated similar proportions of government expenditure on education to the tertiary level (13.7 % in 2013 and 12.2 % in 2014, respectively), while Mauritius was lowest again with an allocation of 6.2 % in 2017 (ibid.).

South Africa's GERD as a percentage of GDP was 0.7 % in 2013, down from 0.9 % in 2008 (ibid.) In the period from 2008 to 2013, the majority of the GERD came from government sources in South Africa (ranging between 42.9 % and 45.4 %) and business enterprise (ranging between 38.3 % to 42.6 %) (ibid.). In 2016, allocation of the GERD by discipline indicates a relatively broad mix of disciplines received the majority: natural sciences (31.3 %), social sciences (21.0 %), medical and health sciences (19.2 %) and engineering and technology (18.2 %) (ibid.).

For Mozambique, the scarce data available indicates that the gross domestic expenditure on R&D was 0.30 % in 2015. The majority of the GERD in the same year came from sources outside of Kenya (47.1 %), the government (26.0 %), and HE (19.0 %) (ibid). Allocation of the GERD by discipline in the same year indicates that agricultural and veterinary sciences received a share of 34.5 %, followed by medical and health sciences (28.6 %), and the social sciences (17.1 %) (ibid.). Data for Mauritius and Zimbabwe were not available for these indicators.

*Table 4.15 – Funding organisations*

| Organisations | What do they fund? |
|---|---|
| *International Development Research Centre* | Economic empowerment. |
| *Humanitarian Aids* | Provide logistical assistance for humanitarian purposes. |
| *South Africa's Department of Arts and Culture* | Supports arts and heritage in South Africa. |
| *United States Agency for International Development* | Responsible for administering civilian foreign aid and development assistance. |
| *Department of International Development* | Provides for humanitarian aid. |
| German Academic Exchange Service | Promotes mobility and exchange for students and staff members. |
| *Swedish International Development Cooperation Agency* | Focuses on the alleviation of poverty. |
| *Economic Social Research Council* | Promotes science that contributes to economic and social development. |
| *Open Society Foundation for South Africa* | Promotes practise of a non-racial and non-sexist, democratic civil society. |
| *European Research Council* | Promotes research around market intelligence. |
| *National Research Foundation (NRF)* | Promotes a wide range of scientific research across institutions in South Africa. |
| *Research Council, UK* | Coordinates seven separate research councils in science, based in the United Kingdom. |

Source: Authors.

### 4.5.8 International mobility and collaborations

Of the four countries examined here, South Africa was the only net receiver of tertiary students in 2015, which is indicated by the large number of inbound, internationally mobile students (43,305) compared to those that were outbound (7,544; see Table 4.16 below; UIS 2018). The outbound mobility ratios in 2015 for Mauritius (17.1 %) and Zimbabwe (12.5 %) show that these countries experienced significant outmigration of their tertiary students (see Table 4.16; ibid.)[12]. This indicates a net loss of intellectual capital from the region (Gyedu 2017; Kong, Odendaal, and Clarke 2017; Méango 2016). In addition to this, there do not seem to be policies in place that encourage brain-exchange within the region, nor that promote return migration. The concern with brain drain in the region emerges clearly in the data regarding the percentage of highly educated persons in the emigrant population for each country, which we also present in Table 4.16. Over half of the South African emigrant population is highly educated (51.7 %), as is over one-third of the emigrant population from Mauritius (34.6 %; OECD 2015). These figures are much lower in Zimbabwe and Mozambique, at 15.2 % and 6.4 %, respectively (ibid.). This data indicates that while the

12 Proportion (in %) of all tertiary students from the host country that move abroad for education.

capacity to train highly educated persons, especially up to PhD level, is underdeveloped across the examined countries, a considerable number of the few who are highly educated emigrate out of the region, at least for a time.

*Table 4.16 – Southern region information of inbound and outbound skills and students*

| | Mauritius | Mozambique | South Africa | Zimbabwe | Source |
|---|---|---|---|---|---|
| **% of highly educated persons in the emigrant population (OECD and selected non-OECD), total (%; 2011)** | 34.6 % | 6.4 % | 51.7 % | 15.2 % | OECD |
| **Total outbound mobile tertiary students, both sexes (number; 2017)** | 6,628 | 2,573 | 7,544 | 17,431 | UNESCO |
| **Total inbound internationally mobile students, both sexes (number)** | 1,736 (2017) | 749 (2016) | 43,305 (2015) | 633 (2015) | UNESCO |
| **Outbound mobility ratio, all regions, both sexes (%; 2015)** | 17.1 % | 1.4 % | 0.7 % | 12.5 % | UNESCO |

## 4.6 Data sources: OECD (2015); UIS (2018); UNESCO (2012; 2015; 2016; 2018, 2020 ).Western region

### 4.6.1 Overview of the region and the development of HE and research

Cameroon, Ghana, Nigeria and Senegal constitute the Western region of the African continent in this study. The University of Ghana and the University of Ibadan were both founded in 1948. The Elliot Commission was set up in 1943, and had the purpose of investigating HE. This commission recommended, among other things, establishing University Colleges in association with the University of London. The Asquith Commission on HE followed, and recommended establishing The University College of the Gold Coast.

Since the establishment of the two universities in Ghana and Nigeria in 1948, publicly funded universities, technical universities and colleges in Ghana and Nigeria have increased in number tremendously, and now number 66 and 75, respectively. Private universities have also increased significantly in number in Ghana and Nigeria over the last 20 years.

The first university in Cameroon was the University of Yaoundé, established in 1962 as the Federal University of Yaoundé. Since that time, eight publicly funded universities have been established. The number of privately funded universities, including technical universities and colleges, have also increased significantly, to 163. Senegal has five publicly funded universities and the first one, which was established before its independence, was Cheikh Anta Diop University, founded in 1957. Senegal has eight accredited privately funded universities.

### 4.6.2 General country indicators

Table 4.17 indicates that Nigeria has the largest population of the four countries by a considerable amount; around 191 million people lived in Nigeria in 2017, while the next closest is Ghana, at around 29 million (UIS 2018). The countries in the Western region present a certain level of similarity when it comes to the gross enrolment ratio at the tertiary level, which ranges between 10.2 % in Nigeria and 17.4 % in Cameroon (UIS 2018). Since the early 2000s, the gross enrolment ratio has increased considerably for Cameroon (268 %), Ghana (174 %) and Senegal (117 %), which is an early indicator of the massification of the HE systems in these countries.

*Table 4.17 – Western region country indicators (country size, population and GDP per capita)*

| | Cameroon | Ghana | Nigeria | Senegal | Source |
|---|---|---|---|---|---|
| **Country size (km²)** | 472,710 | 227,533 | 910,768 | 192,530 | TWF |
| **Total population (in '000 people; 2017)** | 24,053.7 | 28,833.6 | 190,886.3 | 15,850.6 | UNESCO |
| **% Change 2000–2017** | 57.5 % | 52.3 % | 56.0 % | 60.4 % | |
| **Gross enrolment ratio, tertiary** | 17.4 % (2015) | 16.1 % (2016) | 10.2 % (2011) | 10.6 % (2016) | UNESCO |
| **% Change** | 267.7 % (2000–2015) | 173.6 % (2003–2016) | 4.75 % (2003–2011) | 117.45 % (2004–2016) | |
| **GDP per capita PPP (current international $; 2016)** | 3,609.4 | 4,292.4 | 5,861.1 | 2,566.1 | World Bank |
| **Economic growth % (year-on-year; 2016)** | 3.05 % | 2.58 % | -2.94 % | 5.05 % | |

Data sources: TWF (2018); UIS (2018); World Bank 2018.
Among the four countries, Nigeria has the highest GDP per capita in the region, though figure 4.7 (below) shows that it has also experienced negative growth rates, most probably affected by international economic events and oil price fluctuations.

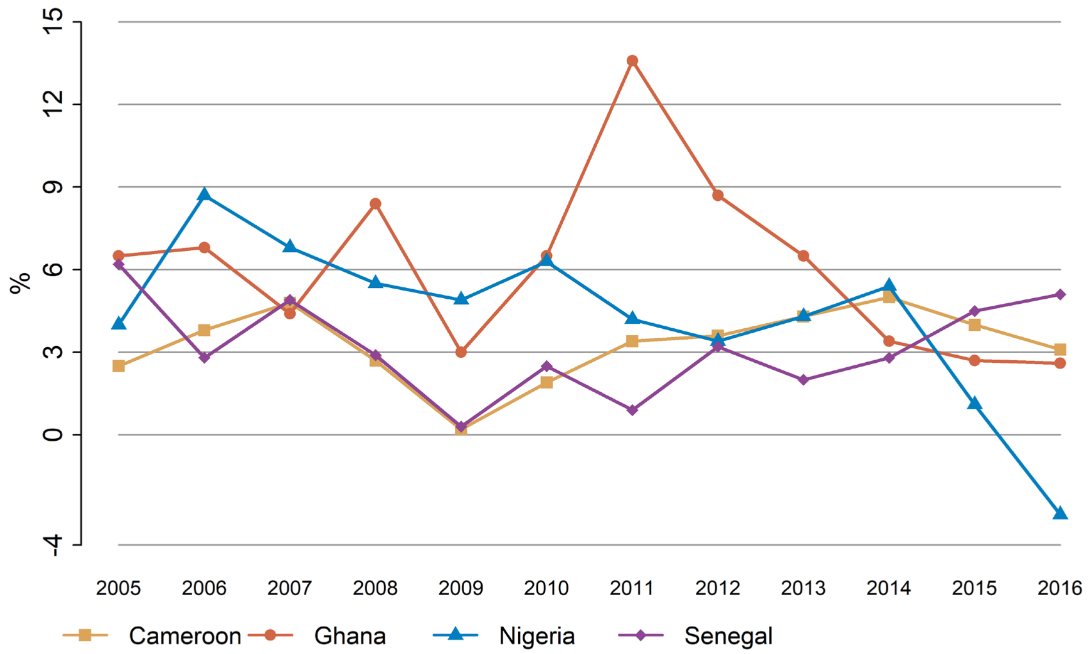



*Figure 4.7 – Western region economic growth (year-on-year % change) 2005–2016*
*Data ource: World Bank 2018.*

### 4.6.3 Description of the research population

Generally, the four countries show a low number of researchers per million people in the population for 2010; this rate is below 40 for both Ghana and Nigeria, but is substantially higher for Senegal, with 361 researchers per million people (see Table 4.18; UIS 2018). In terms of where the concentration of research is in these countries, there were generally high proportions of researchers working in HE, beginning with Ghana (59.9 %, 2010), and rising substantially in Nigeria (80.4 %, 2008) and reaching 95.0 % in Senegal (UIS 2018). This indicates how important the HE sector is for absorbing graduates of Master's and PhD programmes in these countries. The share of female researchers in the HE sector were rather low: 24.8 % in Senegal in 2010, and as low as 17.3 % in Ghana in the same year.

*Table 4.18 – Western region mapping for research population*

| | Cameroon | Ghana | Nigeria | Senegal | Source |
|---|---|---|---|---|---|
| **GERD (% of GDP)** | NA | 0.4 % (2010) | 0.2 % (2007) | 0.5 % (2010) | UNESCO |
| **Researchers per million people** | NA | 38.7 (2010) | 38.5 (2010) | 361.1 (2010) | UNESCO |
| **Researchers in the HE sector (%)** | NA | 59.9 % (2010) | 80.4 % (2008) | 95.0 % (2010) | UNESCO |
| **Researchers (FTE) – % female** | NA | 17.3 % (2010) | 23.3 % (2008) | 24.8 % (2010) | UNESCO |

Data source: UIS 2018.

### 4.6.4 Academic pipeline

In the countries surveyed, there are no clear-cut national or institutional gender policies in place, including codified promotional policies. However, researchers are expected to publish journal and technical articles and books among other requirements that may vary. Figure 4.8 (below) represents the available data for Master's (ISCED level 7) and PhD (ISCED level 8) graduates for Ghana and Senegal only. In both of these countries, less than 25 % of PhD graduates were females in 2012 and 2016. Similarly, less than 37 % of Master's graduates were females in those years.

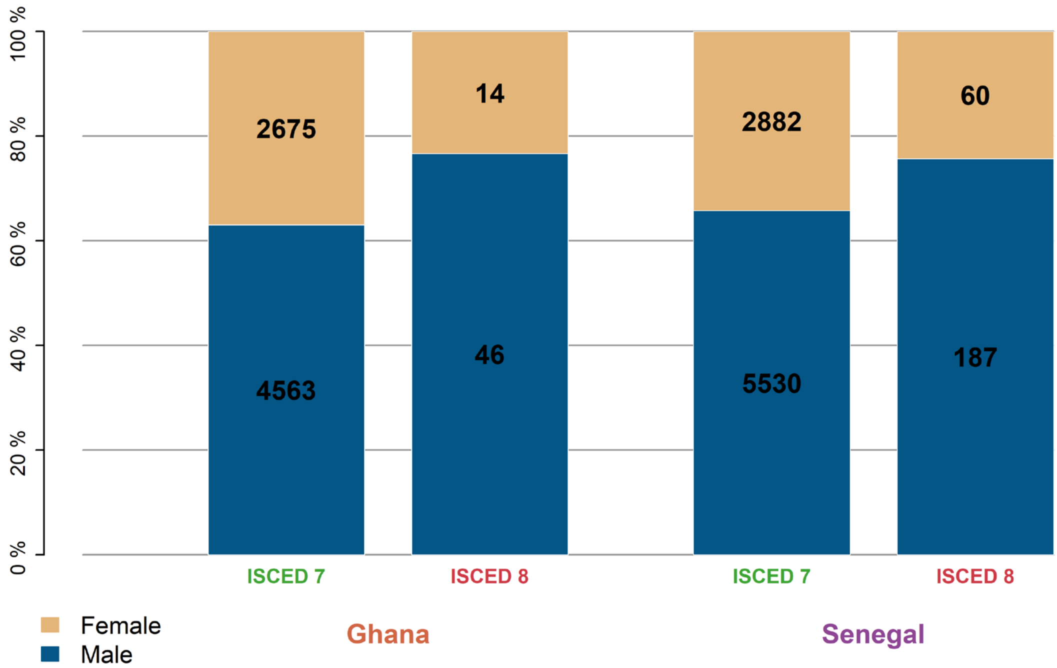



*Figure 4.8 – Western region graduates from ISCED level 7 and 8 programmes*
*Data source: UIS 2018.*

### 4.6.5 Research environment and equity policies

In terms of research impact, indicated by the number of published technical and journal articles as a percentage of global publications, the data reveals negligible impact. In 2016, a very limited proportion of global journal article contributions were made by researchers in Nigeria (0.166 %), Ghana (0.043 %), Cameroon (0.029 %) and Senegal (0.015 %; World Bank 2018).[13]

The data for the unemployment rates for highly educated individuals in the four countries are from outdated to non-existent sources (as in the case of Nigeria; see Table 4.19). The unemployment rate of highly educated individuals Ghana (7.1 %, 2015) and to a lesser extent for Cameroon (10.6 %, 2007) indicate a relatively strong demand for researchers (ILO 2018). However, it remains to be discussed how many researchers emigrate out of the country – which may occur as a result of seeking employment. It is also

13 These percentages only reflect articles classified in natural sciences, engineering and technology, and medicine.

important to note the higher rate of unemployment of highly educated women compared to men in the three countries with data; the disparity is particularly pronounced in Cameroon (16.6 % unemployment of highly educated women compared to 8.3 % of educated men educated to a similar level).

*Table 4.19 – Western region unemployment rates of advanced or highly educated (%)*

| | Cameroon | Ghana | Nigeria | Senegal |
|---|---|---|---|---|
| **Unemployment rate of advanced or highly educated (%)** | 10.6 % (2007) | 7.1 % (2015) | NA | 18 % (2015) |
| **Unemployment rate of advanced or highly educated, male (% of total labour force)** | 8.3 % (2007) | 4.7 % (2006) | NA | 16.6 % (2015) |
| **Unemployment rate of advanced or highly educated, female (% of total labour force)** | 16.6 % (2007) | 4.9 % (2006) | NA | 20.9 % (2015) |

Data source: ILO (2018).

The availability of data with regard to female researchers as a percentage of total researchers is even more limited. There is no data for Cameroon and what does exist is over a decade old data for Ghana, Nigeria and Senegal. Nevertheless, in Table 4.20 (below) we present data that show that in most disciplines, the share of female researchers does not even reach 20 % in Ghana, while in Senegal the shares are marginally higher but still reach a maximum of 31.7 % in the medical and health sciences (UIS 2018).

*Table 4.20 – Western region female researchers as a percentage of total researchers (FTE)*

| | Cameroon | Ghana (2010) | Nigeria (2008) | Senegal |
|---|---|---|---|---|
| **Business enterprise** | NA | NA | NA | 23.1 % (2008) |
| **Government** | NA | 17.8 % | 23.8 % | 22.5 % |
| **HE** | NA | 16.9 % | 23.2 % | 24.9 % |
| **Natural sciences** | NA | 17.5 % | NA | 16.9 % |
| **Engineering and technology** | NA | 7.7 % | NA | 14.1 % |
| **Medical and health sciences** | NA | 19.3 % | NA | 31.7 % |
| **Agricultural and veterinary sciences** | NA | 14.1 % | NA | 27.9 % |
| **Social sciences** | NA | 18.6 % | NA | 27.2 % |
| **Humanities and the arts** | NA | 26.8 % | NA | 17.1 % |

Data source: UIS (2018).

### 4.6.6 Funding

There is a concerning lack of economic data available for the Western region. However, the latest data available indicates government expenditure on all levels of education as a percentage of GDP was 7.1 % in Senegal in 2015 (up from 5.1 % in 2005), 6.2 % in Ghana in 2014 (down from 7.5 % in 2005) and 2.8 % in Cameroon in 2012, which has been relatively consistent since 2004 (UIS 2018). No data was available for Nigeria at any time after 2000. Government expenditures on tertiary education have followed similar trends, with the latest data indicating rates of 2.3 % in Senegal in 2015 (up from 1.1 % in 2005), 1.1 % in Ghana in 2014 (down from 1.6 % in 2005) and 0.3 % in Cameroon (2013), which has been relatively constant since 2005 (UIS 2018).

Senegal and Ghana's GERD as a percentage of GDP were 0.5 % and 0.4 %, respectively, in 2010 (UIS 2018). In 2007, GERD was 0.2 % in Nigeria; no other data on this metric exists for Nigeria. Available data indicates that almost all of the GERD came from government sources in Nigeria (96.4 %, 2007), Ghana (68.3 %, 2010) and Senegal (47.6 %, 2010; UIS 2018). No data was available for Cameroon since 2000. This indicates the reliance the HE and research systems have on government funding in these countries. Nonetheless, an interesting trend emerges in the limited data available for Ghana, where funding from sources abroad increased from 11.9 % in 2007 to 31.2 % in 2010. Though government funding during this period increased by 389 %, it was paired with a 545 % increase in funding from sources abroad (UIS 2018), which points to the growing importance of international sources of funding for research in Ghana. Data for the allocation of GERD by discipline was not available in any of the countries.

### 4.6.7 International mobility and collaborations

Outbound mobility rates indicate that Nigeria had the highest number of tertiary students studying abroad, and that this has increased substantially from 31,312 in 2000 to 95,621 in 2016 (see Table 4.21; UIS 2018). However, the outbound mobility ratio for each country gives a sense of the proportion of students (of all those in the country) that move abroad; in this respect, it is clear that higher proportions of tertiary students in Senegal (8.2 %) and Cameroon (6.5 %) moved abroad than in Nigeria (4 %; UIS 2018). In 2011, the proportion of educated persons in the emigrant population was 47.2 % in Nigeria, 41.1 % in Cameroon, 32.2 % in Ghana, and 20 % in Senegal (see Table 4.21; OECD 2015).

*Table 4.21 – Western region information of inbound and outbound skills and students*

| | Cameroon | Ghana | Nigeria | Senegal | Source |
|---|---|---|---|---|---|
| **% of highly educated persons in the emigrant population (OECD and selected non-OECD), total (%; 2011)** | 41.1 % | 32.2 % | 47.2 % | 20.0 % | OECD |
| **Total outbound mobile tertiary students, both sexes (Number; 2016)** | 24,972 | 12,399 | 95,619 | 12,303 | UNESCO |
| **Total inbound internationally mobile students, both sexes (number) (2016)** | 3,059 (2012) | 15,999 | NA | 12,211 | UNESCO |
| **Outbound mobility ratio, all regions, both sexes (%; 2015)** | 6.5 % (2015) | 2.9 % (2016) | 4 % (2011) | 8.2 % (2016) | UNESCO |

## 4.7 Data sources: OECD (2015); UIS (2018). Regional Comparison of current challenges and best practises

Across the four regions assessed, a common challenge to HE relates to a lack of adequate capacities for training. Most countries do not have a comprehensive national policy on postgraduate training, which often translates into a lack of coherence in postgraduate studies, including funding trends, admissions and priorities on graduate programmes and research. While HEI are teeming with students, giving a false impression of growth that is able to be sustained, GERD for higher education remain low. Governments and institutions offer little financial support for postgraduate studies. A large number of those enrolled in graduate programmes have to self-fund or search for external scholarship opportunities. Since graduate studies are self-funded, the number of ECRs that are motivated to pursue postgraduate studies is limited. For candidates undertaking part-time PhD work, the pressure of work elsewhere means limited time is available for strict commitment and most candidates take longer to finish their degrees. For PhD supervisors who have to contend with institutional workload and perhaps even part-time teaching elsewhere to supplement low salaries, close supervision of PhD candidates is not a priority. This affects both throughput rates and quality to the extent that the capacity for academic reproduction is seriously compromised.

There are promising signs and practices. For instance, the National Councils for Science and Technology in Kenya and Uganda offer competitive grants to support Master's and PhD studies, albeit this largely focuses on science and technology disciplines. The government of Rwanda provides tailored scholarships for students to undertake Master's and doctoral studies outside the country as a way of building capacity in the HE system. South Africa is another good example; a policy of free education for all has recently been put in place as a result of student-led protests that took place in 2015 and 2016. In addition, each of the three countries in the Northern African region has promising medium term policies for empowering their HE system. In addition to having free education policies, Egypt's National Strategy for Science, Technology and Innovation 2030, Tunisia's Strategic plan for the HE and Scientific Research Reforms 2015–2025, and Morocco's Horizon 2025 (i.e., national strategy for scientific research development), all aim to reform and strengthen the HE and research sectors.

Another common challenge is funding, which is critical to the viability and sustainability of HE and research systems the world over. The African Union (AU) recognised this and urged its members in the Khartoum Decision to spend about 1 % of their GDP on research and development (R&D; AU 2007). But HE and research institutions in Africa are the most financially challenged (Tefera 2014). Policy advocacy, especially from development partners, has always favoured low public funding for HE in favour of increased funding for basic education. The expectation that private entities would move in to supplant the public in the provision of HE, especially in critical STI areas has not materialised. Consequently, R&D tend to have very small budgets. There is also a limited range of funding organisations – many of them are international, reflecting the fact that researchers have to look out of Africa when applying for grants, funds and research infrastructure. This often limits ECRs' and researchers' opportunities for career progression, especially if they are unable to travel abroad themselves or compete in highly-competitive fields for funding from abroad.

In table 4.22, this reliance on sources of funding from outside of the country, including international sources, for investment in research (and thus HE) becomes clear; in Uganda and Kenya, for example, over 45 % of funding for research came from outside the country in 2010 (UIS 2018). Senegal (40.5 %, 2010), Ghana (31.2 %, 2010) and Mozambique (39.9 %, 2015) have also registered considerably large proportions of funding for research from outside their respective countries. Though this indicates these countries have established a competitive advantage – by successfully positioning themselves as attractive destinations for international funding – it also establishes a worrying dependency on funding sources that are typically short-term and are generally secured through highly competitive application processes, which means they are insecure sources of funding for the end-user (researchers and institutions). It is important to note that in South Africa, which is an exemplary case of HE and research in the continent, the proportion of GERD from sources outside the country have stayed at much more sustainable levels (around 13 % in both 2012 and 2013, and around that level from 2003 onwards; ibid.). It is also interesting to note that among the focal countries, the top five countries that produce most of the publications[14] are also countries that have a low level of dependence on GERD from sources abroad; we refer specifically to South Africa, Egypt, Tunisia, Nigeria and Morocco (Figure 4.9).

*Table 4.22 – Proportion (%) of GERD funded by sources outside of focal country*

| Country | 2nd most recent data (%) | Most recent data (%) | 2nd most recent data year | Most recent data year |
|---|---|---|---|---|
| Egypt | - | 0.1 | - | 2014 |
| Morocco | 2.6 | 1.7 | 2006 | 2010 |
| Tunisia | 4.0 | 3.9 | 2014 | 2015 |
| Kenya | 17.6 | 47.1 | 2007 | 2010 |
| Rwanda | No data available | | | |
| Uganda | 26.1 | 57.3 | 2009 | 2010 |
| Mauritius | - | 6.4 | - | 2012 |
| Mozambique | 78.1 | 39.9 | 2010 | 2015 |
| South Africa | 13.1 | 12.9 | 2012 | 2013 |
| Zimbabwe | No data available | | | |
| Cameroon | No data available | | | |
| Ghana | 11.9 | 31.2 | 2007 | 2010 |
| Nigeria | - | 1.0 | - | 2007 |
| Senegal | 38.3 | 40.5 | 2008 | 2010 |

Data source: UIS (2018).

14 In the natural sciences and medicine.

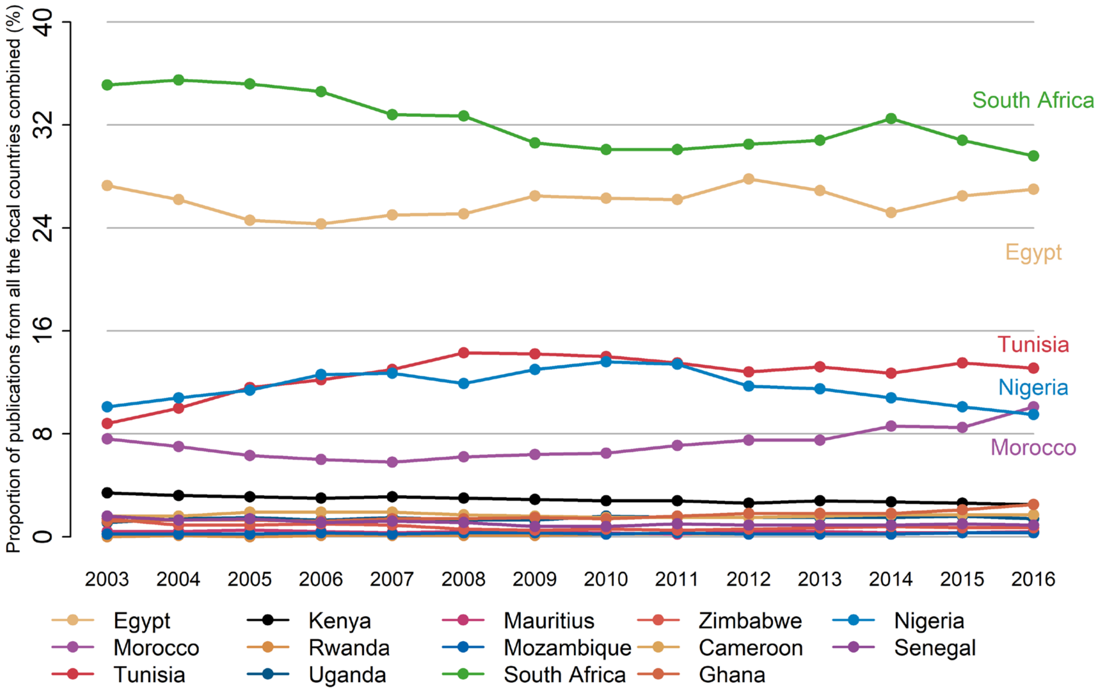



*Figure 4.9 – Proportion of published articles by country, calculated as a percentage of all articles published by researchers in the 14 focal countries (2000 to 2016)*
*Data source: World Bank (2018).*

There are a few good practices to highlight in South Africa, for example, the government's NRF is almost the sole funder of R&D. South Africa also has one of the highest spending rates on R&D (0.8 % in 2016), and the highest output of scientific and technical journal articles.

Another common challenge is mentorship. Sehoole and Ojo (2015) acknowledged the importance of mentorship and the academic pipeline in creating opportunities for new faculty in South African HE. Nevertheless, literature on mentorship across the regions has documented that mentorship is at times non-existent and when available, it is usually of low quality and hierarchical in nature, and ECRs are not properly mentored (Lescano 2019). Indeed, most of the universities across the countries reviewed lack a formal mentoring program for ECRs. The absence of infrastructure and logistics discourage senior researchers to devote time to mentorship. Besides, heavy teaching loads in most universities restrict time for effective mentorship, while more experienced scientists do not tend to prioritise mentorship as an important role, possibly because promotion policies do not incentivise this practice adequately, if at all. However, there are positive signs especially in many universities in the Southern region where formal mentoring systems are being designed to pair experienced and less-experienced ECRs. It will be important to document these mentorship schemes to show their effectiveness.

Mobility is another common issue. While credible data on intra-regional and international mobility and collaborations in all the countries considered in this chapter are limited, many scientists are pushed out of their home countries to take positions in Global North institutions due to poor economic conditions, political instability and lack of adequate job opportunities, and relatively low rewards for employment in their home countries. In addition, there do not seem to be policies in place that encourage brain sharing within regions, or that promote repatriation. In fact, there is a net loss of intellectual capital across all the regions (Gyedu 2017; Kong, Odendaal, and Clarke 2017; Méango 2016). South Africa is the only net receiving country in terms of internal mobility within the continent. Below, figure 4.10 highlights the outbound mobility ratio for each country and region from 2000 to 2016;[15] in most of the 14 focal countries, the proportion of students that leave to seek educational opportunities has decreased over the period. Though this is *prima facie* a good trend as it appears that brain drain is being slowed, there is an important caveat: the proportion of all students that leave each country has decreased over the period; yet, the actual number of students leaving has increased in most countries, and in many cases substantially.

In Figure 4.11 we present the percentage change from 2000 to 2016 in the number of students that left the focal countries for education. All countries registered an increase of 25 % or more, with the exception of Morocco, which had a stable number of students leave the country year-on-year from 2000 (UIS 2018). The growth in number of students leaving between 2000 and 2016 was over 200 % in Egypt and Nigeria, and reached 147.4 % in Ghana. This data indicates that the drop-off in the outbound mobility ratio (figure 4.10) in most countries is a reflection of considerable growth in the number of students enrolled in the countries HE system (Figure 4.11), rather than an absolute decrease in the number of students leaving. This is reflected in Figure 4.11, where the growth in students enrolled in HE is larger than the growth in students leaving the country for HE for each of the countries that have registered sizeable reductions in the outbound mobility ratio (Morocco, Rwanda, Mauritius, Mozambique, Cameroon, and Senegal). So, although more students (proportionally, not absolute) are remaining in the focal countries for HE, this reinforces the impetus to relieve the resource constraints that hinder attempts to provide them a quality education, including infrastructure and funding, and a relevant employment opportunity upon graduation.

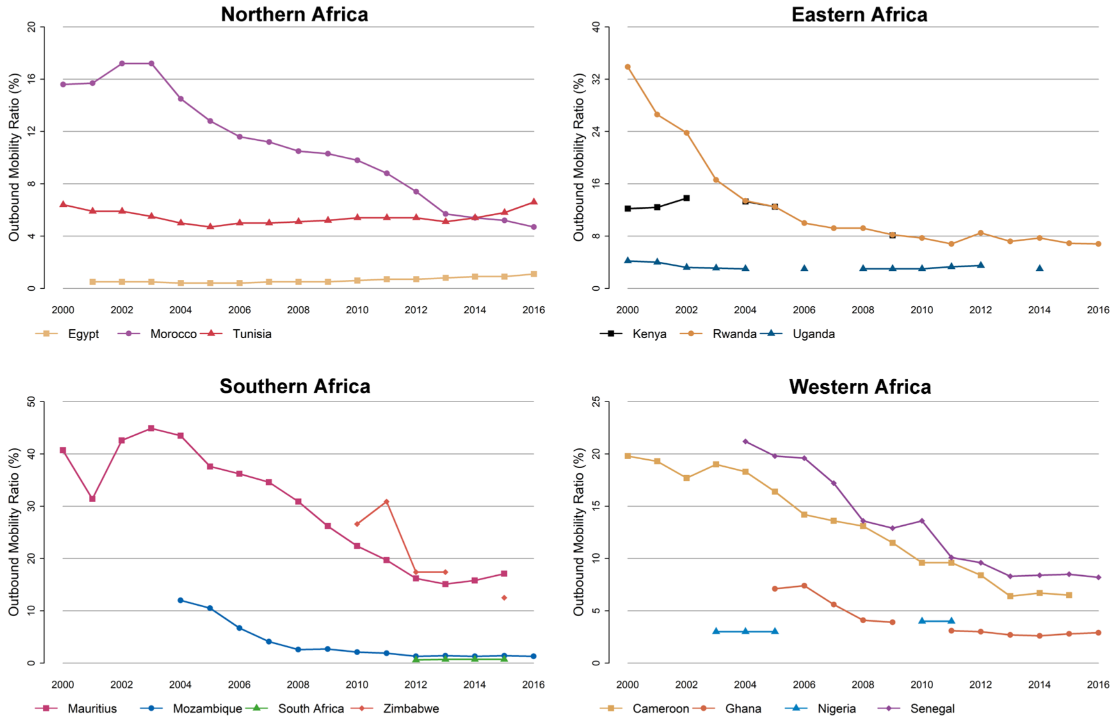



*Figure 4.10 – Outbound mobility ratio from 2000 to 2016 for the Northern region (top-left), Eastern region (top-right), Southern region (bottom-left) and Western region (bottom-right)*
*Data source: UIS (2018).*

15 Proportion (in %) of all tertiary students from the host country that move abroad for education.

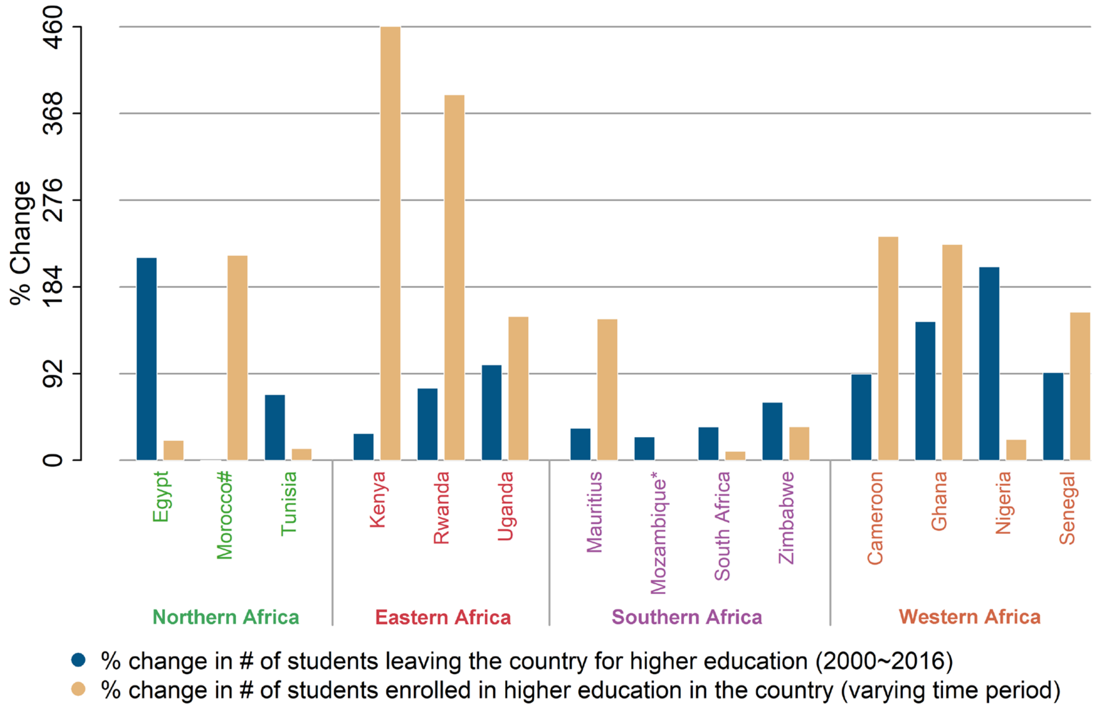


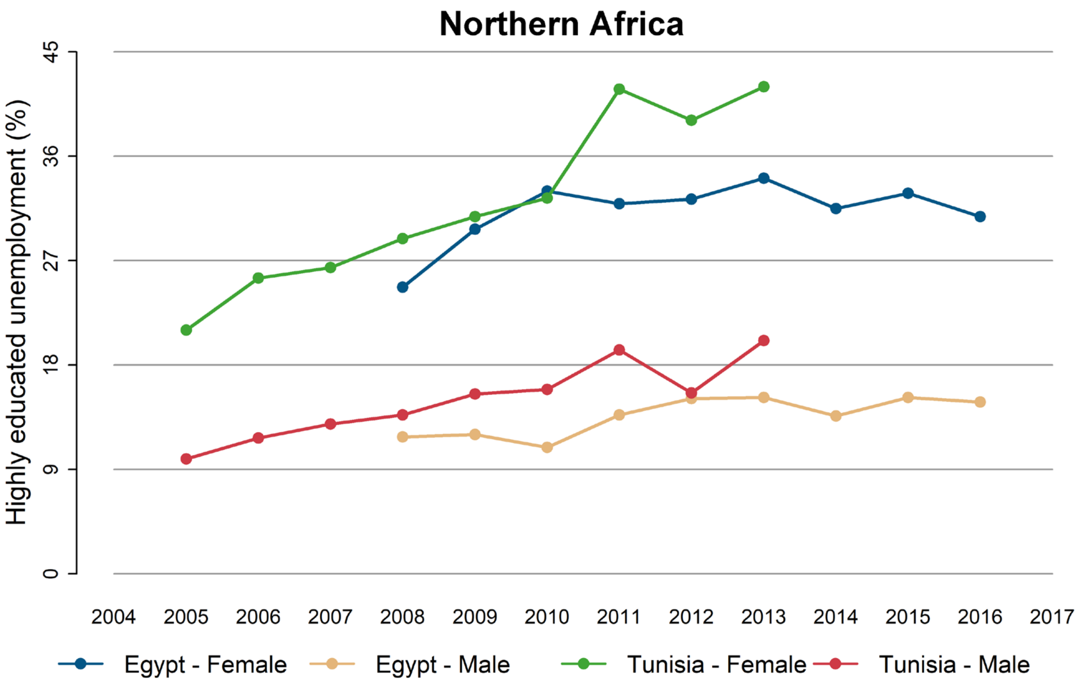

*Figure 4.11 – Change in mobility of HE students and enrolments in HE in focal countries (%)*
*Data source: UIS (2018).*
*Note: The # symbol indicates that Morocco had no growth (0 %) in the number of students leaving the country for HE (2000 to 2016), and as such the data point is not depictable here. Asterisk * = Mozambique's change in the number of students enrolled in HE in the country is not plotted, as it was substantially larger than all other countries (1,376 % from 2000 to 2018) and thus made the axis difficult to read.*

However, a good example of mobility within the Eastern Africa region, which entails no loss of students to other regions or even out of Africa altogether, is the IUCEA. This organisation encourages and supports the mobility of students and teachers within the community, as well as the exchange of information and experience on issues common to the educational systems of its partner states. The "Mwalimu Julius Nyerere" mobility scheme has also been significant for the training and mobility of postgraduate students and ECRs. The East African Science and Technology Commission, established in 2007, also works to promote and coordinate the development, management and application of science and technology in partner states and provides a platform for ECRs to utilise their skills within a large market.

Gender inequity is a further common challenge. While female enrolments are increasing progressively in all regions, women's representation in various professional academic and scientific fields is relatively low. The inequity between females and males is particularly clear in the higher rate of unemployment of highly educated females compared to males, as presented in figure 4.12 (below) for countries with data available. This disparity is particularly high in the Northern region, for example Egypt and Tunisia, where the unemployment rate of highly educated females is over 15 % higher than that of equivalent males (2009 to 2013 for Tunisia, 2009 to 2016 for Egypt; UIS 2018). Nonetheless, there are plenty of promising examples. This gap is considerably lower in South Africa (between 1 % and 2 % from 2009 to 2016) and lower but still concerning in Mauritius (a gap of up to 5.6 % in 2014). Insufficient data was available for countries in the Eastern and Western Regions to make a reasonable comparison.

Despite the gap in unemployment described above, Tunisia stands out as the country where women are still strongly represented in research, with females constituting 58.9 % of the FTE researchers in 2015. Mauritius

(58.6 % male compared to 41.4 % female in 2012) and South Africa (56.5 % male compared 43.5 % female in 2013) also have some of the smaller male-to-female gender gaps in research of the focal countries.



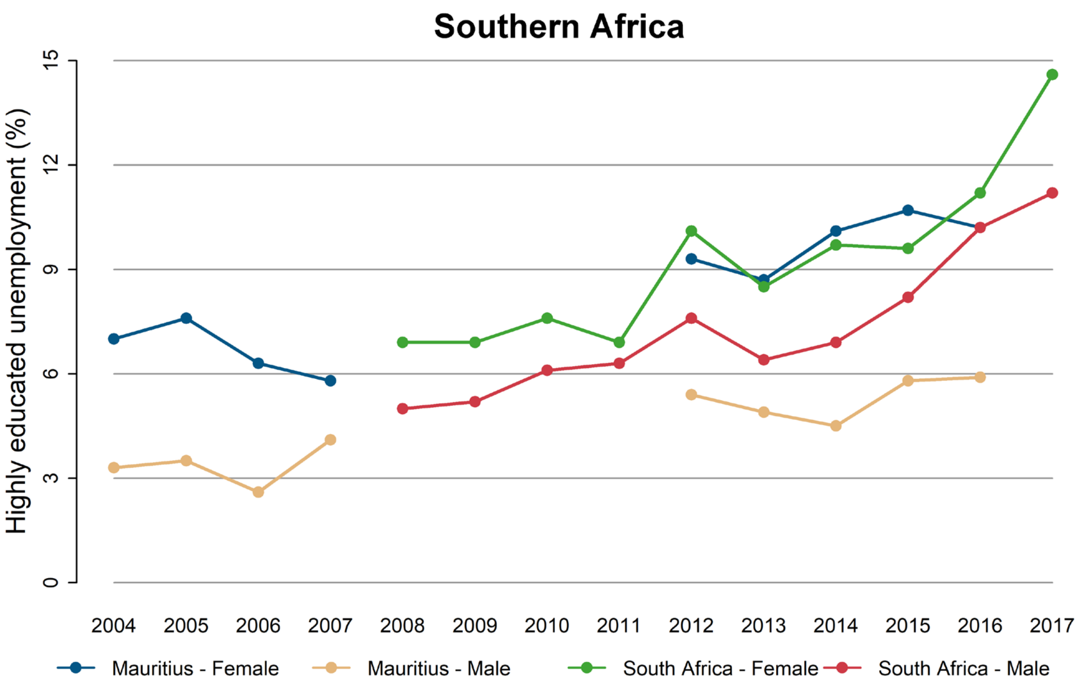




*Figure 4.12 – Unemployment rate of advanced or highly educated females and males in the n (left) and Southern region (right)*
*Data source: UIS (2018).*

Expanding on the above, the World Economic Forum (2018) ranks Rwanda as occupying the 6th position in the world, and remains the only sub-Sahara African country among the top ten countries in the world that have reduced their gender gaps – a good example for the African continent. The national councils for science and technology in all three countries in the Eastern region in this study have specific postgraduate grants for female candidates. Also, the EAC Gender Equality and Development Bill passed in March 2017 has considerable potential to improve conditions for women in science and research across EAC partner states. A number of HEI in all regions have also developed gender equity and equality policies, which, among other things, call for affirmative action in terms of setting gender quotas in admissions, awarding of research grants, and hiring practices to increase the percentage of women in research.

## 4.8 Conclusions

The comparative assessment of the state of HE and research systems across the four regional blocks in Africa has revealed several shared challenges, opportunities and best practices.

Among the key conclusions are:

- Budgetary allocations for education in the assessed countries are not up to the recommended regional and international expenditure benchmarks.
- Funding of R&D in HE is less than 1.0 % of GDP, and external research funding organisations often concentrate more in natural sciences, health, engineering and technology, and agricultural and veterinary sciences to the neglect of arts and humanities, as well as social sciences.
- Mentorship is still in its early stages.
- Outward mobility of graduate students abroad is still greater than the inward mobility of international students in most of the countries assessed.
- Gender equity is still far from being achieved across the HE and research system, which is strongly reflected in the considerable disparity in unemployment rates in most focal countries (female unemployment among the highly educated is higher than males of the same education level).

While some of the challenges identified in this chapter are already being addressed, the recommendations listed below may help improve the situation.

## 4.9 Recommendations

These recommendations also appear as Table 4.23A in Appendix 4.11.

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## 4.11 Appendix

*Table 4.23A – Suggested policies and approaches to availability, access, and integrity of regionally-comparable data*

| Interlocutors | Suggested Policies and Measures |
|---|---|
| **All Stakeholders** | ▪ HEI, research centres and national statistical agencies need to be able to collect and archive their data. Hence, horizontal and vertical coordination between organisations and cross-nations need to be facilitated and maintained.<br>▪ Higher level of commitment to ensuring gender equity by targeting equity policies in HE to adequately redress past imbalances created through the various stages of the education pipeline is also required.<br>▪ There is a strong need to come up with institutional policies to encourage female researchers without compromising productivity in the HE and research system. |
| **African Governments** | ▪ At the state level, governments need to legislate and pass Open Data legislations that would enable and facilitate accessibility to and sharing of data across sectors and borders .<br>▪ Data integrity, especially with regards to assembling, collating, and protecting, is of paramount importance to ensuring the availability of reliable comparable data across regions. Continentally, the AU recognises and has adopted an integrity approach, and it now must be adopted at the state levels. State members need to synchronically design and implement data assembling and collating protocols and models. |

*Table 4.23A – Continued*

| Interlocutors | Suggested Policies and Measures |
|---|---|
| **Government and Institutions** | ▪ There is also a need for a better coordinated, government-led regional approach to graduate education and training as a strategy to regain sovereignty in R&D matters. In particular, clear policies on postgraduate education and training must be established. Bottom-up approaches to strategy design and implementation involving local governments and HEIs leadership must be a part of the process.<br>▪ Supra-regional institutions for graduate education and for the promotion of R&D activities within regions need to be put in place to pave the way for the establishment of mechanisms for monitoring and documenting academic progression.<br>▪ Infrastructures for supporting ECRs do not encompass adequate support for post-doctoral work, including support for conference attendance and long-term research support. This leads to brain drain, as more ambitious ECRs move out to seek opportunities. Local institutions need to establish networks and infrastructures for quality research if ECRs have to stay within their countries/regions. |
| **Institutions and funding bodies** | ▪ Budgetary allocation to HE as well as funding to scientists not only requires a substantial increase, but also rationalised management.<br>▪ Governments are not called upon to solely inject more funds into HE as well as R&D. They need to diversify funding resources by involving the private sector, facilitating public-private partnerships, and including cross-sectorial synergies of civil society organisations and international private partnerships.<br>▪ The need for linking external support for graduate education ought to be addressed; especially that targeting the development of emerging researchers and scientists to the capacity needs of institutions.<br>▪ There seems to be no clear-cut policy on mentorship in institutions of higher learning, and the conditions for training and work environments for ECRs need to be improved across countries. Institution-based mentorship for up-and-coming scholars in the HE system is therefore needed. Senior researchers are thus invited to collaborate in developing comprehensive and systematic mentorship programmes and tools, and contribute in implementing them.<br>▪ Universities and other HE and research systems should evolve mechanisms and strategies that both attract more inwardly bound international students and promote programmes that support brain circulation within the regions or continent. |

Source: Authors.

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# 5 Diversity among African ECRs

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| CI | Confidence interval |
| ECR | Early-career researcher(s) |
| Freq. | Frequency |
| GERT | Gross enrolment ratio for tertiary students |
| GloSYS | Global State of Young Scientists |
| HC | Headcount |
| HE | Higher education |
| NGO | Non-governmental organisation |
| PhD | Doctor of Philosophy |
| Q | Quartile |
| UIS | United Nations Educational, Scientific and Cultural Organisation Institute for Statistics |

## 5.1 Defining an early-career researcher

The working definition of an early-career researcher (ECR) as outlined in previous Global State of Young Scientists (GloSYS) studies is:

> *"[A] Young Scientist or Scholar is defined as a postgraduate or early career researcher who has earned her/his PhD or an equivalent advanced research qualification up to 10 years ago and who is working in the following employment sectors: higher education, private / public research organisations, business enterprise or other sectors where research is conducted (e.g. NGOs). He/she will usually be between 30 and 40 years old." (Geffers et al., 2017, p. 30)*

In structuring this study, we considered the suitability of this definition for ECRs in the African context; particularly the requirement to have a Doctor of Philosophy (PhD) and the indicative age bracket of 30 to 40 years. To understand the suitability (or not) of these conditions, we used indicative data from the United Nations Educational, Scientific and Cultural Organisation Institute for Statistics (UIS) because there were limited studies in the African context that focussed specifically on ECRs at the time of the research design phase.

In table 5.1 below, we present the proportions of researchers with a Master's as their highest degree in each of the 14 focal countries. We present the minimum and maximum proportions recorded in each country from 2000 to 2018. This data indicates that considerable numbers of researchers have a Master's degree as the highest qualification, including over 80 % of researchers at times in Zimbabwe (2012), Morocco (2016) and Mozambique (2006). The lowest proportions recorded were in Egypt (20.1 % in 2015) and Kenya (29.5 % in 2010), and the average minimum proportion across all countries was 53.2 %.[16]

*Table 5.1 – Proportion of FTE researchers with Master's degree as their highest qualification*

| Country | Minimum (%) | Year (min.) | Maximum (%) | Year (Max.) |
|---|---|---|---|---|
| Cameroon | No data | - | - | - |
| Egypt | 20.1 | 2015 | 63.8 | 2007 |
| Ghana | 54.6 | 2010 | 54.6 | 2010 |
| Kenya | 29.5* | 2010 | - | - |
| Mauritius | 55.4* | 2012 | - | - |
| Morocco | 69.3 | 2006 | 83.8 | 2016 |
| Mozambique | 40.9 | 2015 | 95.0 | 2006 |
| Nigeria | 63.6* | 2007 | - | - |
| Rwanda | 62.3* | 2009 | - | - |
| Senegal | 61.3 | 2015 | 78.8 | 2010 |
| South Africa | 47.3 | 2005 | 54.9 | 2004 |
| Tunisia | 64.9 | 2015 | 66.1 | 2014 |
| Uganda | 42.6 | 2014 | 65.4 | 2010 |
| Zimbabwe | 80.4* | 2012 | - | - |
| Average | 53.2 | - | 70.3 | - |

Note: Asterisk * indicates that there was only data available for one year for the country between 2000 and 2018.
Source: UIS (2018).

It is clear from this data that excluding researchers with a Master's degree as their highest qualification from our focus would have limited the explanatory power and significance of our research regarding ECRs in Africa. As such, the criteria for eligibility in this study were adapted to allow people that had obtained a Master's degree in the 10 years preceding the survey to participate.

We also decided not to impose exclusion criteria in this study with respect to age. Instead, we interpreted the age range (usually between 30 and 40 years old) in the definition of an ECR from the GloSYS Association of South Asian Nations (ASEAN) study (Geffers et al., 2017) as indicative only, and thus needing verification in empirical research (such as with this study).

16 This is the numerical average of the data points presented in the minimum column; it has not been weighted to account for the numbers of researchers in each country.

## 5.2 Personal factors

We now outline the personal factors that define the respondents, including age, gender, ethnicity and race, their numbers of children and education level of their parents.

### 5.2.1 Age

The average age of respondents was 36.1 years, and with the first quartile (Q1) at 31 years and the third quartile (Q3) at 40 years. This suggests that the indicative age for an ECR given in the GloSYS ASEAN study is relatively well calibrated; however, the span in ages was from 22 (n=3) to 66 (n=1) years of age (see figure 5.1). Indeed, 15.2 % (n=156) of our sample were 29 or less and a further 22 % (n=226) were 41 or older, such that in total 37.6 % (n=382) of our sample were not between 30 and 40 years of age (Figure 5.1).

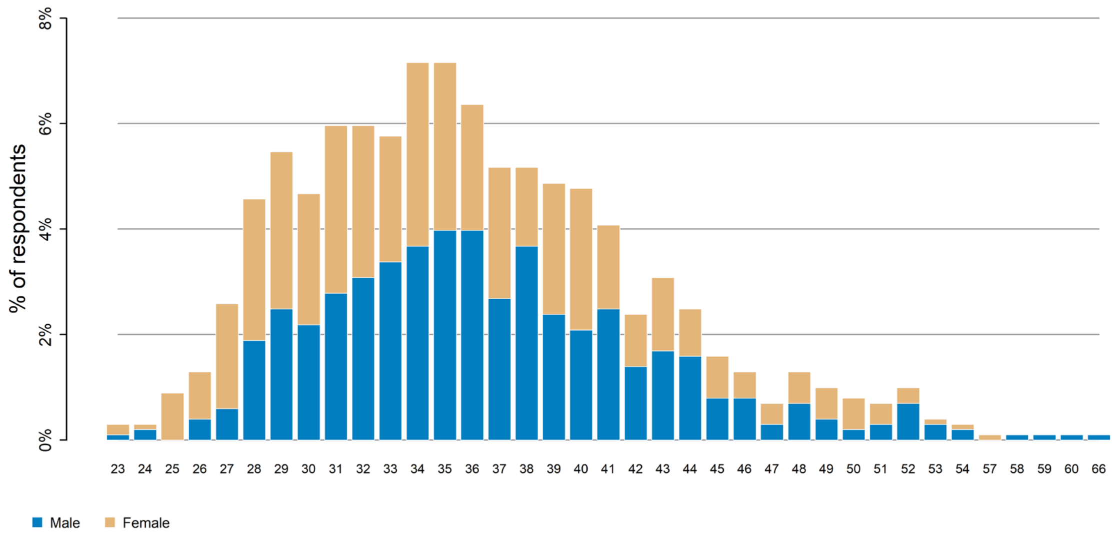


*Figure 5.1 – Age of respondents*
*Source: Authors.*

It is important to note that the indicative age bracket for an ECR given in the GloSYS ASEAN study was to apply to PhD holders only, but our ECR cohort includes both holders of Master's and/or PhDs attained in the preceding 10 years. The average age of GloSYS Africa PhD holders was 38.5 years, with a first quartile (Q1) of 34 and a third quartile of (Q3) of 42 (Figure 5.2). This indicates that PhD holders in our sample were somewhat older than the age range indicated in the GloSYS ASEAN study. As is reasonably expected, the average age of Master's holders was lower that of the PhD holders, at 33.5 years of age.

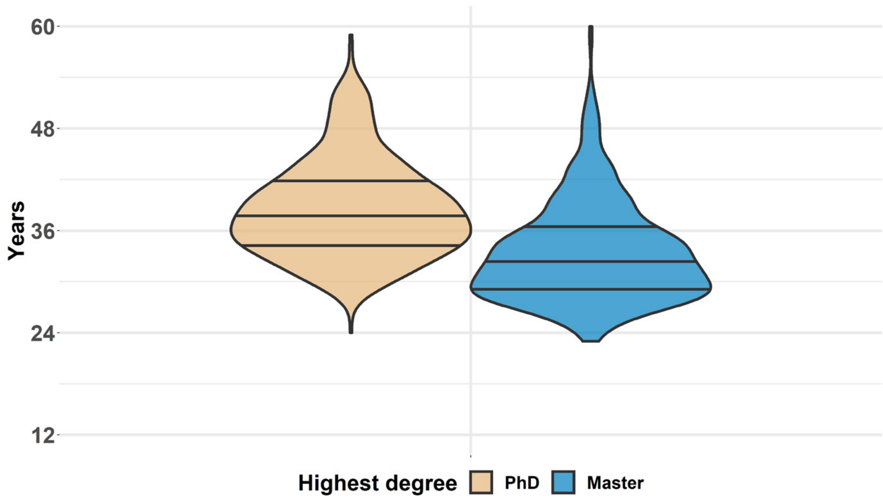


*Figure 5.2 – Age of respondents by highest degree attained in the last 10 years*
*Source: Authors.*

### 5.2.2 Gender

In our sample, 47.4 % (n=529) of respondents identified as female, 51.1 % (n=571) as male, 1.3 % (n=14) chose not to disclose and 0.3 % (n=3) identified as another gender. Among PhD holders, 53.2 % (n=307) were male and 45.6 % (n=263) were female,[17] with 1.2 % (n=7) preferring not to disclose or identifying as another gender. The proportion of females and males among Master's holders was more equal, with 49.3 % and 48.9 % identifying as female and male, respectively.

Regionally, female respondents constituted the majority of respondents born outside of Africa (61.5 %), and of those born in the Southern (60.9 %) and Northern regions of Africa (55.6 %; see Figure 5.3). There was a relative balance of female and male respondents born in the Eastern region (47.5 % and 51.1 %, respectively), while female respondents were a clear minority among respondents born in the West region (39.3 %) and non-focal African countries (39.4 %).

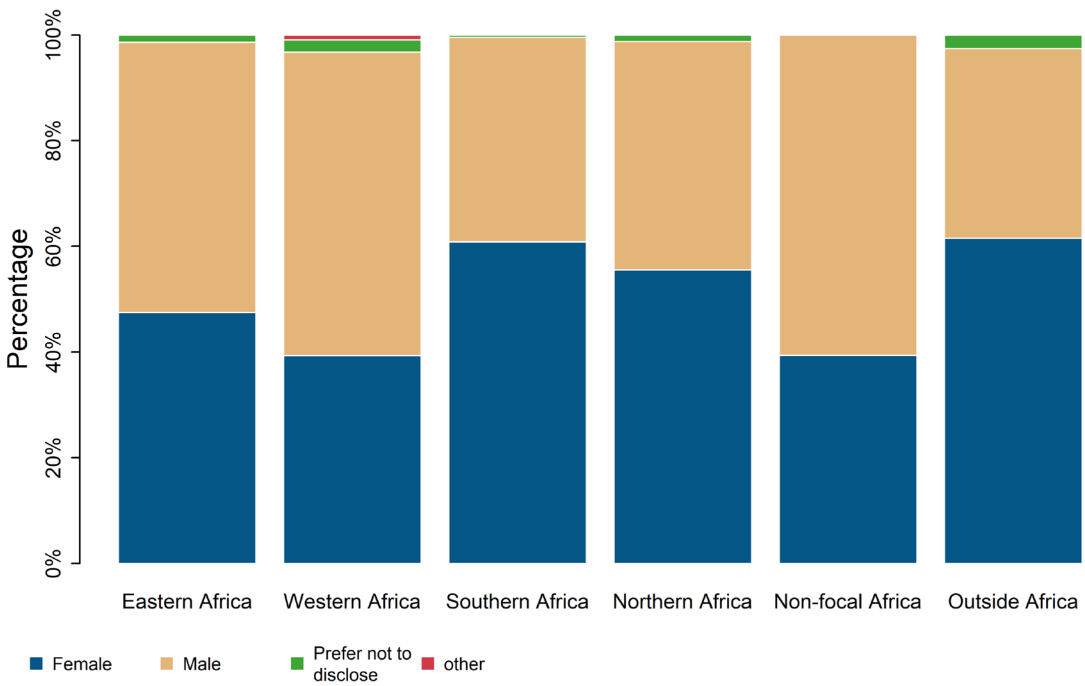


*Figure 5.3 – Self identifying gender of respondents by region of birth*
*Source: Authors.*

### 5.2.3 Ethnicity and race

The majority of the participants self-identified as black (76.3 %, n=845), and 13.2 % (n=146) identified as white, 3.7 % (n=41) as mixed ancestry, 2.8 % (n=31) as Asian, 1.3 % (n=14) indicated another racial category, while 2.8 % (n=31) chose not to respond. People that identified as white constituted a higher

17 This difference was not statistically significant when considering the distribution of all females and males with a PhD and Master's degree.

proportion of the PhD holders (18.0 %) than they did the Master's holders (8.0 %). This difference was statistically significant, such that respondents who identified as white were more likely to have a PhD degree than those who identified as black (P<0.0001).

In terms of gender (figure 5.4), the proportion of men that identified as black (82.2 %) was higher than the proportion of females that identified as black (69.8 %). This was driven by the higher proportions of women compared to men that identified as white (17.9 % compared to 9.4 %), mixed ancestry (4.8 % compared to 2.7 %) and Asian (3.8 % to 1.8 %).

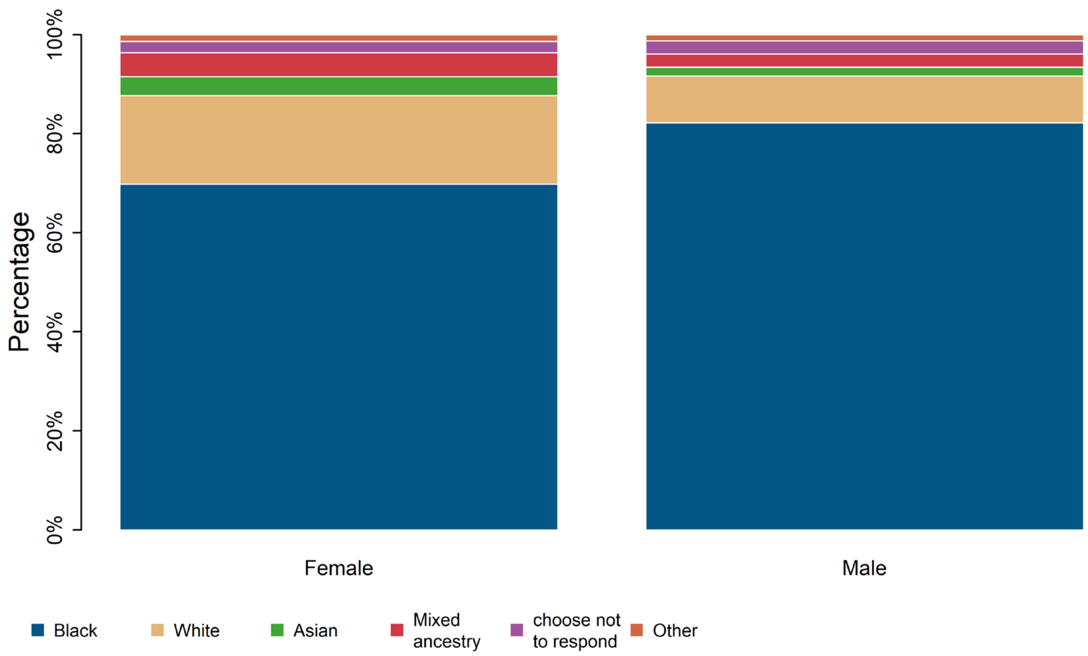


*Figure 5.4 – Self identifying ethnicity and/or race of respondents by gender*
*Source: Authors.*

### 5.2.4 Children

More than half of respondents indicated that they have children (55.3 %, n=613) and this was significantly higher amongst males (62.4 %, n=350) compared to females (47.0 %, n=244) (β=0.670, P=0.0001; Figures 5.5 and 5.5A). Of those that did have children it was most common to have two children (41.7 %, n=246), followed by one child (26.3 %, n=155) and then three children (19.2 %, n=113). The remainder of respondents with children had four or more (12.8 %, n=76).

We found no statistically significant difference between the number of children that female and male respondents had. However, females were more likely than males to have the first child prior to completing their Master's education, while males were more likely than females to wait until after they completed their PhD (P=0.0006).[18]

Regionally, respondents born in the Eastern or Western regions were more likely to have children than those born in the Southern region or outside of Africa (P<0.0029). Figure 5.5B shows that this was driven by the high proportion of respondents born in the Eastern (66.2 %) and Western (62.4 %) regions that have children by comparison to those born in the Southern region (43.7 %) and outside of Africa (25.6 %).

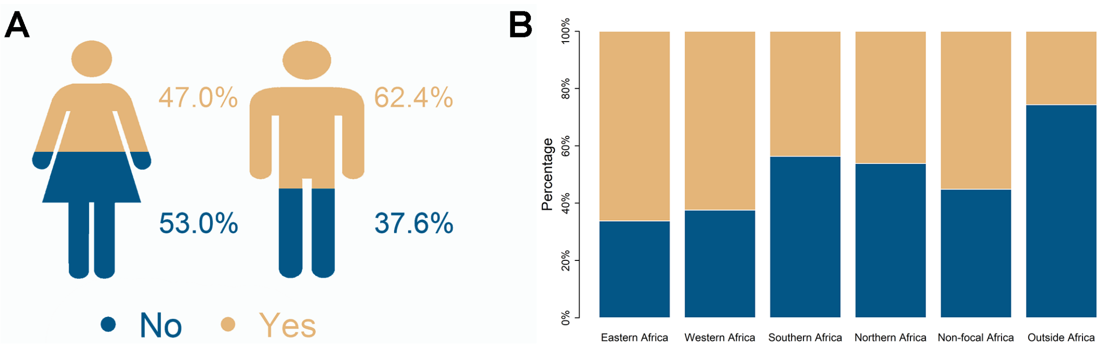


*Figure 5.5 – Proportion of respondents with children by gender (A) and region of birth (B)*
*Source: Authors.*

18 Refer to Chapter 8 for further information on academic progression and the timing of having children.

### 5.2.5 Parents' education

Overall, 40.8 % (n=453) of participants' fathers had at least a Bachelor's degree (or equivalent) compared to 28.1 % of their mothers. These differences were significant; female respondents were more likely than male respondents (P<0.0265)[19] to have fathers with higher levels of education (Bachelor, Master's, PhD) compared to lower levels of education only (primary or no formal education; see Figure 5.6). Similarly, we found that female respondents were more likely than male respondents (P<0.0111)[20] to have mothers with higher levels of education (Master's, Bachelor, Secondary) compared to lower levels of education only (primary or no formal education).

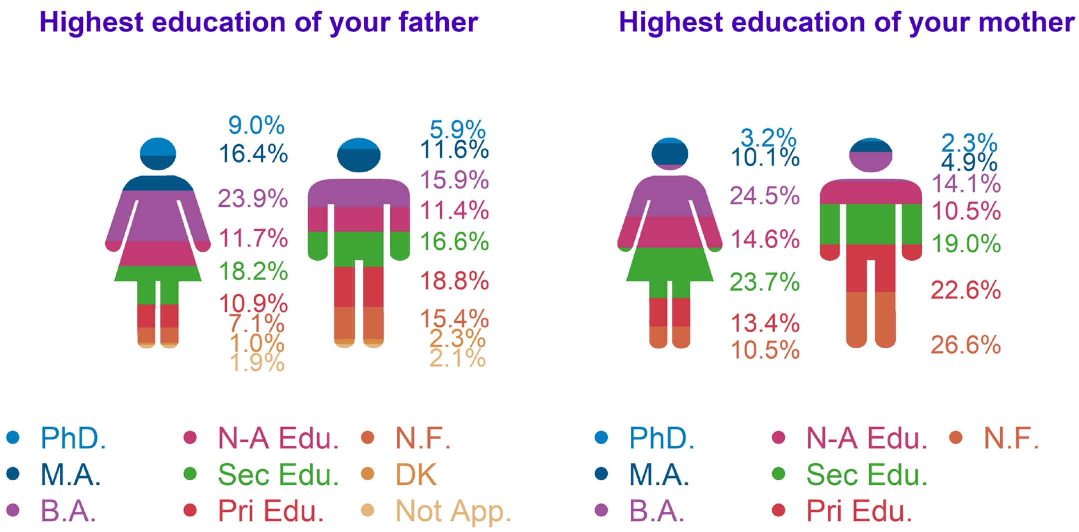


*Figure 5.6 – Highest education attained of parents by respondent gender*

## 5.3 Region and mobility

Respondents were born in 42 of the 54 African nations (n=1,106) and 18 countries outside of Africa (n=51).[21] The majority of respondents (n=1,063) were living in one of 41 African countries (see Figure 5.7). We also captured responses from n=94 Africans currently living in one of 32 countries outside of Africa, with Germany (n=18), China (n=8), the United States of America (n=7) and England (n=7) the most common individual countries. Most respondents (73.0 %) indicated they were citizens by birth where they were living, 8.5 % were permanent residents, 3.8 % were citizens by naturalisation, whilst 13.8 % of the participants were non-permanent residents and 0.9 % had another status of residency, including refugee.

As shown in Figure 5.7, South Africa had the largest population on foreign researchers, with 40.5 % of our respondent population currently living in South Africa having been born elsewhere, and one of the lowest

19 This effect is reported on the basis of where respondents were born.

20 This effect is reported on the basis of where respondents were born.

21 Refer to section 5.6 for an analysis of these figures by region and focal country.

proportions of respondents in the diaspora (7 %). Amongst our focal countries, Zimbabwe (52 %), Cameroon (24 %), Uganda (23 %), Kenya (19 %) and Nigeria (17 %) had the largest number of nationals in the diaspora. Whilst 29.4 % of our respondents received their masters outside their country of birth (n=322 compared to n=775 in their home country), considerably more respondents (46.0 %) received their PhD outside their home country (n=274 compared to n=322 in their home country). Additionally, of all PhD holders, 29.9 % of them received their PhD outside of Africa.[22]

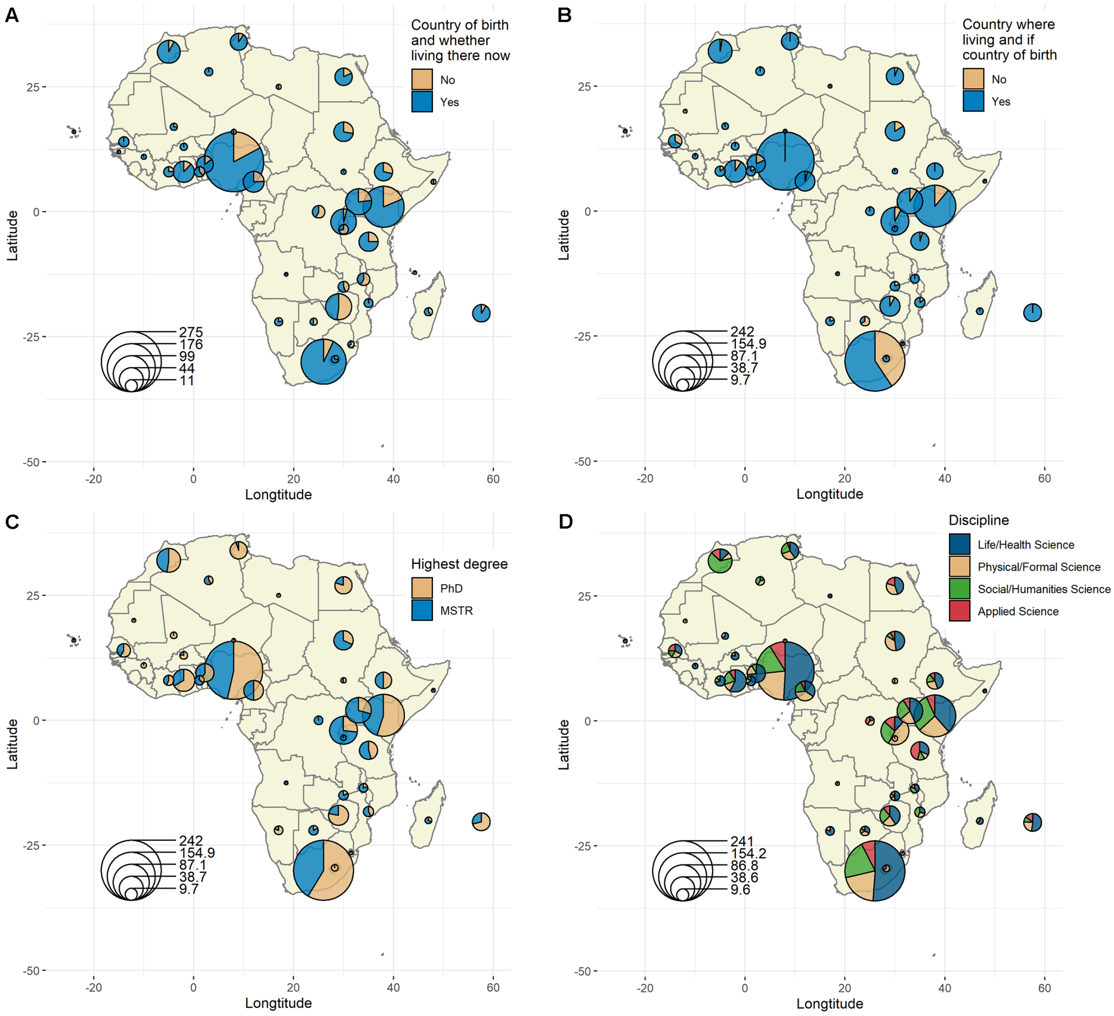


*Figure 5.7 – African country distribution of respondents according to where born and where currently living, and their highest degree and discipline according to where currently living*

22 Refer to Chapter 11 for further discussion of international mobility and education.

## 5.4 Education

### 5.4.1 Highest degree

More than half (52.1 %, n=603) of the participants hold a PhD or doctoral degree (53.8 % of all males compared to 49.7 % of all females, see figure 5.6). Also, 47.9 % (n=554) of the participants have a Master's degree as their highest degree (46.2 % of all males compared to 50.3 % of all females, see Figure 5.8).

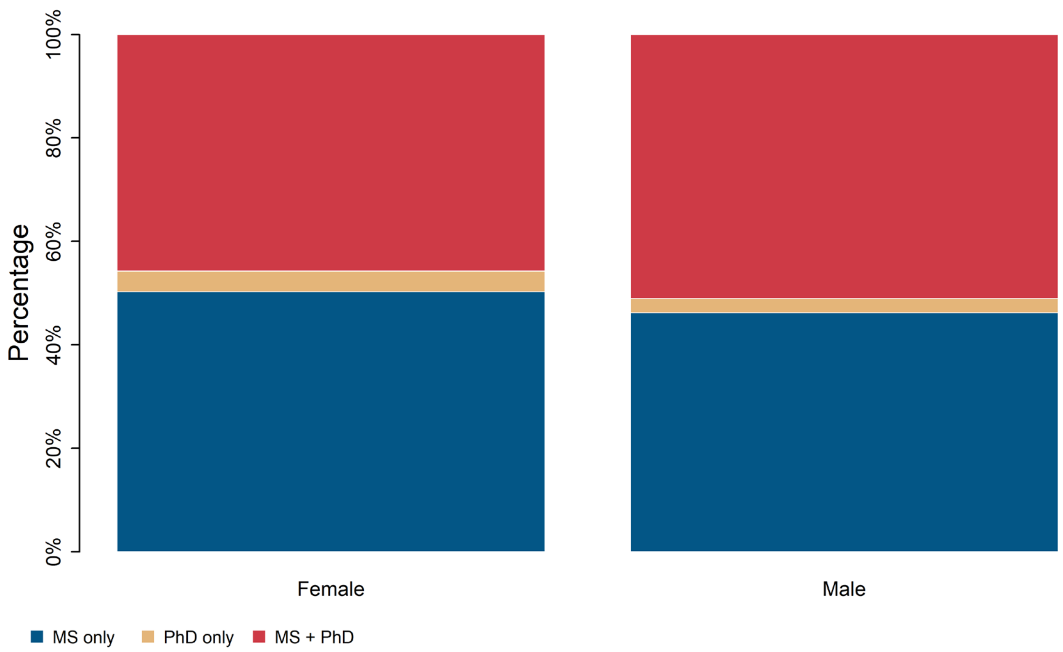


*Figure 5.8 – Highest degree of respondents by gender*
*Source: Authors.*

For those with a Master's as their highest degree, 69.0 % (n=382) reported that they were working toward their PhD, while another 31.0 % (n=172) were not. In Figure 5.9 we present these results by sector; 61.9 % of those employed in the higher education (HE) sector were working toward their PhD (i.e. were doctoral students) and those in this sector were more likely ($P \leq 0.0265$) to be doing so than those in business enterprise (22.2 %), private non-profit/non-governmental organisation (NGO) (26.3 %) and to a lesser extent public and private research institutes (42.6 %).[23]

23 Refer to Chapter 6 for more information on this.

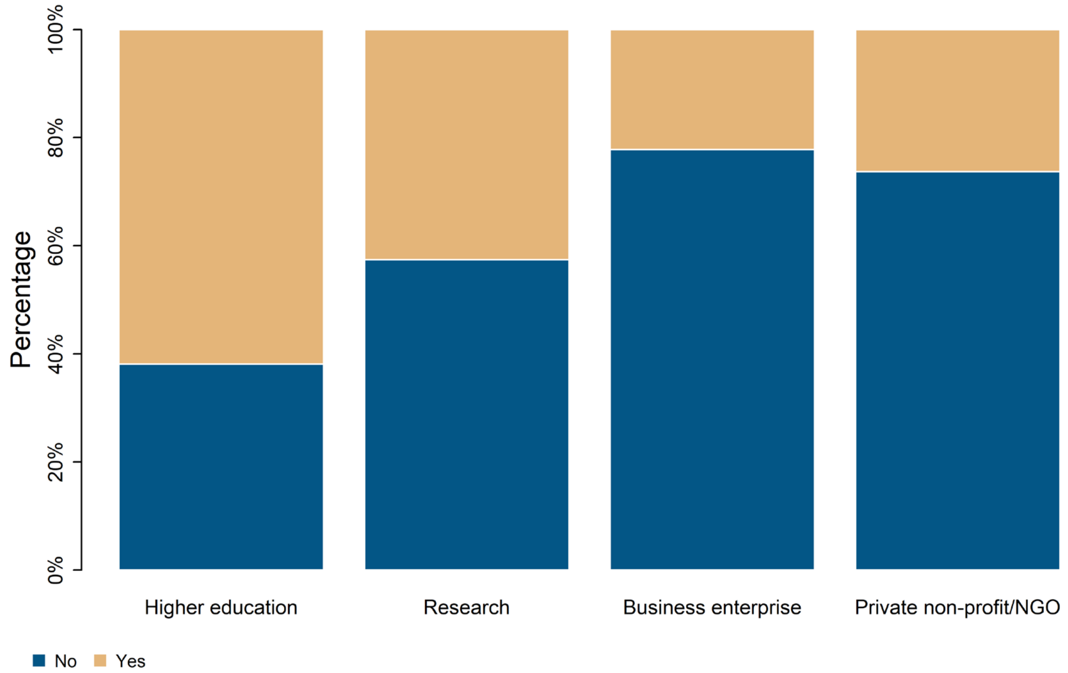


*Figure 5.9 – Doctoral students working toward a PhD qualification by sector*
*Source: Authors.*

The elevated proportion of respondents working toward a PhD in the HE sector by comparison to others is reflected also in the proportions of all respondents by sector that had already attained PhDs; 78.8 % of all respondents working in the HE sector had already attained a PhD. Those working in HE were more likely (P<0.0170) to hold a PhD than those in business enterprise (18.2 %), private non-profit/NGO (29.6 %) and research institutes (64.7 %; Figure 5.10).

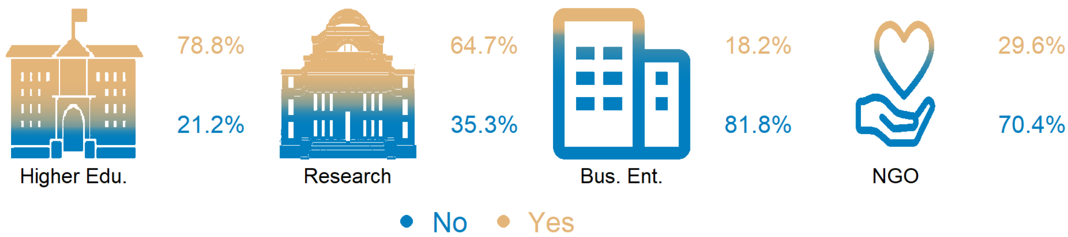


*Figure 5.10 – Attainment (or not) of PhD qualification by sector*
*Source: Authors.*

Finally, the number of PhD holders by region in our sample varied considerably; for all respondents born outside of Africa, 76.9 % held a PhD and a similar proportion was registered for those born in the Northern region (71.8 %). The lowest proportion of PhD holders were among respondents born in the Eastern (41.6 %) and non-focal African regions (41.7 %); see Figure 5.11).

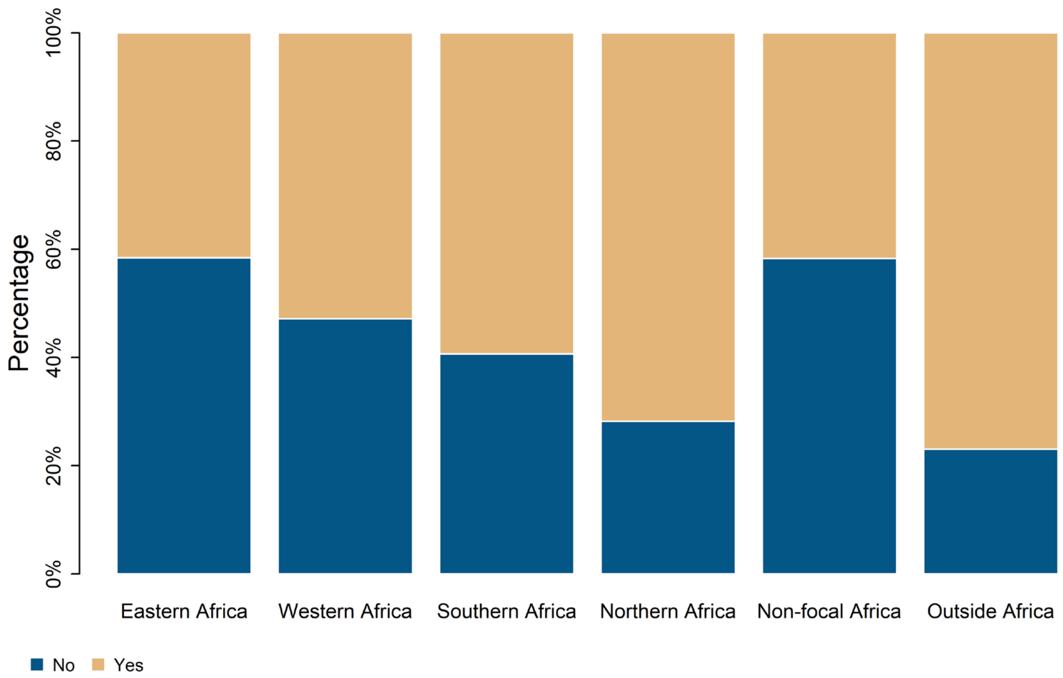


*Figure 5.11 – PhD holders by region of birth*
*Source: Authors.*

### 5.4.2 Discipline of education

Referring to Figures 5.10 and 5.11, the distribution by discipline of respondents is relatively consistent for those with a Master's as their highest qualification compared to those with a PhD. Figure 5.12 shows the distribution of discipline, based on where respondents are currently living within Africa. Overall, with Master's and PhD holders combined, 29.0 % (n=334) completed their degree in the Life Sciences, 15.8 % in the Health Sciences or Medicine (n=182), and 13.8 % (n=159) in the Social Sciences. All other disciplines constituted approximately 10 % or less of respondents' qualifications.

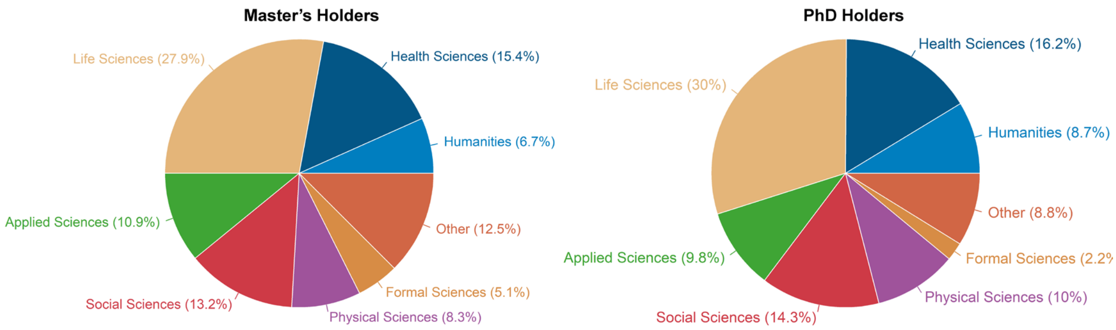


*Figure 5.12 – Discipline of qualification of respondents with a Master's or PhD as their highest degree*
*Source: Authors.*

## 5.5 Employment

### 5.5.1 Employment status and contract conditions

**Employed**

More than half of our respondents (57.8 %, n=668) indicated they were employed, over a fifth (21.9 %, n=253) were current doctoral students, 9.0 % (n=104) were in postdoctoral positions, 2.3 % (n=26) were self-employed and 8.0 % (n=92) were unemployed. The remainder were on leave and planned to return to their job (0.7 %), or were running their own business (0.3 %). Respondents born in non-focal African countries were more likely to be doctoral students (P=0.0309) or unemployed (P<0.0001) by comparison to those born in any of the focal regions of Africa; this result also means that respondents born in any of the focal regions were more likely to be employed (P<0.0309) than those born in non-focal African countries. Furthermore, respondents with a Master's degree as their highest qualification were more likely than those with a PhD to be unemployed (P<0.0001), which was driven by an 11.0 % unemployment rate among Master's holders (5.2 % for PhD holders).

Amongst all respondents, only half (53.3 %, n=352) have a permanent contract; however, less than half of respondents living outside of Africa (27.3 %, n=6), the Northern (39.5 %, n=15) and Eastern regions (42.9 %, n=57) had permanent employment. In contrast, over half of respondents living in the Southern (54.8 %, n=91) and Western regions (61.5 %, n=123) had permanent positions. Master's holders were more likely to have fewer permanent contracts compared to PhD holders (40.6 % compared to 58.6 %), and thus were more likely than PhD holders to have rolling/renewable (P=0.0320) and short-term contracts of less than one year (P=0.0077; see Figure 5.12).

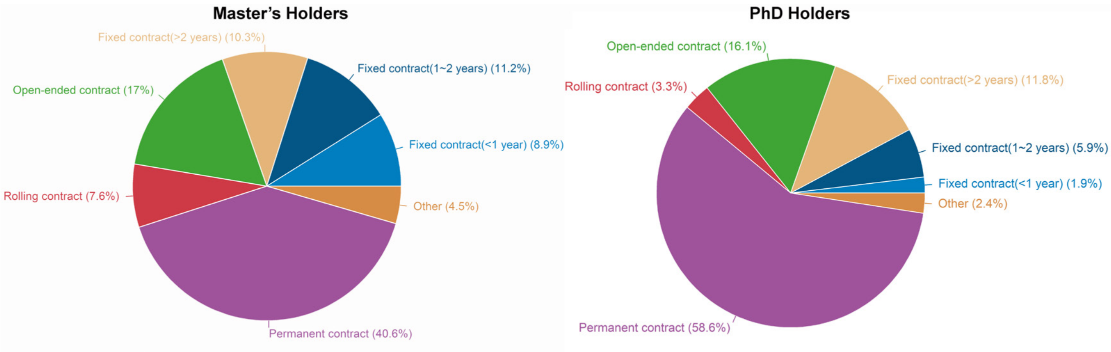


*Figure 5.13 – Employment contract type*
*Note: only respondents who were employed are displayed (excludes doctoral students, self-employed, unemployed and persons on leave at time of survey).*
*Source: Authors.*

### Unemployment

Amongst those who were unemployed, 52.2 % (n=48) were employed in a research capacity prior to their unemployment; 97.8 % (n=89) participants were actively seeking employment, with 69.7 % (n=62) seeking a research-related position and 30.3 % (n=27) were seeking a position not necessarily research-related. Half of those respondents that were unemployed and looking for work (53.4 %, n=46) had been doing so for more than six months. Respondents' reasons for their current unemployment varied, and in order of frequency were: overqualified for available jobs (23 %); under-qualified for available jobs (10.7 %); mobility reasons, such as being unable to move to a location suitable for securing employment (9.8 %), given up looking (9.0 %), family reasons (7.4 %), lack of competitiveness for jobs (4.9 %); 35.2 % of unemployed respondents also indicated "other" reasons, which many explained predominantly related to a lack of job availability.

### Postdoctorate positions

Overall, 27.0 % of the participants who have a PhD indicated that they have held a postdoctoral position (30.2 % of all males with PhDs compared to 25.1 % of females with PhDs). It was more common for those born in the Southern region or outside of Africa compared those born in the Eastern, Western and non-focal African countries to have held a postdoctorate position (P≤0.0282). Those living in the Southern region were also more likely to have done a postdoctorate compared to those living in Eastern, Western and non-focal African countries (P≤0.0098). Most postdoctoral positions were held for one to three years, with an average of 2.1 years.

## 5.5.2 Employment sector

Among our employed participants, three quarters (73.4 %, n=473) work at a university or other HE institution, 15.6 % were employed by a research institution, 4.1 % by business enterprise, and 3.4 % were employed by private non-profit organisation. There was a higher proportion of respondents with a PhD (85.27 %) working in HE compared to Master's (58.8 %; see Figure 5.14).

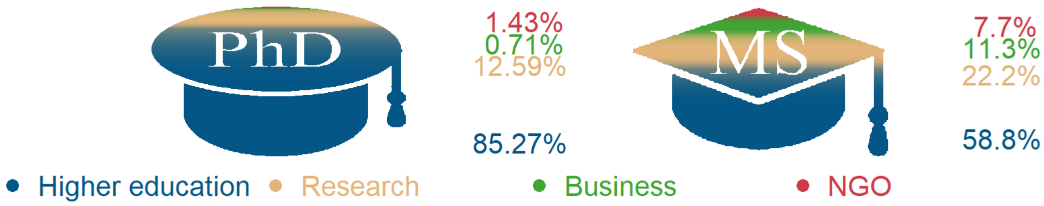


*Figure 5.14 – Proportion of PhD and Master's holders by sector of employment at time of survey*

*Note: only respondents who were employed are displayed, (excludes doctoral students, self-employed, unemployed and persons on leave at time of survey).*
*Source: Authors.*

## 5.6 Survey sample representativeness

### 5.6.1 Methodological challenge of determining the sample size representatively

The significance and explanatory power of this research is dependent upon how well ECRs in the 14 focal countries were represented by the survey (and interviewee) respondents. The representativeness of a sample is normally assessed by comparing the size of the target population (i.e. the number of ECRs in the 14 focal countries) with the number of survey respondents from within the target population. We intended to use this methodology; however, owing to the lack of a primary source of data that provides an accurate estimation of the number of ECRs in each of the 14 focal countries (at the time of survey) we have chosen to provide an estimate of this by combining other primary sources of data and a number of assumptions (discussed and justified).

To formulate an estimation of the number of ECRs in the 14 focal countries, we had to choose some important parameters that directly relate to the definition of an ECR and that also have readily available and accurate sources of data. In this context we decided to define an ECR in the following way: "Any person between the ages of 25 to 44 and that is employed as a researcher[24]."

This definition reflects the distribution of researchers by age that participated in this research (refer to section 5.2.1). Critically, it allows us to use primary data sources for population size by age group and the headcount (HC) of researchers in each of the 14 focal countries as the basis to forming an indirect estimate of the number of ECRs. The indirect estimate was constructed using the following metrics (see Table 5.2):

24 For the purpose of this estimation a "researcher" is defined as per the definition used by the UNESCO Institute for Statistics.

*Table 5.2 – Metrics used to determine sample representivity*

| Metric No. | Metric | Source Database |
|---|---|---|
| **1.** | Researchers (HC) – Total | UIS 2018 |
| **2.** | Population – Total (segregated by age) | UNSD 2018 |

Source: Authors.

### 5.6.2 Estimating the sample size in each country

For each country, the number of ECRs in the country is estimated using the following calculation:

where, X = a focal country in Africa, and HC = headcount

The calculation works on a weighted fractional basis, thus determining the proportion of 25 to 45-year olds in the wider 25 to 64-year-old age bracket for the country, and then multiplying this fraction by the number of researchers in the country. It was necessary to make a number of assumptions for this method to work, which we present and discuss in turn in the following sections (sections 5.6.3 and 5.6.4). Furthermore, though this methodology enabled us to overcome some issues with a lack of data pertaining to ECRs in the 14 focal countries, there were still instances of data lacking with respect to these two metrics, thus in section 5.6.5 we discuss these limits and the level of confidence attained in our analysis, given the sample size achieved.

### 5.6.3 Assumptions

To use these metrics and this calculation to estimate the number of ECRs, the following assumptions were necessary (refer to section 5.6.6 for a comment and analysis of the validity of these assumptions):

(1) The scientists (or researchers) captured by metric number 1 were all between the age of 25 and 64 years of age;
(2) The number of scientists in each country is uniformly distributed by age – so that, for example, the number of scientists that were 30 years old is the same as the number of scientists that were 25, 46 or 64 years of age;

### 5.6.4 Comment on the data availability

As data was not available for each of the necessary metrics in each of the 14 focal countries, the following rules were used to limit the estimation to one that is both accurate and reasonably current.

(1) Any country for which metric 1 (researcher HC) was not available between 2008 and 2017 was excluded from the analysis;
(2) Any country for which metric 2 (population by age data) was not available for any of the 10 years prior to metric 1 being published, or within 5 years afterwards then the country was excluded from the analysis. For example, in Morocco, the most recent data for metric 1 is from 2016. However, the most recent data for metric 2 is from 2004. Because the estimation of the number of scientists in Morocco relies on combining these data sets and the data points are over a decade apart, an accurate estimation of the current number of ECRs is considered possibly prone to error.

### 5.6.5 Sample representativeness of ECRs in the 14 focal countries

Using the methodology outlined above, we determined the following target population sizes (of ECRs) in each of the 14 focal countries in Africa (see Table 5.3).

*Table 5.3 – Calculated target sample size (of ECRs) in the 14 focal countries*

| | Source Data Year | | |
|---|---|---|---|
| Country | Population Data | Researchers (HC) | Calculated No. of ECRs (in country) |
| Cameroon | 2005 | 2008 | 3,240 |
| Egypt | 2017 | 2017 | 87,461 |
| Ghana | 2010 | 2010 | 1,769 |
| Kenya | 2009 | 2010 | 9,402 |
| Mauritius | 2017 | 2017 | 930 |
| Morocco* | 2004 | 2016 | 33,432 |
| Mozambique* | 2007 | 2015 | 1,731 |
| Nigeria | 2006 | 2008 | 12,803 |
| Rwanda | 2012 | 2016 | 373 |
| Senegal | 2013 | 2015 | 9,920 |
| South Africa | 2011 | 2016 | 37,407 |
| Tunisia | 2014 | 2016 | 22,362 |
| Uganda | 2014 | 2014 | 1,422 |
| Zimbabwe | 2012 | 2012 | 2,007 |
| Total | – | – | 224,260 |

Note: Asterisk * designates that estimation is possibly prone to error due to large gap in time between availability of population and researcher data. See Table 5.5A in Appendix 5.9 for full data set.
Source: Authors.

We used Cochran's method (Cochran 1977) to determine the level of confidence and precision reached in our results based on the sample size of respondents living in each of the 14 focal countries. The specific formula is:

where:

- "n" is the sample size required to reach the desired confidence and precision level
- "e" is the required error margin (i.e. precision)
- "p" is the estimated proportion of the sample population that have the attribute being analysed
- "Z" is a constant that is set after selecting the desired error margin and confidence interval (CI). For normal distributions Z=1.645 (for CI=90 %), 1.96 (for CI = 95 %) and 2.576 (for CI=99 %).

Many different p-values may apply to our research because we have performed statistical analysis with respect to many different variables. To simplify this analysis, we have chosen a p-value of 0.5 for all variables as this maximises the required sample size to meet a desired confidence and precision level. In reality, the p-value may be greater or less than 0.5 for a number of the variables we are interested in, for example, in a country where only 30 % of researchers were females the p-value would be 0.3. However, as a p-value of 0.5 maximises the sample size estimation, our approach will always over-estimate the required sample size and thus is a conservative basis for this determination.

In table 5.4 below, we present the confidence intervals and precision levels reached for our sample (overall) and also within each region for more granularity.

*Table 5.4 – Confidence interval and error margin of sample size living in Africa*

| | CI = 99 % | | | CI = 95 % | | | CI = 90 % | | |
|---|---|---|---|---|---|---|---|---|---|
| Region | e =10 % | e = 5 % | e = 10 % | e =10 % | e = 5 % | e = 10 % | e =10 % | e = 5 % | e = 10 % |
| All Focal Countries | | * | * | | * | * | | * | * |
| Northern | | | | | | | | | * |
| Eastern | | | * | | | * | | | * |
| Southern | | | * | | | * | | * | * |
| Western | | | * | | | * | | * | * |

Note: Asterisk * indicates that the sample size was reached to achieve this confidence level and error margin.
Source: Authors.

The results in table 5.4 indicate that across the combined 14 focal countries, our sample size reached a level appropriate for a confidence interval of 99 % and an error margin of ±5 %. At the regional level, the sample sizes in the Eastern, Southern and Western regions were large enough to reach a confidence interval of 99 % and an error margin of ±10 %. The Northern region, where we had fewer responses, reached a confidence interval of 90 % with an error margin of 10 %. Overall, these results indicate that our sample size reached an appropriate level for a high degree of confidence and precision, in particular with respect to statistical analysis that does not split the sample by region; however, even in this respect our sample size reaches a reasonable degree of confidence and precision.

### 5.6.6 Comment on the validity of assumptions to determine sample sizes

In section 5.6.3 we outlined a number of assumptions that we made in order to conduct this analysis, here we discuss these assumptions further.

**Assumption 1**

For the purpose of the justification of assumption 1, it was further assumed that no people aged 80 years or older would be working as a researcher;

(1) It is possible, and not unlikely, that there were some scientists working in each country who were 65 years of age or older.
   (a) However, persons aged between 65 to 79 years of age in these countries constitute on average only 9 % of all people between 25 and 79 years of age (with a range of 5 % to 17 % for individual countries);

(b) Furthermore, in many of the African countries, the retirement age is reported to be generally below 65 years of age (Retirement age around the globe 2020). As such, it is reasonable to expect the number of scientists working past the retirement age (to somewhere between 65 and 79 years of age) to be low.

Considering points 1, 2(a) and 2(b) together. it is considered reasonable to exclude 65 to 79-year olds (and anyone older) from the analysis, and that this would not unduly inflate the estimation.

**Assumption 2**

It is quite possible that the number of researchers in a country would not be uniformly distributed by age. To this point, we note that across the 14 countries in the analysis, the gross enrolment ratio for tertiary students (GERT) increased between 1990 and 2017 (UIS 2018). As this indicates that over this period more students have at least been enrolled at university, it is expected that the distribution of researchers by age would be biased toward younger to middle aged persons, as more would have graduated and (presumably) taken up employment. Therefore, as we have assumed to the contrary for this analysis – that the distribution would be uniform – it is expected that our estimation for the number of ECRs is conservative, in respect to assumption 2. There is at least one potential counterbalances to this, however, which may limit the uncertainty of this assumption: the GERT represents student enrolments at all levels of tertiary education (including Bachelor) but not graduations, and as such a considerable rise in the GERT does not necessarily entail an equal rise in the graduation rate of students, and particularly not of Master and PhD students. Nevertheless, we conducted a sensitivity analysis on this assumption to demonstrate that our sample representativeness analysis is not dependent on this assumption. (i.e. changes to this assumption have a limited impact on the outcome of the sample representativeness analysis). To do this we varied the estimated number of ECRs in each of the 14 focal countries by 50 % and re-determined the confidence intervals and error margins reached by the actual number of surveyed responses living in Africa (and the particular regions). We found that the same confidence intervals and error margins would be reached as those presented in table 5.4 above, thus indicating there is minimal dependence of our analysis of sample representativeness on our calculated number of ECRs when using the Cochran method.

## 5.7 Interviewee sample representativeness of survey sample

Overall, we are relatively pleased with our efforts to seek comparable representation of interviewees to survey respondents. As a start, it is important to note that despite only interviewing half the number initially intended, we still interviewed nearly 10 % of the PhD holders surveyed, a sizeable proportion. Further, there are many ways in which the two sample groups were roughly equivalent. For instance, the comparative distributions of survey responses and interviewees by age and employment category are excellent. Similarly, distribution across labour sectors and job type is roughly equivalent. The two samples were relatively well-matched regarding time since graduation, considering leaving academia, and self-reported ethnicity. Finally, disciplinary affiliation is roughly comparable, with only a slight over-representation of physical sciences and under-representation of social sciences in the interviews (see table 5.6A in Appendix 5.9 for exact values).

In other ways, the interviewees were less well-matched to respondents, which is evident in the following statistics regarding only the PhD holders in the interviews and survey. We interviewed fewer males (43.9 %) and more females (56.1 %) than those surveyed (53.2 % and 46.8 %, respectively). We also interviewed more women with children (35.1 %) than survey respondents (25.7 %), and fewer men (35.1 %)

with children compared to survey respondents (39.3 %). Overall, though, we interviewed a similar proportion of respondents with children (70.2 %) compared to the survey population (65.0 %). Finally, we have a higher representation in the interviews of respondents who had spent three months or more outside their home country compared to respondents who had not[25] – though in both samples the percentage of respondents who had spent time outside their home country was high (70.1 % for surveys, 87.7 % for interviews).

Finally, we sought an even distribution of interviews across African regions and those living outside of Africa (i.e., not weighted by survey respondent rate). As such, relative to survey respondents, interviewees in the diaspora (both elsewhere in Africa and outside of Africa) and those from the Northern region were over-represented, whilst interviewees from the Western and non-focal regions were under-represented.

## 5.8 References

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25 As an aside, we found, not surprisingly, that survey respondents with PhDs were much more mobile (70.1 %) than those with Master's as their highest degree (47.3 %).

## 5.9 Appendix

*Table 5.5A – Raw Population and Researcher (HC) data for determining target sample size of ECRs*

| | Population in Age Bracket | | | | | | | | | Researcher Data | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | 25–29 | 30–34 | 35–39 | 40–44 | 45–49 | 50–54 | 55–59 | 60–64 | Data Year | Head Count | Data Year | Calc. No. ECRs |
| Cameroon | 1,368,560 | 1,086,007 | 847,768 | 713,376 | 576,662 | 470,027 | 305,741 | 285,354 | 2005 | 4,562 | 2008 | 3,240 |
| Egypt | 8,167,607 | 7,344,289 | 6,486,415 | 5,152,723 | 4,392,511 | 3,998,096 | 3,260,371 | 2,649,360 | 2017 | 133,527 | 2017 | 87,461 |
| Ghana | 2,050,111 | 1,678,809 | 1,421,403 | 1,186,350 | 938,098 | 833,098 | 523,695 | 475,849 | 2010 | 2,542 | 2010 | 1,769 |
| Kenya | 3,201,226 | 2,519,506 | 2,008,632 | 1,476,169 | 1,272,745 | 956,206 | 711,953 | 593,778 | 2009 | 13,012 | 2010 | 9,402 |
| Mauritius | 93,947 | 84,833 | 100,887 | 87,289 | 84,579 | 94,652 | 84,568 | 71,214 | 2017 | 1,779 | 2017 | 930 |
| Morocco | 2,482,273 | 2,203,371 | 1,891,551 | 1,860,474 | 1,489,679 | 1,227,188 | 759,563 | 740,891 | 2004 | 50,142 | 2016 | 33,432 |
| Mozambique | 1,549,019 | 1,251,554 | 1,037,587 | 755,605 | 649,896 | 514,520 | 402,668 | 299,703 | 2007 | 2,434 | 2015 | 1,731 |
| Nigeria | 12,211,426 | 9,467,538 | 7,331,755 | 6,456,470 | 4,591,293 | 4,249,219 | 2,066,247 | 2,450,286 | 2006 | 17,624 | 2008 | 12,803 |
| Rwanda | 928,094 | 760,884 | 509,666 | 415,560 | 340,856 | 338,309 | 241,323 | 176,349 | 2012 | 530 | 2016 | 373 |
| Senegal | 1,033,035 | 841,899 | 666,643 | 555,359 | 425,881 | 405,797 | 288,564 | 257,942 | 2013 | 14,335 | 2015 | 9,920 |
| South Africa | 5,059,317 | 4,029,010 | 3,467,767 | 2,948,619 | 2,620,283 | 2,218,289 | 1,797,408 | 1,385,768 | 2011 | 56,761 | 2016 | 37,407 |
| Tunisia | 934,617 | 983,781 | 816,986 | 727,848 | 682,956 | 650,608 | 535,168 | 425,424 | 2014 | 37,176 | 2016 | 22,362 |
| Uganda | 2,486,176 | 1,951,739 | 1,535,837 | 1,272,417 | 921,124 | 808,103 | 480,284 | 440,053 | 2014 | 1,942 | 2014 | 1,422 |
| Zimbabwe | 1,131,691 | 920,747 | 736,741 | 524,786 | 348,014 | 350,855 | 282,344 | 226,716 | 2012 | 2,739 | 2012 | 2,007 |

Source: Authors.

*Table 5.6A – Representativeness of interviewees by comparison to the survey sample*

| | | Survey | | Interview | | Difference |
|---|---|---|---|---|---|---|
| **Factor** | **Sub-Category** | **Frequency** | **%** | **Frequency** | **%** | **%** |
| **Region** | Northern | 55 | 9.2 | 7 | 12.3 | 3.1 |
| | Eastern | 87 | 14.5 | 7 | 12.3 | -2.2 |
| | Southern | 121 | 20.1 | 8 | 14 | -6.1 |
| | Western | 162 | 27 | 14 | 24.6 | -2.4 |
| | Non-focal | 67 | 11.1 | 0 | 0 | -11.1 |
| | Diaspora-Out | 37 | 6.2 | 12 | 21.1 | 14.9 |
| | Diaspora-In | 44 | 7.3 | 8 | 14 | 6.7 |
| | International-In | 28 | 4.3 | 1 | 1.8 | -2.9 |
| | *Total (sub-category)* | *601* | *100* | *57* | *100* | - |
| **Race** | Black | 397 | 69.5 | 37 | 64.9 | -4.6 |
| | White | 103 | 18 | 10 | 17.5 | -0.5 |
| | Mixed Ancestry | 21 | 3.7 | 0 | 0 | -3.7 |
| | Asian | 17 | 3 | 1 | 1.8 | -1.2 |
| | Not Disclosed | 22 | 3.9 | 8 | 14 | 10.2 |
| | Other | 11 | 1.9 | 1 | 1.8 | -0.2 |
| | *Total (sub-category)* | *571* | *100* | *57* | *100* | - |
| **Gender** | Female | 263 | 45.6 | 31 | 54.4 | 8.8 |
| | Male | 307 | 53.2 | 25 | 43.9 | -9.3 |
| | Not Disclosed | 5 | 0.9 | 1 | 1.8 | 0.9 |
| | Other | 2 | 0.3 | 0 | 0 | -0.3 |
| | *Total (sub-category)* | *577* | *100* | *57* | *100* | - |
| **Qualification** | Master | 554 | 47.9 | 4 | 6.6 | -41.3 |
| | PhD and Master | 564 | 48.7 | 56 | 91.8 | 43.1 |
| | PhD without Master | 39 | 3.4 | 1 | 1.6 | -1.7 |
| | *Total (sub-category)* | *1157* | *100* | *61* | *100* | - |

*Table 5.6A – Continued*

| | | Survey | | Interview | | Difference |
|---|---|---|---|---|---|---|
| **Factor** | **Sub-Category** | **Frequency** | **%** | **Frequency** | **%** | **%** |
| **PhD Discipline** | Life Sciences | 180 | 30 | 18 | 31.6 | 1.6 |
| | Physical Sciences | 60 | 10 | 10 | 17.5 | 7.5 |
| | Formal Sciences | 13 | 2.2 | 1 | 1.8 | -0.4 |
| | Health Sciences or Medicine | 97 | 16.2 | 8 | 14 | -2.1 |
| | Applied Sciences | 59 | 9.8 | 6 | 10.5 | 0.7 |
| | Social Sciences | 86 | 14.3 | 4 | 7 | -7.3 |
| | Humanities | 52 | 8.7 | 5 | 8.8 | 0.1 |
| | Other | 53 | 8.8 | 5 | 8.8 | -0.1 |
| | *Total (sub-category)* | *600* | *100* | *57* | *100* | - |
| **Current Employment Status** | Currently Employed | 440 | 73.2 | 39 | 66.1 | -7.1 |
| | Currently Holding Post-doctoral | 101 | 16.8 | 14 | 23.7 | 6.9 |
| | Currently Self-Employed | 14 | 2.3 | 0 | 0 | -2.3 |
| | Current Doctoral Student | 8 | 1.3 | 2 | 3.4 | 2.1 |
| | Currently Runs Own Business | 3 | 0.5 | 1 | 1.7 | 1.2 |
| | Currently On Leave | 4 | 0.7 | 0 | 0 | -0.7 |
| | Currently Unemployed | 31 | 5.2 | 3 | 5.1 | -0.1 |
| | *Total (sub-category)* | *601* | *100* | *59* | *100* | - |
| **Employment Sector (a) – Currently Employed** | University / HE | 359 | 83.9 | 31 | 79.5 | -4.4 |
| | Research Institution (Pub./Private) | 53 | 12.4 | 6 | 15.4 | 3.0 |
| | Business Enterprise | 3 | 0.7 | 1 | 2.6 | 1.9 |
| | Private non-Profit / NGO | 6 | 1.4 | 1 | 2.6 | 1.2 |
| | Other | 7 | 1.6 | 0 | 0 | -1.6 |
| | *Total (sub-category)* | *428* | *100* | *39* | *100* | - |

*Table 5.6A – Continued*

| | | Survey | | Interview | | Difference |
|---|---|---|---|---|---|---|
| **Factor** | **Sub-Category** | **Frequency** | **%** | **Frequency** | **%** | **%** |
| **Employment Sector (b) – Current Post-docs** | University / HE | 72 | 72 | 9 | 64.3 | -7.7 |
| | Research Institution (Pub./Private) | 27 | 27 | 5 | 35.7 | 8.7 |
| | Business Enterprise | 0 | 0 | 0 | 0 | 0.0 |
| | Private Non-Profit / NGO | 1 | 1 | 0 | 0 | -1.0 |
| | Other | 0 | 0 | 0 | 0 | 0.0 |
| | *Total (sub-category)* | *100* | *100* | *14* | *100* | - |
| **Employment Sector (c) – Own Business** | University / Higher Education | 1 | 33.3 | 0 | 0 | -33.3 |
| | Research Institution (Pub./Private) | 0 | 0 | 0 | 0 | 0.0 |
| | Business Enterprise | 2 | 66.7 | 1 | 100 | 33.3 |
| | Private Non-Profit / NGO | 0 | 0 | 0 | 0 | 0.0 |
| | Other | 0 | 0 | 0 | 0 | 0.0 |
| | *Total (sub-category)* | *3* | *100* | *1* | *100* | - |
| **Employment Sectors (a) to (c) Combined** | University / HE | 432 | 81.4 | 40 | 74.1 | -7.3 |
| | Research Institution (Pub./Private) | 80 | 15.1 | 11 | 20.4 | 5.3 |
| | Business Enterprise | 5 | 0.9 | 2 | 3.7 | 2.8 |
| | Private Non-Profit / NGO | 7 | 1.3 | 1 | 1.9 | 0.5 |
| | Other | 7 | 1.3 | 0 | 0 | -1.3 |
| | *Total (sub-category)* | *531* | *100* | *54* | *100* | - |
| **Future Intention to Leave Employment Sector** | Yes, Previously Considered | 138 | 28.1 | 10 | 23.3 | -4.9 |
| | Yes, Currently Considering | 194 | 39.5 | 20 | 46.5 | 7.0 |
| | No, Never Considered | 159 | 32.4 | 13 | 30.2 | -2.2 |
| | *Total (sub-category)* | *491* | *100* | *43* | *100* | - |

*Table 5.6A – Continued*

| | | Survey | | Interview | | Difference |
|---|---|---|---|---|---|---|
| **Factor** | **Sub-Category** | **Frequency** | **%** | **Frequency** | **%** | **%** |
| **Children** | With Children – F | 148 | 25.7 | 20 | 35.1 | 9.3 |
| | With Children – M | 226 | 39.3 | 20 | 35.1 | -4.2 |
| | With Children – No Gender Disclosed | 2 | 0.3 | 0 | 0 | -0.3 |
| | Without Children – F | 112 | 19.5 | 10 | 17.5 | -1.9 |
| | Without Children – M | 75 | 13 | 5 | 8.8 | -4.3 |
| | Without Children – No Gender Disclosed | 2 | 0.3 | 0 | 0 | -0.3 |
| | No Response re: Children – F | 3 | 0.5 | 1 | 1.8 | 1.2 |
| | No Response re: Children – M | 6 | 1 | 0 | 0 | -1.0 |
| | No Response re: Children – No Gender Disclosed | 1 | 0.2 | 1 | 1.8 | 1.6 |
| | *Total (sub-category)* | *575* | *100* | *57* | *96.5* | - |
| **PhD Completion Year** | 2013 Onwards | 436 | 72.5 | 43 | 75.4 | 2.9 |
| | 2007 to 2012 | 165 | 27.5 | 14 | 24.6 | -2.9 |
| | *Total (sub-category)* | *601* | *100* | *57* | *100* | - |
| **Mobility Beyond Birth Country (PhD Only)** | 3 months or more | 401 | 70.1 | 50 | 87.7 | 17.6 |
| | Never more than 3 months | 171 | 29.9 | 7 | 12.3 | -17.6 |
| | *Total (sub-category)* | *572* | *100* | *57* | *100* | - |
| **Age** | 29 or younger | 10 | 1.9 | 2 | 3.8 | 1.9 |
| | 30 to 34 | 121 | 22.8 | 11 | 20.8 | -2.1 |
| | 35 to 39 | 193 | 36.4 | 20 | 37.7 | 1.3 |
| | 40 to 44 | 128 | 24.2 | 15 | 28.3 | 4.2 |
| | 45 or older | 78 | 14.7 | 5 | 9.4 | -5.3 |
| | *Total (sub-category)* | *530* | *100* | *53* | *100* | - |

*Table 5.6A – Continued*

| | | Survey | | Interview | | Difference |
|---|---|---|---|---|---|---|
| **Factor** | **Sub-Category** | **Frequency** | **%** | **Frequency** | **%** | **%** |
| **Contract Type** | Fixed Term Contract, total duration of less than 1 year | 8 | 1.9 | 0 | 0 | -1.9 |
| | Fixed Term Contract, total duration of 1 to 2 years | 25 | 5.9 | 1 | 2.7 | -3.2 |
| | Fixed Term Contract, total duration more than 2 years | 50 | 11.8 | 5 | 13.5 | 1.7 |
| | Open-ended Contract | 68 | 16.1 | 6 | 16.2 | 0.1 |
| | Rolling / Renewable Contract | 14 | 3.3 | 3 | 8.1 | 4.8 |
| | Permanent Contract | 248 | 58.6 | 22 | 59.5 | 0.8 |
| | Other | 10 | 2.4 | 0 | 0 | -2.4 |
| | *Total (sub-category)* | *423* | *100* | *37* | *100* | - |

Note: Due to the limited number of Master's holders interviewed, comparisons of survey respondents to interviewees is only done for those with PhDs, unless otherwise stated (e.g., under "Qualification").
Source: Authors.

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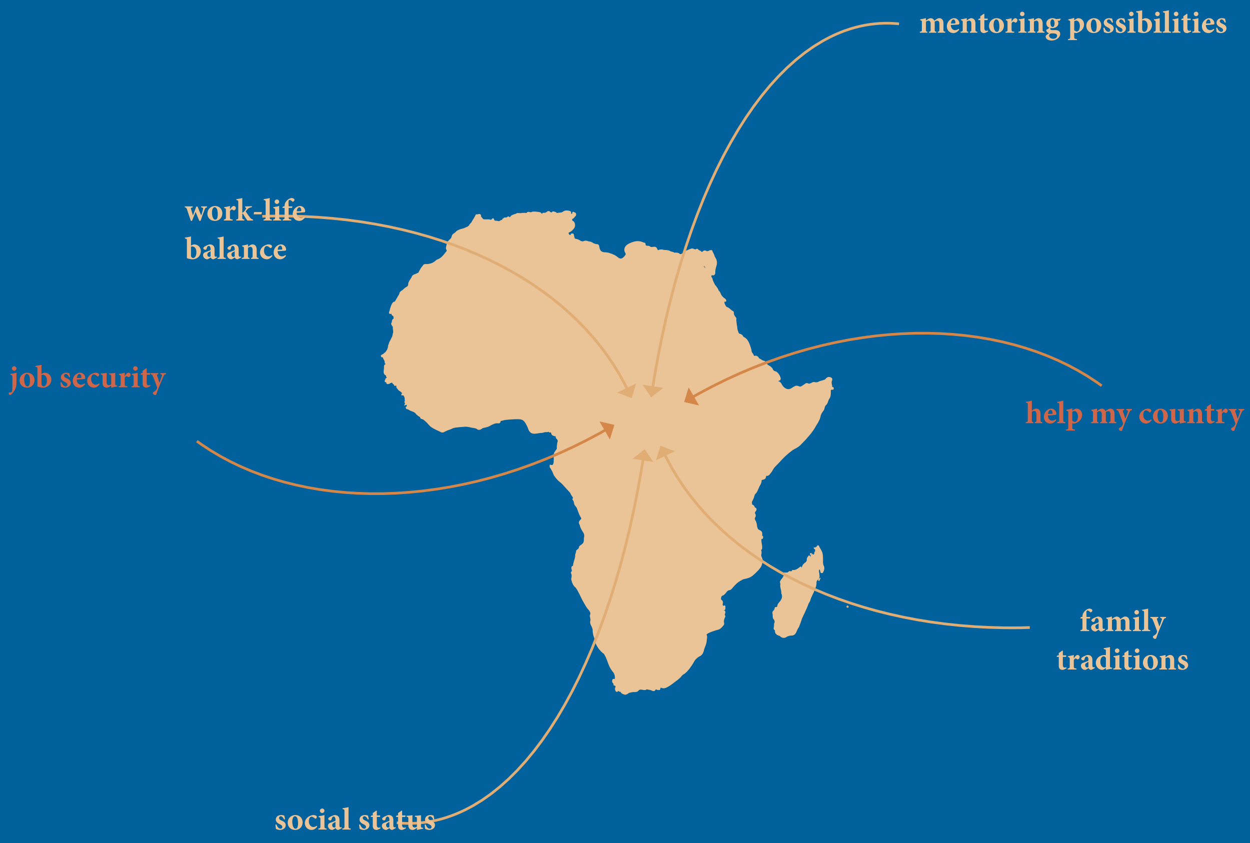

# 6 Motivations and realities of pursuing a research career

*"My greatest motivation is that I love my job, I love teaching and I love research. I think that is the most important thing for me."*
**Hunter, Male, 38, Cameroon, Western Region, Humanities, Academia, PhD**

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ECR(s) | Early-career researcher(s) |
| HE | Higher education |
| PhD | Doctor of Philosophy |
| STEM | Science, technology, engineering and mathematics |

## 6.1 Introduction

In this chapter, we open the discussion of our respondents as early-career researchers (ECRs) through a simple focal question: *What factors motivate ECRs to pursue a career in research?* The discussion generated forms a background that is important to other themes and chapters in this report, to which we refer throughout. It also flows organically into the second component of this chapter, where we examine the academic journey of respondents as they initiate their training – from Master's to Doctor of Philosophy (PhD) – for a research career, and into postdoctoral and other positions thereafter. Henceforth, we refer to this process as "the academic pipeline".[26]

To begin that discussion, we must bring into focus one important element: the academic pipeline encompasses progression through levels of education and employment. Progress in either realm interacts with the other in important ways, and with the private demands and responsibilities of individuals themselves. To enrich our understanding of the intersection of these three realms of respondents' lives, our approach in this study is to focus on their responses regarding education and employment in turn, while still keeping the other present. In each, we consider how certain personal circumstances and motivations shape their experience.

In this chapter we focus mainly on the experience respondents have in education, that is, through the lens of their highest qualification (Master's and PhD). Then in Chapter 7, we expand on this by looking at the experience of respondents as employees, including their experiences with promotion, job security and the like.

26 Please refer to Chapter 2.3 for a discussion of the "academic pipeline" model and its role in our research approach.

To underpin this, we first provide a brief literature review that focuses on motivations and barriers to pursuing research careers, each from an international and African perspective. This forms the background to the additional research questions that we explore in this chapter:

(1) Do those with a Master's (as highest degree) and currently in a research career intend to complete a PhD? Why, or why not?
(2) For those with a Master's (as highest degree), what factors are associated with their desire to complete a PhD, currently or into the future?
(3) What factors are associated with the length of time to complete their PhD?
(4) Is there a different level of confidence in career prospects at the time of receipt of their highest degree compared to current career expectations?
(5) What are the reasons that researchers want to change employment sectors? Is this related to an intention to move out of a research career? At what stage in their career do they move sectors?

Whilst these questions are our focus, we keep the discussion of the underlying questions of this study in view: (1) What are the opportunities and challenges that ECRs in Africa face in pursuing a career in research?
(2) Do these differ by region, discipline, employment sector, highest qualification, gender, or academy membership?

Finally, we conclude by making some recommendations pertaining to retaining ECRs in research-orientated careers, whether from (or living in) Africa.

## 6.2 Literature review

The impact of personal and environmental factors on career choices and outcomes has been of interest to researchers at least since the 1950s and has received intensified investigation during the last decades. Some researchers (Bailey, 1999; Leonard, Becker and Coate 2005) point out that the increasing pressure of performance indicators in higher education (HE) encourages institutional management to investigate factors that may provide indications on which persons may have a better "fit" with research, who might be better suited to teach, and to assess employability. At the system level, policy makers are interested to know of the career aspirations of PhD-trained scientists with regard to different employment sectors to avoid shortages of required professionals (Cyranoski et al. 2011; Sauermann and Roach 2012). Research on barriers to careers in academia, both objective and perceived, has also identified a range of challenges ECRs face, adding to the analyses of the 'leaks' in the academic pipeline.

### Motivation

Evidence on motivation and preferences related to academic or other research-oriented career taps into both the requirements of workforce related issues as well as personal motives. Lindholm (2004) highlights personal needs for autonomy, independence and a general appreciation of the university work environment as central career aspirations reported by professors of a research-oriented university. In their study on science PhD career preferences in the U. S., Sauermann and Roach (2012) revealed that a faculty research career is considered "extremely attractive" across fields, and that advisors and departments seem to be more encouraging of faculty research careers than of other career paths. The authors also provided evidence for a decline of interest in academic research over time (ibid., p. 6), which was previously reported by Russo (2011).

This decrease might be, it is argued, due to a lack of information on the challenges and job prospects of careers in research and academia, which calls for formal career advice prior to starting a PhD and opportunities to explore career alternatives during the PhD (Russo 2011; Sauermann and Roach 2012 Cressey 2012; Zusi 2016; Castelló et al. 2017). In a previous GYA publication (Geffers et al. 2017), respondents from four Association of Southeast Asian Nations countries rated: a) research process, b) the aim to apply new knowledge to improve the society, c) having research upgraded to become a service, and d) training and inspiring the next generations as the most important motivations for starting a research-oriented career (ibid.).

### Barriers

In efforts to understand the factors that push ECRs from academic-related careers, research has investigated various terrains ranging from different academic stages (doctorate and postdocs) to demographics (women, minorities, and people with disabilities). Fox and Stephan (2001) note that surveyed doctoral students' expected salaries and employment options differ from the actual data from recent graduates. The authors highlight that the subjective prospects that may have an impact on career decisions rest upon preferences, which reflect expectations "of what is regarded as feasible, by gender and field in science" (p. 120). Hunter and Devine (2016) found that emotional exhaustion of doctoral students is positively correlated with the latters' intentions to leave academia. Similarly, Castelló et al. (2017) report that students face difficulties achieving a balance between work, personal life and doctoral studies, as well as a lack of motivation. Similar evidence has been found for the postdoc stage, with work stress influencing postdocs' intentions to leave academia (Dorenkamp and Weiß 2018). Waaijer (2017) reports that recent PhD graduates in the Netherlands see their career choices strongly influenced by long-term career perspectives and the availability of permanent positions, leaving the Dutch academic sector at a disadvantage with competing sectors. Given the limitations of the study, the author cannot determine "whether some of the best researchers are indeed driven out of academic research by the career prospects" (p. 11).

With regard to gender, female underrepresentation in academia has been a major topic of research in previous decades (Ceci et al. 2014; Bebbington 2002; Fox, Whittington and Linková 2017). One of the main factors reported to account for a higher rate of women than men leaving HE between graduate school and tenure is related to marriage and childbirth (Goulden et al. 2011). In a study on perceived barriers to becoming a professor, van Anders (2004) points to different views of men and women in academia related to childbearing; though men and women in this study reported an equal desire to have children, "[m]en and women obviously view childbearing differently: men view it as something that will happen; women see it as something they need to fit into their lives and careers" (p. 519). Conversely, Waaijer et. al. (2016) reported that only small gender differences were found on the employment, career perception and research performance of recent PhD graduates in the Netherlands. Still, the authors conclude that the differences in part-time employment, with female academics more often working part-time, may amount to a larger gender gap, supporting the more negative career expectations of females in all three sectors (academia, non-academic research and outside research).

Research on different performance of minorities in Science, Technology, Engineering and Mathematics (STEM) and HE in general has a longstanding tradition in the United States, with workforce studies based on the pipeline approach dating back to the 1980s as outlined above (Berryman 1983; NSB 2015; Fox, Whittington and Linková 2017). Other studies have inquired into the reasons for discrimination, such as skin tone bias (Abiola 2017), how racial experience in the faculty-student relationship has an impact on doctoral student degree completion and success (Felder, Stevenson and Gasman 2014), or different salaries between the (white) majority and minorities (Webber and González Canché 2018). In a study on neo-nationalism in HE in South Africa, Lee (2017) explores the complex interplay of race and nationalism, pointing out that black Africans – in particular those from Zimbabwe or Nigeria – felt unwelcome from black South Africans once they were identified as "not-local", such that the residents preferred whites or people from other continents to their fellow Africans. Research on academic or research careers for people with disabilities is scarce. Booksh (2018) reports that people with disabilities account for only about 2 % of STEM doctorates in the United States, citing practical issues such as securing suitable accommodation and societal factors such as an inherently negative descriptor for disability and a solo- or token-status among others as barriers to pursuing a research career. Williams and Mavin (2015) report on the experience of impairment effects of disabled academics and how they shape career choices and opportunities.

## 6.3 Results – Motivations for a research-orientated career

In this section, we focus on respondents' motivations for joining a research career and their educational status at the time of survey. Later, in section 6.4 and in subsequent chapters, we refer back to this information to provide insights to the findings we discuss for the ECRs that responded to our survey.

### 6.3.1 Why research as a career option?

Respondents that considered themselves to be researchers were able to make multiple selections from a prepared list of possibilities regarding the motivating factors to them entering a research-oriented career. Referring to Figure 6.1, numerous factors emerged as leading motivators: of the respondents that answered (1,086≤ n ≤1,110), 92.6 % (n=1,009) *agreed* or *strongly agreed* that continuous learning and training was a motivating factor for entering a research career.[27] Additionally, 90.6 % (n=996) were motivated to apply knowledge to improve society, 86.6 % (n=936) to work internationally,[28] and 79.5 % (n=867) considered the opportunity to train the next generation of students had been a motivating factor.[29]A smaller majority of respondents (65.9 %, n=717) *agreed* or *strongly agreed* that employment and job security influenced their decision to enter a research career, and almost half (47.7 %, n=525) *agreed* or *strongly agreed* that they pursued a research career for the salary.[30]

On the five-point scale, "continuous learning and training" was ranked as a slightly stronger influence ($\bar{x}$=4.5) by respondents than "applying knowledge to improve society" ($\bar{x}$=4.45) and the remainder of the variables (P<0.0001). 'Remuneration' ($\bar{x}$=3.3) was ranked as a weaker influence than "work-life balance" ($\bar{x}$=3.51) and all other variables (P=0.0001). The relative strengths of these motivations were reflected also in the interviewees' responses regarding their motivation to remain in (or leave) a research career; refer to section 6.4.5 for further discussion of this.

27 See Chapters 7 and 9 for further discussion of accessing training opportunities, and support and mentorship.

28 See Chapter 11 for further discussion of mobility.

29 See Chapter 9 for further discussion of support and mentorship.

30 See Chapter 7 for more discussion of how respondents' expectations of job security and salary compare to reality once they establish a research-orientated career. Also refer to Chapter 10 for further discussion of funding, including those who self-fund their research activities.

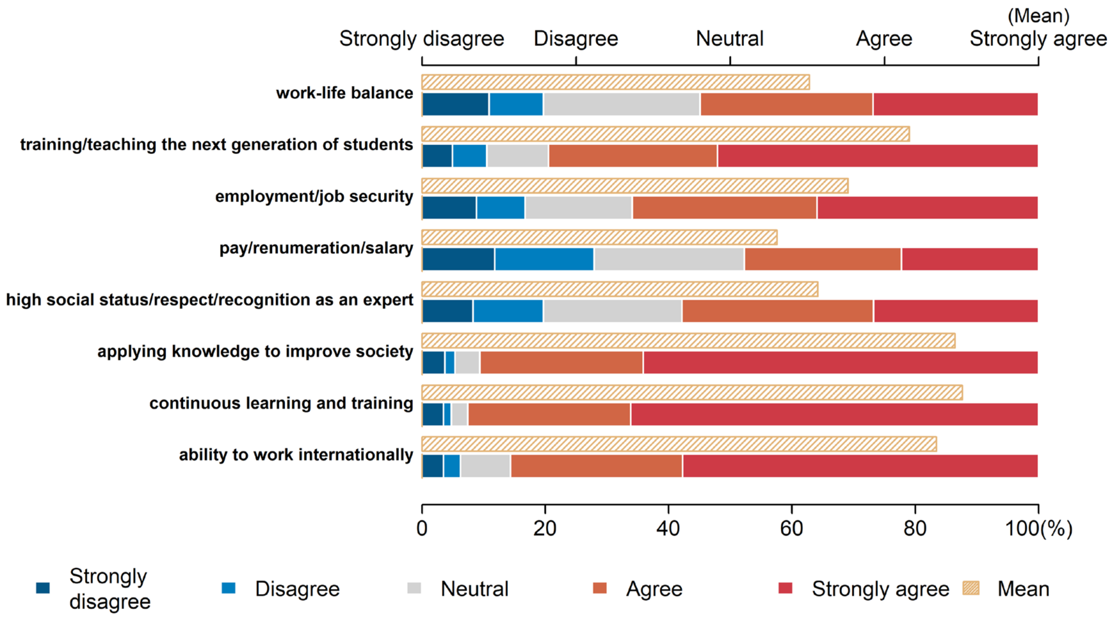


*Figure 6.1 – Influences to decision to enter research-oriented career*
*Source: Authors.*

The statistical analysis that we conducted revealed that responses to the motivations discussed above varied by region, and in some cases by discipline. We step through these in turn:

### Work-life balance

Respondents in the applied and physical sciences were both more likely (P≤0.0323) than respondents in life and health sciences to have been influenced by work-life balance in their decision to enter a research career (β=0.977, and β=0.501, respectively).[31] From a regional view, respondents born in the Western region were more likely (P≤0.0342) to be influenced by this than those born outside of Africa, or in the Eastern or Southern regions (β=1.373, β=0.770, and β=0.609, respectively). Similarly, those born in the Northern region were also more likely to be influenced by this than those born outside of Africa (β=1.252, P=0.0499).

### Opportunity to train the next generation of students

Respondents that were born in the Western region were more likely (P≤0.0066) than those born outside of Africa (β=1.308) or in the Southern region (β=1.118) to have been influenced by this opportunity. Likewise, respondents that were born in the Northern region (β=0.944) or non-focal African countries (β=0.851) were more likely (P≤0.0478) than those born in the Southern region to have been influenced by this. Refer to Chapter 9 for further discussion of support and mentorship, including mentoring others.

### Job security

Respondents born outside of Africa were *less likely* (P≤0.0266) to have been influenced (in their decision to enter research) by job security than for those born anywhere within Africa (see table 6.1). Refer to Chapter 7 for a more thorough discussion of job security and section 6.4.5 for the influence it has on respondents' retention in research careers.

31 This effect is measured on the basis of where respondents were born.

*Table 6.1 – Influence of job security on decision to enter research career*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Northern Region | Outside Africa | Born | 2.030 | <0.0001 |
| Western Region | Outside Africa | Born | 1.710 | <0.0001 |
| Non-focal Africa | Outside Africa | Born | 1.651 | 0.0003 |
| Eastern Region | Outside Africa | Born | 1.550 | 0.0005 |
| Southern Region | Outside Africa | Born | 1.147 | 0.0266 |

Source: Authors.

**Social status/recognition as an expert**

People who were born in the Northern region were more likely ($P \leq 0.0459$) than those born in the Southern, Eastern and Western regions as well as outside of Africa to have been influenced by social status and respect when deciding to enter a research career ($\beta$=1.569, $\beta$=1.385, $\beta$=0.919, and $\beta$=0.882, respectively). Furthermore, respondents who were born in non-focal African countries, or the Western or Eastern regions were more likely ($P \leq 0.0430$) than those born in the Southern region to have been influenced by these in their decision to enter research ($\beta$=0.995, $\beta$=0.687 and $\beta$=0.653, respectively).

Summarising the above-mentioned influences, we found across three of the four that respondents born in the Western region were more likely than those born in the Southern region to consider that they had influenced their decision to enter a research-orientated career (job security as the exception). We found this difference also across three of four influences for respondents born in the Western region relative to those born outside of Africa (social status as the exception). We considered the possibility that social or cultural differences may have influenced the way in which respondents from different regions translated their subjective experience of their own motivations to the scale used to answer the questions. However, were this occurring, we would expect significant differences also between the Western and the Eastern, Northern and non-focal regions, or these other regions and the South region. As this did not occur, we consider the aforementioned statistically significant differences by region to be legitimate, and not caused by social or cultural factors influencing the manner in which respondents answered the question.

Finally, we found no statistically significant differences in responses regarding the influence of salary, societal improvement, continuous learning and training, and ability to move internationally.

### 6.3.2 What is the highest degree of the respondents?

Eligibility to take the survey required the respondents to have at least a Master's degree, or equivalent. Referring to table 6.2, 47.9 % (n=554) of all survey respondents had a Master's as their highest degree, while the remaining 52.1 % (n=603) had already earned a PhD.

*Table 6.2 – Highest degree of survey respondents*

| Highest degree | No. respondents (n) | Percentage (%) |
|---|---|---|
| Master's | 554 | 47.9 |
| PhD | 603 | 52.1 |
| **Sub-Total** | **1,157** | **100** |

Source: Authors.

As for Table 6.3, for those with a Master's as their highest degree, 69 % (n=382) reported that they were working toward their PhD (henceforth, "doctoral students"), while another 31 % (n=172) were not.

*Table 6.3 – PhD enrolment for respondents with Master's as highest degree*

| Highest degree – Master's | No. respondents (n) | Proportion (%) |
|---|---|---|
| – Enrolled in PhD | 382 | 69.0 |
| – Not Enrolled in PhD | 172 | 31.0 |
| **Sub-Total** | **554** | **100.0** |

Source: Authors.

## 6.4 Results – Training for a career in research

We now have a sense of the respondents' motivations for entering research, and of the numbers of respondents with a Master's as their highest degree, the numbers of doctoral students among them, and the number of PhD holders. To enable some specificity in the discussion of the experiences of respondents at each stage of the academic pipeline, we turn now to the examination of these sub-groups.

In doing so, we consider each group in turn: we asked those with a Master's as their highest degree what their motivations and barriers are for doing a PhD in the future (refer to section 6.4.1). Similarly, we asked doctoral students what their motivation for beginning their PhD were (refer to section 6.4.2). While for those with a PhD already, we queried for factors that affected the time it took them to complete it (refer to section 6.4.3). Finally, for all respondents that are currently employed in research, we asked about their intentions for moving out of a research-orientated career (refer to section 6.4.5).

### 6.4.1 Master's holders only – Motivation and barriers to progressing to PhD

#### Motivation

The Master's holders that were not working toward their PhD were asked if they would like to do so into the future; 91.1 % (n=143) noted that they do, 8.2 % (n=13) were unsure, while just 0.6 % (n=1) did not want to. We asked the respondents that *do* for their reasons in an open-ended question. To quantify the results, we coded their responses into one of six categories, presented in table 6.4 below. Of these respondents, 55 % (n=71) indicated it was primarily related to their interest in pursuing a research career. This may be a simple outright interest in research or driven by underlying motivations – such as being promoted or securing access to funding. Or it may be connected to more benevolent reasons, such as societal improvements. Indeed, almost 40 % of respondents did select these two more specific motivations; in particular, 20.2 % (n=26) identified career advancement and 18.6 % (n=24) the desire to generate positive outcomes for society as their motivation for doing a PhD in the future.

*Table 6.4 – Master's holders' motivation for future PhD*

| Motivation for future PhD | n | % |
|---|---|---|
| Pursue Research Career | 71 | 55 |
| Career Advancement | 26 | 20.2 |
| Societal Change | 24 | 18.6 |
| Pursue Teaching Career | 7 | 5.4 |
| Financial | 1 | 0.8 |
| Other | 0 | 0 |
| **Sub-total** | **129** | **100** |

Source: Authors.

The rate of Master's holders (18.6 %) motivated to do a PhD by the opportunity to improve society seems to contrast considerably with the 90.6 % (n=996) of all respondents motivated by this when choosing to enter a research career (refer to section 6.3). However, the latter result was generated in a question where respondents were able to select multiple answers, and it is unclear in which order they prioritised those selections. While, in answering the question about their intention to do a PhD into the future, the Master's holders were only able to make one selection. A clear majority (55 %) were motivated by their interest in pursuing a research career, and as we have noted above, this itself may be driven by more pragmatic (or personal) interests and values. Indeed, when we consider that respondents ranked societal change third and in almost equal proportion to career advancement (18.6 % and 20.2 %, respectively), it is clear the relative importance of effecting societal change to respondents is high. Moses, one of the four Master's holders we interviewed, reflects the sort of attitude that underpins the motivation to effect societal change:

> *"I just feel I belong here more, they need me here more."*
> **Moses, Male, 45, Nigeria, Western Region, Health Sciences/Medicine, Para-public, Masters**

This sense of duty to country (and continent) exemplified by Moses emerged consistently in the interviews of PhD holders, too; as we discuss further into this chapter (see Section 6.4.5), it is a reason people persist in their research-orientated careers in spite of the barriers to doing so, and in Chapter 11 it appears again with respect to interviewees' attitudes toward mobility.

Returning now to the Master's holders that were unsure about doing a PhD, 57.1 % (n=8) identified finance as a prohibitive barrier to doing so, while for several others (21.4 %, n=3) the inapplicability of a PhD for the work they do was a reason they disinclined to pursue one.

### Barriers

Further to their motivations discussed above, the Master's holders that want to do a PhD were asked about the barriers they have to pursuing doctoral studies. We coded the responses from the open-ended question into one of 13 categories. For responses that contained more than one barrier, we coded the first and second responses, and refer to these as such (see Table 6.5).

This revealed that 72.8 % (n=99) of the first responses indicated a lack of, or difficulty, securing funding as a barrier to their pursuing a PhD. Also, 8.1 % (n=11) identified a lack of institutional programmes and (or) supervisors as a barrier. Combining the first and second responses yields similar results, with 63.7 % (n=114) of responses identified funding as a barrier to pursuing a PhD, and 11.7 % (n=21) identified a lack of institutional programmes and (or) supervision.

*Table 6.5 – Master's holders' barriers to pursuing future PhD*

| Barriers to pursuing future PhD | 1st response (n) | % | All responses (n) | % |
|---|---|---|---|---|
| Finances | 99 | 72.8 | 114 | 63.7 |
| Institutional Resources – Programmes, Supervisors and HR | 11 | 8.1 | 21 | 11.7 |
| Family Commitments | 3 | 2.2 | 7 | 3.9 |
| Institutional Resources – Equipment | 1 | 0.7 | 5 | 2.8 |
| None | 5 | 3.7 | 5 | 2.8 |
| Time | 5 | 3.7 | 5 | 2.8 |
| Working Commitments | 2 | 1.5 | 5 | 2.8 |
| Admission | 2 | 1.5 | 3 | 1.7 |
| Language | 2 | 1.5 | 2 | 1.1 |
| Location | 1 | 0.7 | 2 | 1.1 |
| Political and Economic | 0 | 0 | 2 | 1.1 |
| Career Advancement | 0 | 0 | 1 | 0.6 |
| Other | 5 | 3.7 | 7 | 3.9 |
| **Sub-total** | **136** | **100** | **179** | **100** |

Source: Authors.

## 6.4.2 Doctoral students only – Motivation to begin PhD

Of all survey respondents, 33.0 % (n=382) were working toward their PhD. These doctoral students were influenced to begin their PhD by several factors, in order of frequency: (1) their desire to enhance competitiveness and job prospects (50.6 %, n=240); (2) they had always wanted to pursue a doctoral degree but previously did not have the resources or opportunities (27.4 %, n=130); (3) they needed the degree to retain employment (13.3 %, n=63), (4) other unspecified reasons (8.6 %, n=41).

Those employed in the HE sector were more likely ($P \leq 0.0265$) to be working toward their PhD than those in private non-profit, business enterprise, and to a lesser extent, public or private research institutions ($\beta=1.933$, 1.648, and 1.126, respectively). It is plausible that this is linked to the promotional criteria used in HE systems (whereby a PhD is usually required to attain certain positions), and (or) eligibility requirements for funding. The latter is demonstrated here by Felix, a Master's holder who intends to do a PhD in the future:

> *"There was funding that I wanted to apply for. I felt I was in the right field, [and] I have had the right experience. But one of the criteria was having a PhD that I do not have at the moment. So that's actually one of the inspirations to do a PhD."*
> **Felix, Male, 31, Uganda, Eastern Region, Health Sciences or Medicine, Academia, Master's**

For more discussion of promotional criteria refer to Chapter 7, and for further discussion of funding refer to Chapter 10.

### 6.4.3 PhD Holders Only – Factors Affecting PhD Length

As previously outlined, 52.1 % of all survey respondents (n=603) had completed a PhD. Referring to figure 6.2 below, the mean completion time of their PhD was 4.1 years, with 50 % of respondents taking between three and five years, and 25 % taking between five and eight years.

It is clear there is considerable spread in the PhD completion time of respondents, and we found that the region wherein respondents did their PhD has a significant effect on this (table 6.8A). Those who conducted their PhD in the South region took a significantly shorter time (median 3 years, interquartile range (IQR) 3–4) than those who studied in countries in the Eastern (4 years, IQR: 3–5), Northern (4 years, IQR: 4–5) and Western (5 years, IQR: 4–6) regions ($P \leq 0.0031$ ). Those that did their PhD in the Western region were more likely to take longer than those that did theirs outside of Africa ($\beta=1.083$, $P=0.0001$). There was no gender or discipline difference in the time to complete a PhD. We discuss both of these results further below.

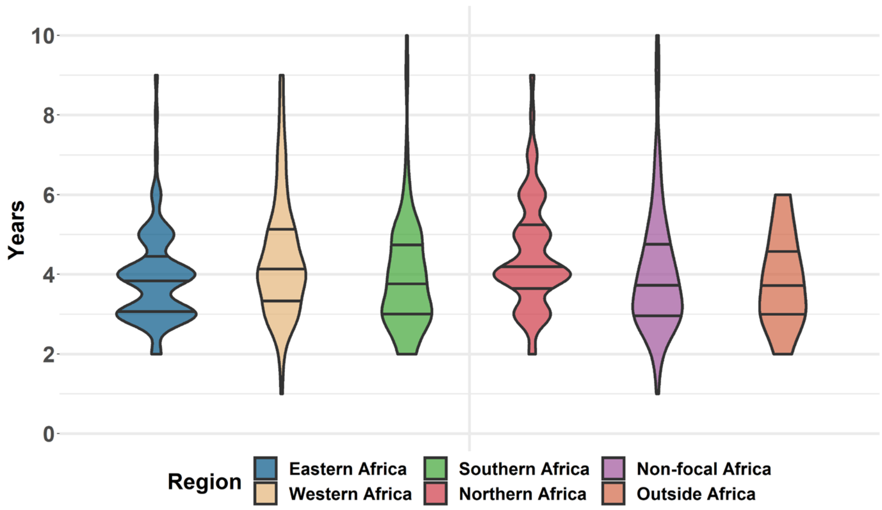


*Figure 6.2 – Years taken to complete PhD by region where completed*
*Source: Authors.*

From the interviews we conducted, we get an indication of the factors that contributed to respondents' PhD completion time and these regional differences. Across the Northern, Eastern and Western regions, where PhD completion times were generally longer, inadequate funding and limited access to research equipment both emerged as barriers that people faced in doing their PhD. This is exemplified by Kenneth, Kimberley and Janet, who each did their PhD in the same country that they live in:

*"[G]etting more scholarships…is the most important [thing], I'm still living the same experience with my PhD students, finding a scholarship to cover training, it's a challenge for us."*
**Kenneth, Male, Morocco, Northern Region, Health Sciences or Medicine, Public, PhD**

*"If I had access to funding I would have progressed more quickly. If I had access to a good research environment, I mean equipment [and] not having power outages, that [would've] helped me progress faster."*
**Kimberley, Female, 39, Nigeria, Western Region, Life Sciences, Academia, PhD**

*"I was so limited because I didn't have funds to do the research actually I needed to do, I just did a section of it, because of lack of funds…and [for] other support I will talk of mentorship."*
**Janet, Female, 40, Kenya, Eastern Region, Humanities, Academia, PhD**

As Kenneth, Kimberley and Janet help demonstrate, interviewees raised access to resources as broad as high-tech laboratory equipment, training, mentorship, online journal databases, stable power supply, and the like. They all link these directly to funding. These issues were a reason other respondents from these regions moved elsewhere in Africa or internationally to complete their PhD, as demonstrated here by Gerald who left the Western region of Africa to do his PhD in Asia:

*"[F]inancial and equipment [availability], there were a lot of problems and I was trying my best to complete that programme in my university. But [I had] a lot of challenges there because I had to pay from my pocket…. I tried and I got a scholarship and so I travelled to [Asia], and that is where I completed my PhD within three years."*
**Gerald, Male, 41, Cameroon, Western Region, Applied Sciences, PhD**

Although people who did their PhD in the South region or outside of Africa also raised issues with funding and access to research equipment, they did so less frequently, which is reflected in the findings of the quantitative data – people doing their PhD in Africa were more likely to complete their PhD quicker if they did it in the South region ($P \leq 0.0367$). A number of interviewees referred to the higher quality of research facilities, and even funding availability in the South region and outside of Africa, as Cathrin and Trevor, who both did their PhDs in South Africa, demonstrate here:

*"[T]he availability of resources, mainly equipment is quite a challenge [in Zimbabwe]. We can't compare ourselves with other countries, like South Africa or other developed countries, in terms of the research resources…and journal subscriptions."*
**Cathrin, Female, 35, Zimbabwe, Southern Region, Applied Sciences, PhD**

*"I did my PhD in South Africa and so looking at how the system functions…[It is] one of the countries I consider is privileged in Africa, that seems to be doing a good job. Because most of the time when I look [at] accessibility to grant and funding, you tend to see South Africa getting it…At least for South Africa, I know that the government is really doing a lot."*
**Trevor, Male, 33, Nigeria, Western Region, Life Sciences, PhD**

It is clear from Cathrin and Trevor's responses that equipment availability and funding are the types of contributing factors that enable shorter PhD completion time in the Southern region and outside of Africa. An important insight to this result that emerged in the interviews, and that Cathrin highlights, is that this perception of higher-quality facilities and funding in the Southern region relates specifically to South Africa – it is not a view respondent held with respect to Zimbabwe, particularly, but also Mauritius and Mozambique. For more discussion of funding refer to Chapter 10, and for the effect of a lack of infrastructure and equipment availability refer to Chapter 7.

In contrast to the regional differences discussed above, supervision was an issue that emerged universally in the interviews. Dorcas, who was born in the Eastern region, completed her PhD in Western Europe and demonstrates this below:

> *"Sometimes I would send [my supervisor] a chapter and only get comments on it eight months later, that really delayed the writing of my thesis."*
> **Dorcas, Female, 41, Mozambique (from Kenya), Southern Region, Social Sciences, Academia, PhD**

The first quantile of all respondents (25% of all respondents) completed their PhD within three years or less. Gerald has already indicated above how moving internationally facilitated this for him, and here Nelisiwe, who was born in the Western region and did her PhD in the Eastern region, demonstrates the potential for an enabling environment within Africa:

> *"My PhD was sponsored, so during the programme we had finding to encourage us to attend conferences, they gave us transportation, accommodation and registration support. I was able to travel [within Africa] and to present a paper. Some of my other colleagues also travelled to different countries…And they also brought some experts from different parts of the world to come and teach us these are scientific writing skills."*
> **Nelisiwe, Female, 39, Europe (from Nigeria), Outside Africa, Applied Sciences, PhD**

Here Nelisiwe points again to funding and mobility as important enabling factors to her PhD completion, which we explored further using the survey data. We completed Fisher's exact and Chi-square tests on PhD completion time by reference to responses regarding being mentored, funding applications, mobility, and family responsibilities (children). We found a significant positive association (P=0.0089) between respondents who had been mobile and a shorter PhD completion time (refer to table 6.6 ). We also found that having received funding in the three years preceding the survey came close to significance, too (P=0.0779).

*Table 6.6 – Significance of PhD completion time cross-tabulated with select variables*

| Cross-tabulation variable with PhD completion time | Significance (P) |
|---|---|
| Mentorship (yes/no) | 0.5924 |
| Funding received in three years preceding survey (yes/no) | 0.0779 |
| Mobility (3 months or more abroad in 10 years preceding survey – yes/no) | 0.0089 |
| Family responsibilities (have children – yes/no) | 0.2336 |
| Family responsibilities (no. of children) | 0.6702 |

Source: Authors.

These results from these Fisher and Chi-squared tests indicate that there is an association between mobility and PhD completion time, and a weaker one between funding and PhD completion time, though they do not reveal the direction of that association. It is conceivable, for example, that completing one's PhD quickly could improve one's chances of attracting funding and (or) being mobile, rather than the other way around. However, the interviewees that were asked about what would have helped them to complete their PhD faster made it clear that mobility and funding are important factors, which corroborates the association in the direction we consider most important (funding and mobility enabling a shorter PhD completion time, rather than vice versa). Valentina and Alice, who were both born and did their PhDs in the Southern region, demonstrate this here:

> *"I did not get a lot institutional support or supervisory support during my PhD…what really saved me was the fact that I was awarded a visiting graduate fellowship in [Northern America]."*
> **Valentina, Female, 42, Oceania (from South Africa), Outside Africa, Physical Sciences, Academia, PhD**

> *"Attending international conferences would have helped [my PhD] because a lot of my work was presented at these. My supervisor went with my presentations and presented them…it was mainly a funding issue…the person I was studying with didn't have enough money to sponsor my travel."*
> **Alice, Female, 34, South Africa, South Region, Life Sciences, Academia, PhD**

Valentina and Alice's responses reflect a clear message from the interviewees: access to mobility and funding would benefit PhD candidates, in general, more than other things. This connects to the enabling and sometimes compensatory role mobility and funding had in overcoming other issues for PhD candidates. For many, mobility helped them to access equipment, journals, conferences, and sometimes infrastructure, such as stable internet and power – for Valentina it even compensated for a lack of supervision. While a lack of funding was often a key reason PhD candidates lacked access to many of these things to begin, Alice's response demonstrates how funding for mobility, specifically, is critical to enabling them to overcome some of these issues. However, mobility is neither open to all ECRs in Africa nor, strategically speaking, a response to the root cause of the barriers they face. Furthermore, the driver of being internationally mobile is not necessarily the same to people in all disciplines, as we discuss further in Chapter 11.

PhD supervision is another theme that appears in Valentina and Alice's responses, and this was a focus in the interviews with other ECRs also:

> *"My supervisor was constantly going [abroad]. He had access to some online libraries and got a lot of material, since I was his supervisee he offered me some material for free, and that is what I used for completing my PhD."*
> **Hunter, Male, 38, Cameroon, Western Region, Humanities, Academia, PhD**

> *"I have never heard about any PhD candidate who finished their dissertation within a period of three years…one of the reasons for this impossibility is that the supervisors are not being very helpful and I do blame them that's true, but I also understand that they have piles of other stuff to do... sometimes you have a supervisor who supervises like 30 candidates at the same time."*
> **Amina, Female, 38, Tunisia, Northern Region, Humanities, Academia, PhD**

Here we see that for Hunter, his supervisor was critical to him accessing journal articles he otherwise could not. Amina's perception that PhD supervisors are unavailable and overworked points to an issue that emerges when we take an integrated perspective of the results in this study. In Chapter 9, we discuss our ECR respondents' perception of themselves as mentors and supervisors, and in Chapter 7 we discuss their perception of their workload. Here we briefly pair them together to reveal an important insight:

85.1 % (n=564) of the respondents who are PhD holders (those who are most likely to supervise others) consider themselves mentors (or supervisors), and 51 % (n=234) of PhD holders consider their workload *too high* or *much too high*. It is clear then that Amina points to a fundamental problem – many people who have a supervisory role do not have the availability to fulfil that role. Yet in Valentina, Alice, Hunter and Amina's responses, one other thing is clear: a supervisor with the capacity to be available is integral to a PhD candidate's success.

Looking again at the four responses: Valentina and Alice are both in the life sciences and stress the importance of mobility, while Hunter and Amina are in the humanities, and have more focus on PhD supervision. In Chapter 11, we consider further whether respondents in different disciplines are motivated to seek opportunities for international mobility for different reasons. What we cannot draw out at this point of our analysis is how mobility has been important to Hunter and Amina's career development – post-PhD completion. To read more on their mobility and other ECRs stories please refer to our publication: "Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective" (McAlpine et al. 2020).

### 6.4.4 Current confidence in research career success vs. at the time of graduation

One of the choices that influences embarking on a research career is the confidence you will have for future career prospects in that field. We asked respondents about the confidence they have in their future career prospects (i.e. obtaining a good job, securing funding, etc.) at the time of graduation, and currently; finding a significant decrease in their career confidence now, compared to at graduation ($P<0.0001$). At graduation 42 % strongly agreed and 31.9 % agreed they had confidence in their future careers, whilst currently only 34 % strongly agree and 36.8 % agree; those with a neutral response increased from 15.5 % at gradation to 18.8 % currently. At graduation, those in Applied Sciences had more confidence in their career prospects than those in Life and Health Sciences ($P=0.0002$), Physical and Formal Sciences ($P=0.037$) and Social Sciences and Humanities ($P=0.049$). However, the difference between disciplines is lost when asking about current career confidence, including analysis adjustment for where respondents are now living (Figure 6.3).

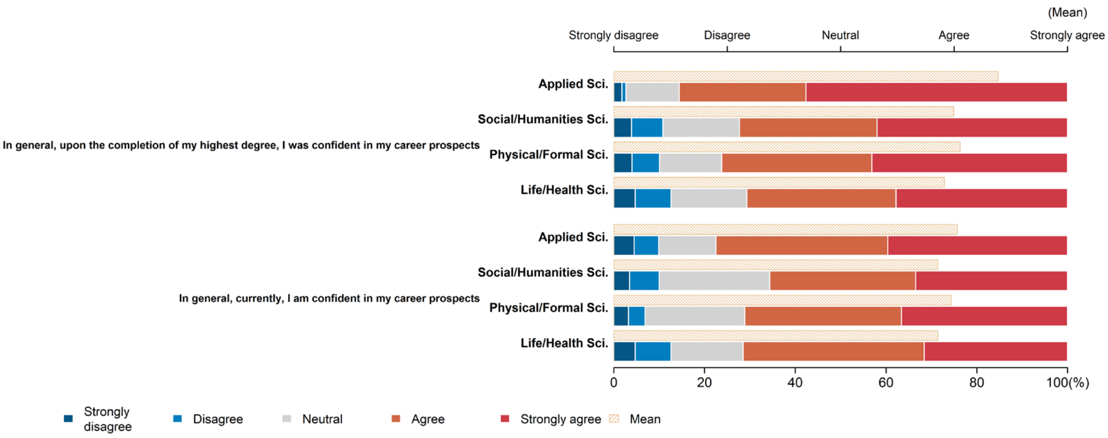


*Figure 6.3 – Confidence in career prospects at graduation for all respondents by discipline*

Looking specifically at PhD graduates (see Figure 6.4), adjusting the analysis for where respondents did their PhD, those who graduated in the Southern had less confidence in their career success at PhD graduation, than those who graduated in the Western (P=0.0003). Analysing by where respondents are now living, the Southern remain less confident than those living in the Western (P<0.0001) and now also the Eastern (P=0.003); those living outside of Africa also show significantly lower confidence in their career confidence compared to those in the Western (P=0.0024).

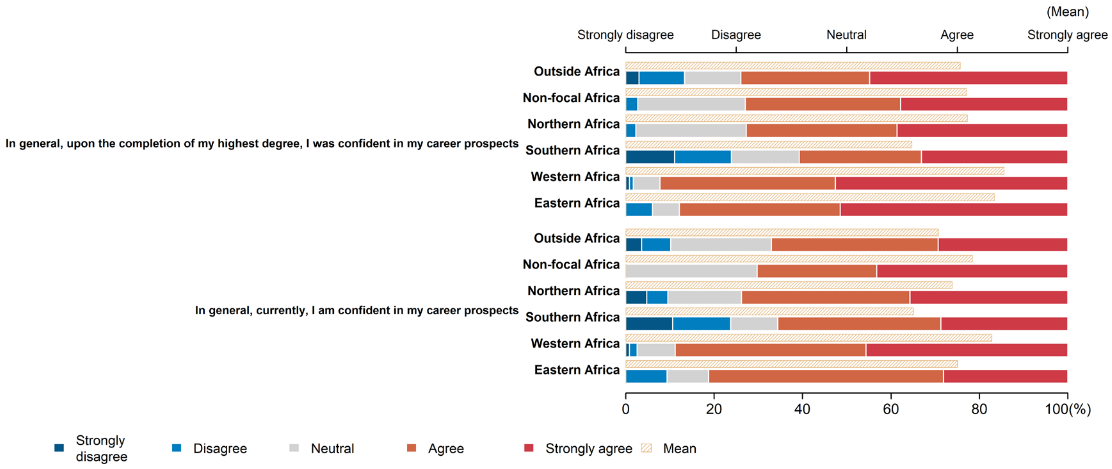


*Figure 6.4 – Confidence in career prospects at for thisethose with a PhDgraduation and currently, stratified by discipline and region where PhD graduated and where currently living*
*Source: Authors.*

### 6.4.5 All respondents – Moving out of a research career

All respondents who indicated that they were currently employed in a research role – including those who are employed whilst completing a PhD – were asked if they had considered leaving their employment sector for a different one. Referring to table 6.7, the total percentage of respondents with a Master's as their highest degree that have *previously* considered or that were *currently* considering changing employment sectors was similar to those with PhDs (67.4 % compared to 66.2 %, and $n_{master}$ =147 and $n_{PhD}$ =304, respectively).

*Table 6.7 – Respondents' consideration of employment sector change*

| | Master's | | PhD | | Sub-total/ Total (n) | Proportion (%) |
|---|---|---|---|---|---|---|
| *Response* | *n* | *% (Column)* | *n* | *% (Column)* | | |
| **Previously Considered** | 48 | 22 | 110 | 23.9 | 158 | 23.3 |
| **Currently Considering** | 99 | 45.4 | 194 | 42.3 | 293 | 43.3 |
| **Never Considered** | 71 | 32.6 | 155 | 33.8 | 226 | 33.4 |
| | 218 | 100 | 459 | 100 | 677 | 100 |

Source: Authors.

The reasons these respondents were looking to move sector were not captured by the survey. However, five of 11 respondents that had previously been in research careers but left it cited financial reasons. We can also gain some insights from interviewees who were asked about their intentions to shift sectors. Work-life balance, or salary, or both, were cited with some regularity as reasons for people considering shifting out of academia:

> *"Sometimes I feel like academia is too demanding, so, [a] few times in a year I consider going into the policy world, or into consultancy, or something like that."*
> **Anna, Female, 37, Europe (from Zimbabwe), Outside Africa, Social Sciences, Academia, PhD**

> *"Every month I ask myself why I didn't do accounting instead…My friends who are chartered accountants are sitting pretty. From what I know they earn five times what I get, it's quite a difference in salary."*
> **Olivia, Female, 33, South Africa (from Zimbabwe), Southern Region, Life Sciences, Academia, PhD**

In both Anna and Olivia's responses, it is clear their concerns about work-life balance and salary persist through time, and these concerns emerged for survey respondents more broadly, as is discussed further in Chapter 6. Here we have reason to ask, why are people such as Anna and Olivia not actively leaving academia – in spite of their concerns? An answer that emerged clearly in the interviews was their "passion" for science, their "love" of research, and their "duty" to their country. This is demonstrated in the responses of Stephen and Ivy below:

> *"I think I was born to be in this profession… So, because I see the situation is going slowly but it is really improving, I say, 'Okay, I'll stay.'"*
> **Stephen, Male, 36, Rwanda, Eastern Region, Life Sciences, Academia, PhD**

> *"The teaching profession gives me enough time to do my research and other things, but apart from that it's not the pay package [that I stay for]…it's just for the love [of] it and patriotism."*
> **Ivy, Female, 41, Cameroon, Western Region, Health Sciences or Medicine, Academia, PhD**

Stephen's and Ivy's thoughts give us an insight into how the ECR respondents reconcile their choice to remain in academia or research, even if they doubt that decision at times. They also reveal how important it is that tangible improvements are made to enabling them as researchers, even if these come slowly.

It is reasonable to expect that for those that do not share this reverence for research, or that simply need stability for family reasons or otherwise, the temptation of a secure and reasonable salary in industry would be difficult to choose against (in pursuit of a research career instead). This is highlighted in Nathaniel's response below:

> *"So as soon as someone finishes honours, they walk into industry with a salary that's more than mine [as a lecturer]. So it's very difficult to convince someone to stay [as] a post-graduate student for another year or two because the only thing that they're [thinking] is, 'But, think about the money that I'm missing I'm out on."*
> **Nathaniel, Male, 28, South Africa, Southern Region, Formal Sciences, Academia, PhD**

Nathaniel highlights here that those that stay in research careers despite the low salary – such as demonstrated by Ivy and Olivia above – are likely an exception to the norm: instead, people leave academia because low salaries make it difficult to retain talented people. What is not obvious here is the sense of isolation this creates for Nathaniel, but for more on his and other ECRs' stories, please refer to our publication: "Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective" (McAlpine et al. 2020).

Despite the factors pushing people to leave academia and research-orientated careers, among our interviewees were people who had been in industry or government jobs and then shifted into academia and research:

> *"I got a job in industry and I really enjoyed it because it was different. Different types of responsibilities, different day-to-day activities…But then, after two years I found that it was getting too predictable."*
> **Eveline, Female, 33, Mauritius, Southern Region, Other (Food Sciences), Academia, PhD**

Whilst the "predictability" of an industry-based job may have driven Eveline from industry back into academia and research, it is conceivable that other ECRs would move into industry seeking precisely that – especially considering the breadth of barriers many face to pursuing their research careers, as we discuss throughout this report. Sylvia demonstrates this attitude:

> *"I need security, if there is no security for me, I must go to industry and leave research. Because at the end of the day, I love this job, but I need the financial security too for my future. So, I would consider it [leaving research]."*
> **Sylvia, Female, South Africa (born in Middle Eastern), Southern Region, Life Sciences, Academia, PhD**

Finally, for some respondents the opportunity to work with people in industry enhanced their prospects in their research-orientated career, even when they were not in industry themselves. This benefit was realised by our interviewees mostly through collaborations with industry, as Ethan demonstrates:

> *"I cannot change my discipline but I can collaborate with industry or companies that can be beneficial to my research, or that can utilise my research."*
> **Ethan, Male, 36, Egypt, Northern Region, Life Sciences, Public, PhD**

Ethan reflects for us here the general reluctance among the interviewees to move out of academia or research-based roles and into industry. A passion for research and their countries, represented earlier by Stephen and Ivy, emerged as the key reason. Ethan shows us here that it is still possible to utilise some of the benefits of industry-based roles without actually shifting across. Refer to Chapter 11 for more discussion of collaboration. All things considered, the difficulty in deciding to stay in a research career or to change is captured by Stanford:

> *"The main motivation [to stay] is really how far I've come. Basically, I started almost 20 years [ago], having done secondary school, Bachelor's degree and a Master's degree. Then you go through the entire PhD and you can't really think about sacrificing all that. I mean it's a thin line between giving up and continuing."*
> **Stanford, Male, 33, Oceania (from Uganda), Outside Africa, Life Sciences, Academia, PhD**

## 6.5 Conclusions

Career prospects in academia and research are a much-debated topic, both in countries with more mature and well-funded research and HE systems (e. g., The Royal Society 2010; Consortium for the National Report on Junior Scholars 2017) as well as countries with expanding HE systems (ASSAf 2010). Commonly, the vast majority of ECRs embarking on an academic career will not achieve a permanent position in HE: the study of the Royal Society (2010) indicates that less than 0.5 % of those earning a PhD will become professors, and an additional 3 % will find permanent research positions in HE. In Germany, the ratio of first professorships awarded to academics with habilitation to completed habilitation is about 1:5 (Consortium for the National Report on Junior Scholars 2017), with the chances of attaining a permanent position being lower if other career paths to a professorship were included. It is obvious that the figures and ratios for those entering and staying in research-oriented careers vary from country to country, depending on the structure of the HE systems, definitions of what constitutes a permanent position, and many other factors such as funding for HE and research or alternative career opportunities.

Our exploration of motivations and barriers perceived by ECRs in Africa pursuing a research-oriented career presents evidence on the conflict they are facing: a passion for research and a desire to contribute to society on the one hand, a serious lack of resources – primarily financial and training opportunities – as well as family obligations on the other. Our research did not include analyses of statistical data, for example, on how Master's holders consider themselves as researchers, how many start a PhD or continue as Postdocs, hoping to find a permanent position in research or academia. For many of the countries included in our study, this data does not exist, at least not at a level sufficiently coherent to link it to our findings or allow comparisons between different countries. Therefore, we cannot assess the ratios of persons that do or do not continue their careers during the different phases of a research career or who chose to not continue their career while in transition between these phases. Our findings primarily relate to the main factors reported by ECRs that have an impact on their decision for staying or why they are considering leaving a research-oriented career.

First, our findings reveal a diverse set of motivations for pursuing a research-oriented career, with a group of four motivations forming the core. Among those, striving for continuous learning was the strongest, followed by the motivation to apply knowledge to improve society, the desire to work internationally, and finally the opportunity to train and mentor the next generation of students. While two of these motivations – continuous learning and international mobility – might be considered to focus on the individual's ongoing personal growth, the two other motivations – improving the society and training the next generation – are indications of the strong bond to their communities. Other factors such as security of employment, social status, the perspective of having a good work-life balance, or the salary were less influential for the decision to pursue a research-oriented career.

Second, nine out of ten Master's holders currently not working toward their PhD intend to do so in the future. Primary motivating factors were the general pursuit of a research-oriented career, followed by career advancement, and the more societal-oriented factors of supporting social change and the pursuit of a teaching career. We see the shift in the order of motivations compared to the general findings reported above, that is, a stronger emphasis on career-related motivations, not as an indication of a more individualist perspective among those who have not yet started to work on their PhD. Within the context of academic hierarchies and funding policies, having a PhD is a precondition to more independently pursue the more general strivings related to individual growth, international connectedness, and the more community-oriented motivations outlined above.

Third, a lack of funding and limited access to institutional resources – primarily training- and mentoring-related resources such as programmes and supervisors – were identified as barriers the ECRs with a Master's degree considered as most prohibitive for pursuing a PhD. These findings from an open-ended question support our findings on the mentoring and lack of funding discussed in Chapters 9 and 10.

Fourth, the reasons that ECRs currently working on their PhD have for taking up doctoral studies tend to focus on career- and employment-related themes such as their desire to enhance their competitiveness and job prospects, finally having secured the resources to engage in PhD work, and retaining their employment. These findings mirror those reported for Master's holders not currently working on their PhD.

Fifth, the main factors associated with the extended time required to finish a PhD were a lack of financial resources, limited access to research equipment, and insufficient access to supervision. Though these main factors were reported across all regions, the lack of funding and insufficient research equipment were less frequently reported in the Southern Africa region.

Sixth, approximately two out of three ECRs, both with or without a PhD, have considered or are currently considering leaving their employment sector for a different one. Our findings indicate a strong tension between several factors in favour of continuing or abandoning a research-oriented career. On the one hand, the strong passion for research and the desire to contribute to the betterment of the society outlined above emerged as key factors in our interviews for our respondents to cling to a research-oriented career in academia. On the other hand, low salaries as well as a strained work-life balance and family reasons keep tugging on ECRs to consider other career options.

In sum, our analysis focused on the (inner) conflict and struggle as reported by the participants of our study. Many of the issues we have touched here briefly – for example, the lack of funding, limited access to adequate training and supervision, the scarce opportunities for international mobility and collaboration – will be explored more in-depth in the following chapters. Future research will need to provide more in-depth analyses at the national and regional levels, incorporating both statistical or administrative data on the population of ECRs at different levels of their career, as well as dedicated research to inform a better understanding of why (and which) groups of ECRs do not continue their careers.

## 6.6 Recommendations

Recommendations have been formulated at five levels, as follows.

**All Stakeholders**

- Institutions, local and national governments, funding bodies, publishers and all stakeholders should work collaboratively on implementing existing policies for improving ECRs' working environment, funding allocation and management.
- National and regional public and private stakeholders should support and partake further research on diagnosing the states of ECRs' working environment, with the aim to evaluate the impact of implemented actions on ECRs' experiences in the academic and research environment.

### Governments and Institutions

- National governments are invited to devise ways and means for increasing gross domestic expenditure on research and development as a percentage of gross domestic product, to at least 1 %, with the goal of reaching at least the world average of 1.64 % by 2025.
- This objective can be attained by involving the private sector in the design and implementation of research and development policies, as well as offering incentives to private entities that are engaged in allocating funds for the benefit of science and scientists.
- Tracking Master´s and PhD graduate employment and career outcomes would give a better idea about the impacts that research training has on the country's economy, society and environment.
- Both local governments and institutions should work together on instilling a spirit of long-term career visions and aspirations at the graduate and postgraduate education level among young researchers. Thus, creating more long-term research positions and permanent appointments would improve the balance in available contract types.
- Increase salaries for ECRs to a level comparable to their peers in industry-based roles.

### Government and funding bodies

- To increase the annual enrolment rate of MAs and PhDs, the amount and diversity of funding support and opportunities need to be allocated. This would also facilitate the successful completion of degree programmes, and reduce dropouts and pipeline leakage.
- Institutions should work with governments and funding bodies on designing more innovative models of funding, and hybrid funding programmes that include short-term fellowships and semester abroad exchange programmes, participation in scientific workshops, and professional capacity-building trainings.

### Higher Education

- Modelling newer PhD programmes that encourage publications and trainings on science communication to align with the growing international trend; as well as providing linked career mentorship and soft-skills training to PhD award recipients.
- Designing trainings on various forms of academic and professional writings (writing for publishing in academic journals; writing for project proposals, and writing for funding applications).
- Encourage PhD students and supervisors/mentors to feedback to funders independently, so that reviews are not biased by relationship pressures.
- This will provide increased experience in writing scientific publications, an increased number of African-lead published literature, as well as enhance the international competitiveness of the new graduate.

### Policy makers and review panels

- Revise the rules and conditions that regulate review criteria and selection panel diversity with the intent of increasing equity in funding awards across gender, socioeconomic background, race/ethnicity, and persons living with disabilities, to complete a PhD.

These recommendations also appear as Table 6.8A in Appendix 6.8.

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## 6.8 Appendix

*Table 6.8A – How to facilitate the retention of African ECRs in research-oriented careers*

| How to facilitate the retention of African ECRs in research-orientated careers | |
|---|---|
| **All Stakeholders** | ▪ Institutions, local and national governments, funding bodies, publishers and all stakeholders should work collaboratively on implementing existing policies for improving ECRs' working environment, funding allocation and management.<br>▪ National and regional public and private stakeholders should support and partake further research on diagnosing the states of ECRs' working environment, with the aim to evaluate the impact of implemented actions on ECRs' experiences in the academic and research environment. |
| **Governments and Institutions Government** | ▪ National governments are invited to devise ways and means for increasing gross domestic expenditure on research and development as a percentage of gross domestic product, to at least 1 %, with the goal of reaching at least the world average of 1.64 % by 2025.<br>▪ This objective can be attained by involving the private sector in the design and implementation of research and development policies, as well as offering incentives to private entities that are engaged in allocating funds for the benefit of science and scientists.<br>▪ Tracking Master´s and PhD graduate employment and career outcomes would give a better idea about the impacts that research training has on the country's economy, society and environment. |

*Table 6.8A – Continued*

| | |
|---|---|
| | ▪ Both local governments and institutions should work together on instilling a spirit of long-term career visions and aspirations at the graduate and postgraduate education level among young researchers. Thus, creating more long-term research positions and permanent appointments would improve the balance in available contract types.<br>▪ Increase salaries for ECRs to a level comparable to their peers in industry-based roles. |
| **Government and funding bodies** | ▪ To increase the annual enrolment rate of MAs and PhDs, the amount and diversity of funding support and opportunities need to be allocated. This would also facilitate the successful completion of degree programmes, and reduce dropouts and pipeline leakage.<br>▪ Institutions should work with governments and funding bodies on designing more innovative models of funding, and hybrid funding programmes that include short-term fellowships and semester abroad exchange programmes, participation in scientific workshops, and professional capacity-building trainings. |
| **HE** | ▪ Modelling newer PhD programmes that encourage publications and trainings on science communication to align with the growing international trend; as well as providing linked career mentorship and soft-skills training to PhD award recipients.<br>▪ Designing trainings on various forms of academic and professional writings (writing for publishing in academic journals; writing for project proposals, and writing for funding applications).<br>▪ Encourage PhD students and supervisors/mentors to feedback to funders independently, so that reviews are not biased by relationship pressures.<br>▪ This will provide increased experience in writing scientific publications, an increased number of African-lead published literature, as well as enhance the international competitiveness of the new graduate. |
| **Policy makers and review panels** | ▪ Revise the rules and conditions that regulate review criteria and selection panel diversity with the intent of increasing equity in funding awards across gender, socioeconomic background, race/ethnicity, and persons living with disabilities, to complete a PhD. |

Source: Authors.

*Table 6.9A – PhD completion time*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Western Region | Southern Region | PhD | 1.565 | <0.0001 |
| Eastern Region | Southern Region | PhD | 1.143 | 0.0031 |
| Northern Region | Southern Region | PhD | 1.127 | 0.0031 |
| Western Africa | Outside Africa | PhD | 1.083 | <0.0001 |
| Non-focal Africa | Southern Region | PhD | 0.951 | 0.0367 |

Source: Authors.

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Fridah Kanana Erastus, and Mona Koury

# 7 Career satisfaction, workload and promotion

*"I love my work, most of time I'm there from 7am to 7pm."*
**Christine, female, 40, Nigeria, Western Africa, Physical Sciences, Academia, PhD**

*"The thing the university has to change is the ability to give researchers the space and the materials to do their research. If the space, time and the materials are not there then all we do is teach undergraduate students with our time and you never get promoted because you are not producing the research publications."*
**Jacob, Male, 37, Ghana, Western Region, Health Sciences/Medicine, Academia, PhD**

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| CAP | Changing Academic Profession |
| CDH | Careers of Doctorate Holders |
| ECR(s) | Early-career researcher(s) |
| GloSYS | Global State of Young Scientists |
| HE | Higher education |
| HEI | Higher education institution |
| IT | Information technology |
| NGO | Non-governmental organisation |
| PhD | Doctor of Philosophy |
| USA | United States of America |
| RI | Research institution |

## 7.1 Introduction

The figures for employment opportunities in research oriented positions for early-career researchers (ECRs) in different sectors and in academia in particular vary distinctly between countries (Auriol, Misu and Freeman 2013; Teichler, Arimoto and Cummings 2013; Consortium for the National Report on Junior Scholars 2017), but in general terms, these figures draw the picture of a highly selective process with only a minority of Doctor of Philosophy (PhD) holders attaining a permanent position in academia or other privately or publicly funded research organisations. In the United Kingdom, for example, about 0.45 % of scientific careers following a PhD will result in a professorship and an additional 3 % will end up in a permanent research position in academia (The Royal Society 2010). The picture in Africa is nowhere near clear. With an ever increasingly constricted top of the academic hierarchy, with increasing PhD graduates and disproportionally increased top positions, what does this mean for the career trajectory of ambitious ECRs? The diminishing numbers of ECRs continuing their research career may be explained by both structured processes of selection (e.g. promotion and tenure) and self-selection due to receding motivation or a decrease of satisfaction with the working conditions and career perspectives.

In this chapter we focus on the work, social and lifestyle factors which associate with African ECR satisfaction in their research careers. We present the factors which our respondents perceive to have negatively impacted their career success and we draw out specific changes to the research work environment which they believe will improve their chances of a successful research career. We then take a structured approach to investigate the personal and systems-based factors within the workplace which influence our respondents' career trajectory. We present both their perception of institutional and national policies regarding promotion and workloads, actual versus desired workloads, clashes in research vs teaching task prioritisation and their relationship to promotion.

To underpin this, we first provide a brief literature review that focuses on factors which impact career satisfaction, workloads and promotion, each from an international and African perspective. This forms the background to the specific research questions that we explore in this chapter:

**Career Satisfaction**

(1) What factors are associated with satisfaction and dissatisfaction in their careers? How does their current level of job satisfaction reflect their expectations?

**Workload**

(2) What is the average total workload (total hrs/week) of respondents and how does this compare to their desired workload? What dictates their task-specific workload distribution?
(3) For those who want to spend more time on research, how could they be better supported?
(4) What support structures exist for teaching duties and what support structures would help with managing your teaching responsibilities/workload?

**Promotion**

(5) What is the distribution of measured research outputs over the last 3 years for our respondents?
(6) What is their personal experience of the criteria weighted into promotion?
(7) What is their option of standardised promotional criteria? Does this vary between countries? Does this benefit their career progression or hinder it?
(8) What is the frequency of success for respondents who have applied for promotion and what factors impacted their eligibility and ability to apply for promotion?

Whilst these questions are our focus, we keep the discussion of the underlying questions of this study in view: (1) What are the opportunities and challenges that ECRs in Africa face in pursuing a career in research? (2) Do these differ by region, discipline, employment sector, highest qualification, gender, or academy membership?

Finally, we conclude by making some recommendations for removing barriers to facilitate greater career success, as seen through the experiences of ECR, whether from or living in Africa.

## 7.2 Literature Review

### 7.2.1 Satisfaction in research careers

Doctorate holders tend to enjoy better economic conditions than other tertiary graduates (Auriol et al. 2013), but working conditions in academia have come under pressure since the 1980s (Moses 1986; Kinman and Jones 2008; Bentley et al. 2013a). Though considerable differences between countries as well as between junior and senior staff exist, the clear majority of academics remains satisfied with their jobs (Teichler, Arimoto and Cummings 2013; Bentley et al. 2013b).

Shin and Jung (2014) point to two different dimensions of satisfaction or dissatisfaction, one related to intrinsic motivation derived from the work itself and the other to (external) working conditions that may help to explain these controversial findings on academic work and job satisfaction. Analyses of these two different types of job satisfaction build on Maslow's "hierarchy of needs" and Herzberg's "two factor" theory (Maslow 1943, 1954; Herzberg, Mausner and Snyderman 1959; Herzberg 1968; Hagedorn 2000). In his theory on human motivation, Maslow (1943, 1954) classifies different patterns of motivations such as "Physiological", "Safety", "Love/belonging", "Esteem" and "Self-actualisation" and locates them at different levels of a pyramid, i.e. hierarchical order. Maslow further stresses that needs on the more basic levels (Physiological and Safety) will have to be met before people become motivated to pursue higher level needs. Herzberg (1968), building on Maslow's theory, introduced a dual approach or types of factors: The first type, called "dissatisfiers" or "hygiene factors" relate to working conditions and can generate dissatisfaction if not fulfilled. Yet, fulfilment of these lower-level needs does not generate strong motivation.

The second type of factors, called "motivators" or "satisfiers" can spur individuals into high levels of motivation, but their absence does not prove strongly dissatisfying. Moses (1986) provides examples for different motivators within the academic context based on those proposed by Herzberg (1968): Recognition as a motivating factor may be achieved by an invitation to give an address or paper, to join a committee or to referee promotion applications; the work itself in its various aspects – research, teaching, service/administration – can provide personal challenges; autonomy may find its expression in a rather free choice of how research and teaching are carried out; advancement is possible through promotions, and status may be conferred by being a member of academia, which is considered a highly reputable profession in many countries. In their analysis of determinants of the job satisfaction of PhD holders in Spain, Escardíbul and Afcha (2017) mostly confirm the differentiation of factors proposed by Herzberg (1968), but also identify differences in the importance of basic motivational factors (i.e. wages, income) between the university and non-university sector, with wages having less of an impact for researchers in universities than in the non-university sector.

A study on job and career satisfaction at an institution of HE in South Africa (Dorasamy and Letooane 2015) identified major dissatisfaction due to poor organisational culture, unfair allocation of duties, poor facilities, the training required for the job, work overload and renumeration. An analysis by Bigirimana, Sibanda and Masengu (2016) of the causes for high staff turnover at a private Zimbabwean university identified a broad range of factors contributing to high levels of dissatisfaction: Leadership style was considered insensitive to the needs of the academic staff and did not encourage academic development; distribution of equipment, resources and salaries were considered unsatisfactory; performance appraisals were neither guided by clear goals nor were they perceived to be executed consistently and fairly; the distribution of workload among academic staff was not considered fair. Ineme and Ineme (2016) collected data on job satisfaction and burnout at a Nigerian university, with the findings showing a significant correlation between low satisfaction, high burnout and a positive attitude towards strike actions.

Bentley et al. (2013b) give an account of average measures of job satisfaction of academics across 19 countries participating in the Changing Academic Profession (CAP) study. Across all countries and ranks, 65 % of academics were satisfied (i.e. answered 4 or 5 on a scale of 1 to 5), with distinct differences between countries: The highest figures for all staff were reported for Mexico (87 %), Korea (77 %) and the Netherlands (73 %) whereas the share of satisfied academics was lowest in the United Kingdom (47 %), South Africa (51 %), Portugal (53 %) and Australia (55 %). Satisfaction rates for junior academic staff was generally lower (59 %) than for senior academics (70 %). Junior staff from Mexico (86 %), Korea (73 %) and Canada (71 %) reported the highest rates of satisfaction whereas the lowest share of satisfaction was noted for the United Kingdom (44 %), Australia as well as Portugal and South Africa (all 50 %). Findings from the Global State of Young Scientists (GloSYS) Association of Southeast Asian Nations (ASEAN) study on ECRs in Indonesia, Malaysia, Singapore and Thailand indicate an overall satisfaction of 70 % (Geffers et al. 2017). The respondents were most satisfied with the flexibility of working hours (76 %), followed by challenging tasks and social status (74 % for each aspect), and they were least satisfied with infrastructure, that is, rooms and equipment (44 %) and income (47 %) (ibid.).

Shin et al. (2014) identify the introduction of new public management resting on performance-based management systems as the major source of job stress for academics and intrinsic factors related to the work itself as highly associated with job satisfaction. Bentley et al. (2013a) interpret their finding that institutional resources and time available for research are positively correlated with job satisfaction as related to the latest reforms in the higher education (HE) sector "to do more with less". Based on a similar description of recent developments in HE, Dorenkamp and Weiß (2018) use an effort-reward imbalance model incorporating strain and job satisfaction as mediators to analyse intentions of postdocs to leave academia. The authors identify gender differences, e. g., a more direct link between work stress and the intention to leave academia for female postdocs than for their male peers, and they suggest strengthening the postdocs rewards and reducing the required effort (e. g., reducing teaching loads) to bring efforts and rewards back into balance.
Besides contributing to research, teaching and possibly other obligations, ECRs are also engaged in the pursuit of their own qualification. This process is not without tensions and hardships itself, and a trend towards a loss of satisfaction and interest with graduate school experience and career perspectives can be observed which may lead to a change of mind regarding career plans (Russo 2011; Cressey 2012; Sauermann and Roach 2012; Zusi 2016; Castelló et al. 2017).

### 7.2.2 Work environment and employment conditions

While permanent full-time employment for professors at universities is customary in most economically advanced countries, ECRs often face part-time and short-term employment (Teichler, Arimoto and Cummings 2013; Auriol et al. 2013). Short-term employment for junior academics at universities is the most common form of employment in economically advanced countries with particularly high rates reported in countries of the CAP study for Korea (86 %), Canada and Hong Kong (82 % each) and Germany (79 %), but less than 10 % in Malaysia and South Africa (Teichler et al. 2013). Similar findings are related in the Careers of Doctorate Holders (CDH) study of the OECD (Auriol et al. 2013), indicating that doctoral graduates who received their degree for five years or less are more likely to be on temporary contracts than those who have earned their degree more than five years ago. The share of short-term contracts reported in this study is particularly high in Portugal (57 %), Germany (45 %) and the Netherlands (41 %; ibid.). The share of part-time contracts in the CDH study ranges between 1 % and 9 % for most countries, with higher shares noted for Lithuania, Latvia, Germany and Israel (with shares between 10 % and 16 %). Auriol et al. (2013) also report gender differences for working part-time in most of the countries surveyed with female PhD holders having higher shares of part-time contracts than their male peers. Findings from the GloSYS ASEAN study in Indonesia, Malaysia, Singapore and Thailand (Geffers et al., 2017) do not confirm these trends. In Indonesia, Malaysia and Thailand, full-time permanent positions are the most common (between 71 % in Malaysia and 91 % in Indonesia), while full-time contract positions were the most common (67.5 %) in Singapore.No significant differences between fields of research or gender were found (ibid.).

Working hours and the distribution of time across different tasks, research and teaching, are frequent topics in discussions on the situation of academics. Based on data from the CAP study, Teichler, Arimoto and Cummings (2013) report an average of 48h per week for university professors across countries with mature HE systems participating in the study, with highest and lowest working hours differing substantially between countries as well as between senior and junior academics. Senior university professors have the highest weekly working hours in Hong Kong (53h), Germany and Korea (52h) while senior university professors in Portugal (41h), the Netherlands and Norway (44h) have lower averages and are rather close to normal weekly working hours. Working hours for senior university professors from emerging countries participating in the study (Argentina, Brazil, Malaysia and South Africa) report a lower average of 40 hours per week, which is also the figure reported for South Africa. The authors note that the lower figures may reflect the fact, that a major part of the respondents pursue their work in academia on a part-time basis. Figures for junior academic staff at universities are lower than for their senior peers with an average of 44 hours reported across all countries with mature HE systems and 37 hours for emerging countries. The highest working hours for junior academics from universities are reported for Korea (56h) and Canada (49h), the lowest figures for Argentina (29h), Norway (33h) and Brazil (34h).

Teichler, Arimoto and Cummings (2013) also report on the shares of time spent for different functions or tasks. These shares vary substantially by rank, type of higher education institution (HEI) and country. In rough strokes, the highest proportion of time spent on research by senior university professors varies between 45 % in Italy, 44 % in Korea and Japan on the upper end of the range reported, while lowest proportions can be found in South Africa (27 %), Malaysia (28 %) and the United Kingdom (30 %). The figures for junior staff at universities differ substantially from their senior peers as they are not expected to teach as much as their seniors in most countries, may be employed for research purposes only and have a lower share of their time absorbed by administrative duties and service (ibid.). A striking difference between junior academic staff in countries with mature HE systems and those from emerging countries is that the latter spend more time on teaching than on research, while the opposite is true for almost all of their peers in economically more advanced countries (see Table 7.1).

*Table 7.1 – Average percentages of work time spent on teaching and research for senior and junior academic staff at universities*

| | Canada | Germany | Japan | Norway | United Kingdom | USA | Brazil | Malaysia | South Africa |
|---|---|---|---|---|---|---|---|---|---|
| **Senior Academics** | | | | | | | | | |
| **Teaching** | 28 | 29 | 30 | 33 | 32 | 28 | 41 | 31 | 40 |
| **Research** | 41 | 38 | 44 | 39 | 34 | 38 | 37 | 28 | 27 |
| **Junior Academics** | | | | | | | | | |
| **Teaching** | 32 | 22 | 18 | 21 | 29 | 36 | 44 | 43 | 43 |
| **Research** | 46 | 53 | 42 | 65 | 41 | 33 | 32 | 24 | 26 |

Source: Teichler, Arimoto and Cummings (2013), p. 104; Figure 5.8, selected data .

The remaining percentages are spent on other assignments, including categories such as services, administration and other academic activities (Teichler et al. 2013). On average, university professors in economically advanced countries spend 30 % of their time on other assignments, the respective figure for emerging countries is 25 % (ibid.).

### 7.2.3 Promotion

According to Merton (1973), the normative structure of science demands the acknowledgment of success in research and science to be based on achievements; careers should be open to talents and the rejection or acceptance of claims should not depend on personal or social characteristics of the protagonist. Identifying, recruiting and managing the best scholars has probably become the main business of universities (van den Brink, Fruytier and Thunnissen 2013; van den Brink 2009). The last decades have witnessed major administrative reforms in the HE system often characterised as marketisation or new public management, introducing rankings to facilitate orientation of the “customers” in the HE market and performance measurement systems within HE and research organisations to “manage” these organisations (Álvarez Mendiola 2012; Hicks et al. 2015; Martin-Sardesai et al. 2019).

Along with these changes, the role and relations between universities, state and industry have been transformed and so have the notions of what should be acknowledged and rewarded as meaningful contributions of those working in HE and research (Mok 2012, 2013; Martin-Sardesai et al. 2019). While research and teaching remain the core functions of HE (Teichler, Arimoto and Cummings 2013), other aspects such as stronger recognition of patents and commercialisation (Sanberg et al. 2014) or engagement in policy (Chan, Higgins and Porder 2005; Singh et al. 2014, 2019) toward tenure and career advancement have been voiced. The latter point to an increased recognition in policy and society as a whole that science needs to be included in policy making to address global issues (e.g. climate change or loss of biodiversity), yet note that this form of contribution is not recognised in promotion criteria. Currently, a tension in academic promotion exists between the recognition and reward of contributions from research and teaching, with contributions from research often being given more weight (Parker 2008; Nunn and Pillay 2014; Subbaye 2018; Subbaye and Vithal 2017a, 2017b).
Not only what constitutes academics activities’ worth of acknowledgement and reward is subject to debate, also their assessment and evaluation has changed substantially, shifting from evaluations performed by peers to a widespread use of metrics (Hicks et al. 2015; Lane 2010). In their “Leiden Manifesto for research metrics”, Hicks et al. (2015) criticise that data and metrics have come to lead evaluations instead of judgement, that collecting quantitative information has shifted from being an instrument in evaluations to becoming a goal in itself. The authors also suggest ten principles to realign quantitative and qualitative evidence in decision-making processes that need to be pursued in clear understanding of the aims and the nature of the research to be evaluated.

In the GloSYS ASEAN study conducted in Indonesia, Malaysia, Singapore and Thailand (Geffers et al. 2017), performance evaluation was pervasive, reported by 96 % of those ECRs responding to the online survey. The most important criteria as perceived by the respondents were the number of publications (88 % answering “important” or “very important” on a five-point scale), the reputation of the journals (84 %) and the ability to attract funding (83 %) (ibid.). From the interviews conducted for this study, pictures of diverse opinions emerged on whether or not the way the performance evaluation conducted was fair and whether or not the focus on “tangible results” such as the number of publications is warranted by the end of bringing objectivity into the process or if this focus tends to disregard the quality of the output. The participants widely agreed that the workload required to provide all the information for the process should be reduced (ibid.).

Though personal or social characteristics should have no impact on the acknowledgement and reward of academic achievements, previous research indicates that success in academia does not only rely on promotion based on the achievements in the acknowledged areas at the given institution. In their analysis of determinants of success in academic careers, van Balen et al. (2012) did not find a systematic relationship between the academic performance (measured as the number of publications and citations) and academic success, but identify a variety of combinations of multiple factors, accumulating advantages and disadvantages that resulted in inhibiting or furthering careers in academia. These factors include individual and ascriptive aspects such as gender, cultural capital (e. g. educational level of parents), family situation, social capital (e. g. mentoring, networks) and university characteristics (career development systems). Similar findings are reported by Jungbauer-Gans and Gross (2013) indicating that mentorship, the educational level or occupational prestige of the parents, gender and age, among other factors (including the number of publications in journals listed in the Science Citation Index ), have a positive effect on the chances of being appointed to a chair. The analyses of the importance in three different fields of research – law, mathematics and sociology – reveal different levels of effect and even converse effects of factors are reported (ibid.). Personal factors such as race or self-declared ethnicity and gender continue to be an issue in academic promotions in South Africa, where white men are still predominant in senior academic ranks (Sadiq et al. 2019). The study of Sadiq et al. (2019) analysed time to promotion as a proxy for fairness in promotion processes. No differences between gender were found, international staff in junior positions with higher qualifications and in particular faculties seems to have experienced quicker promotion time, and some differences between different groups of self-declared ethnicity were found, but these were not consistent (ibid.).

## 7.3 Results – Career satisfaction and perceived hindrances to success

For the purposes of this report, it is important to gain a comprehensive overview of the working conditions and their impact on the work-life balance of our ECR respondents. To do this, we asked respondents about the factors that triggered dissatisfaction in their careers and the factors exerting influence on their levels of satisfaction overall (refer to Section 7.3.1). Next, we explore the structural factors they perceive to inhibit their career progression and research interests (refer to Section 7.3.2). We turn then to look at the intersection between these factors and their workload (Section 7.4.1), support structures (Section 7.4.2) and productivity (Section 7.4.3). Finally, we discuss respondents' experiences with seeking promotion (Section 7.4.4).

### 7.3.1 Factors associated with satisfaction and dissatisfaction in research careers

#### Dissatisfaction

Overall career satisfaction ranked similarly across employment sectors, with 45 % in HE, 41.1 % in research institutes and 40.6 % in other employment sectors generally satisfied, whilst fewer were very satisfied, only 13.1 %, 12.6 % and 14.1 %, respectively. Of the ten individual job factors we asked respondents to consider, as their level of satisfaction, only three displayed a general consensus of satisfaction, across the board. Of these, intellectual freedom was the primary driver of career satisfaction for those in HE ($P=0.0127$) and a similar trend for those in research institutes. Job security and working hours were the only other factors which had a satisfaction majority for those working in HE and research institutes. Whilst for those working in other sectors, working hours was the only factor with a satisfaction majority. Interestingly, despite the overall career satisfaction, respondents were predominately dissatisfied or neutral with regard to the other seven factors. Institutional research infrastructure was the primary driver of strong dissatisfaction for those in HE ($P<0.0001$), closely followed by teaching infrastructure, income/renumeration, management structures, and healthcare benefits for all sectors. Opportunities for advancement and family leave benefits generally showed a broad range in responses but on average displayed neutral or caused dissatisfaction (see Figure 7.1).

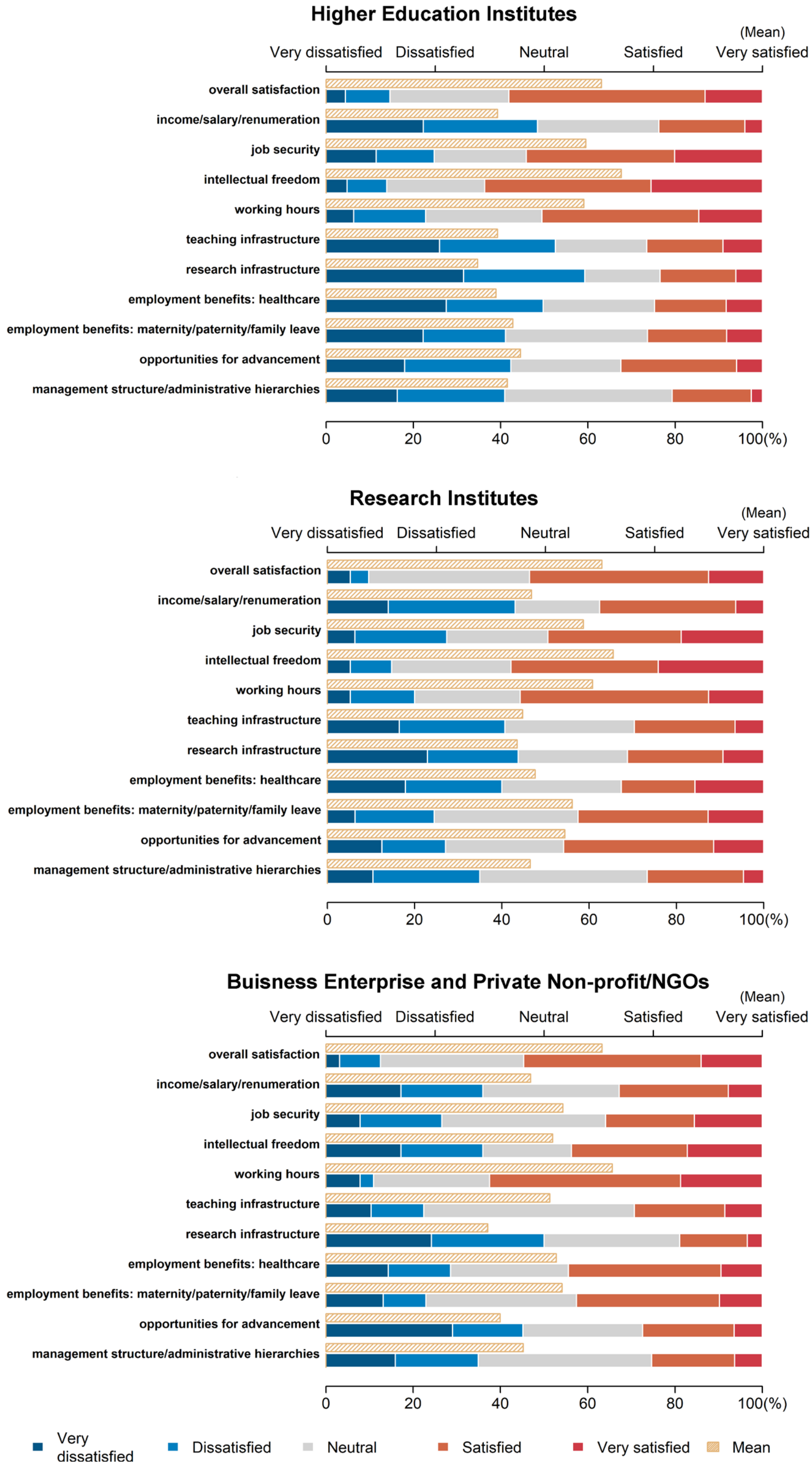


*Figure 7.1 – The level of satisfaction with structural aspects of their current research position for those in HE (top), research institutes (middle) and other employment sectors (bottom)*

Source: Authors.

### Regional differences in career factor satisfaction

Comparing levels of job satisfaction depending on where our respondents are currently working, those outside of Africa were more satisfied with salary, in comparison to those working in the Eastern and Western regions ($P \leq 0.0185$). Those working in the Southern region were also more satisfied with their salary than those working in the Eastern region ($P=0.0126$). Those working in the Southern region or outside of Africa were also more satisfied with teaching infrastructure, compared to those living in Eastern, Western or non-focal African countries ($P \leq 0.0007$). Those living in the Southern region or outside of Africa were also more satisfied with research infrastructure compared to those living elsewhere in Africa ($P \leq 0.0190$). During the interviews our respondents described the negative impact of their institution's low resources on both their ability to succeed in their work as well as their future career stability:

> *"We have problems. Even when we try to use the little infrastructure we have, we end up not getting our work published in good international journals…because you are judged based on your experiments. And if your experimental procedure is backward you will not get your paper flying in any high impact journals."*
> **Edna, Female, 42, Nigeria, Western Region, Physical Sciences, Public, PhD**

> *"At the moment I'm working on a contract. I don't know when my contract will be terminated and having stayed so many years without getting any money, I'm still having to settle for something that I think is very minimal. I can't do anything because I don't know if I will [retain] that post or they will take somebody else."*
> **Clara, Female, 29, Mauritius, Southern Region, Life Sciences, Academia, PhD**

## 7.3.2 Factors perceived to have a negative impact on research career success

### Common inhibitors of success

Irrespective of their current employment sector, discipline or highest degree, our respondents unanimously indicated that a lack of funding opportunities or research grants had the greatest ($P<0.0001$) negative impact on their career success (see Figure 7.2 below). A lack of staff and material resources and a lack of support to find and apply for funding were equally the next most common inhibitors experienced by our respondents (Figure 7.2). The importance of mentorship, support structures and funding are addressed in more detail in Chapters 9 and 10. Amongst the factors which had the least impact across all respondents were inequality based on sexual orientation and harassment based on gender (Figure 7.2). Female respondents, however, experienced greater inequity and harassment than male respondents ($P<0.0001$). We investigate inequities in research in detail in Chapter 8.

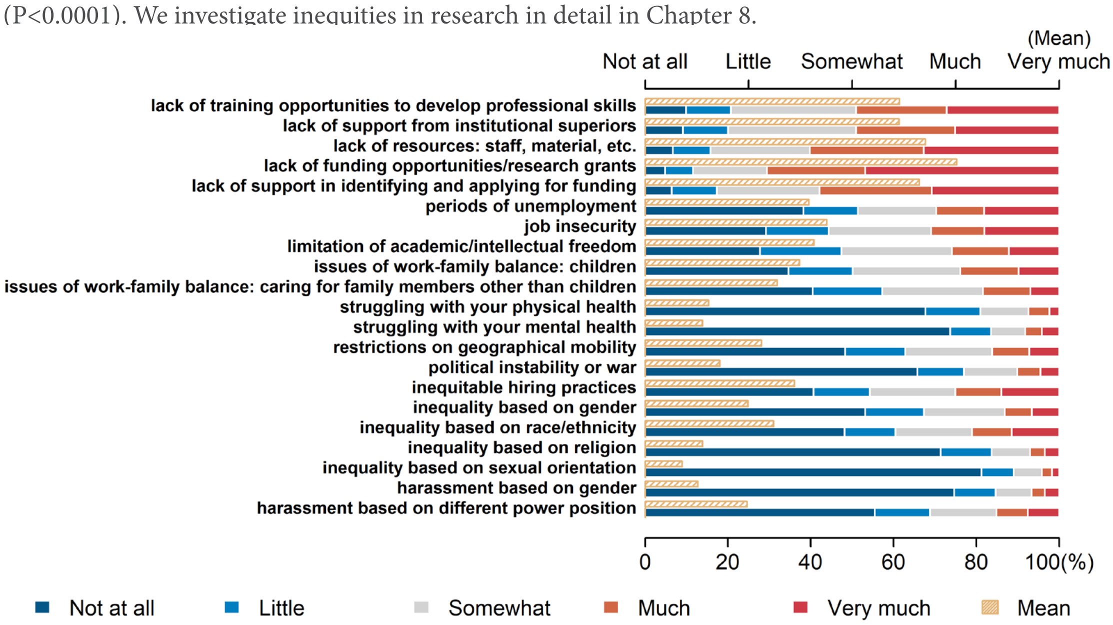

*Figure 7.2 – The degree to which work, society, family and political factors are felt to have had a negative impact on careers*
*Source: Authors.*

### Decreased job satisfaction associates with a lack of funding, support, and professional skills training

Across all employment sectors, overall job satisfaction was negatively correlated with a lack of funding opportunities, with the greatest negative effect experienced by those working in research institutes ($\beta$=-0.317, p=0.002; Table 7.2). Overall job satisfaction in HE and research institutes was also negatively correlated with a lack of resources ($P \leq 0.0001$), support from institutional supervisors ($P \leq 0.002$), support in identifying funding opportunities ($P \leq 0.046$) and limitation of academic or intellectual freedom ($P \leq 0.0005$). Job security was negatively correlated with overall job satisfaction in HE (P=0.0001; Table 7. 2).

### Lack of funding limits resources required for research productivity

During the interviews we delved deeper into the specific job areas where a lack of funding has the greatest negative impact. Interviewees indicated that, when working in African countries, they have difficulties with sourcing and maintaining equipment necessary for conducting experiments, and also with upgrading equipment as new technological developments emerge. Securing reliable access to the internet, online journal databases and even adequate office spaces were also frequently highlighted issues limiting their research capacity. Scientists working in Africa also experience different demands regarding access to other key resources in comparison to those in the diaspora. These include – but are certainly not limited to – effective working spaces and technical, administrative, and financial support for research activities. Thus, funding of structural facilitators including equipment, data access and staff resources (rather than project-specific funding) is the strongest theme that emerged as a primary facilitator that needs to be addressed in order to enhance the potential of African ECRs.

> *"First and foremost, there's no space. To be productive, at the least you need an office, and that office should have the required facilities like the internet for you to be able to deliver. But currently, we have a shortage of space. So, most of us either work from our cars or from our houses."*
> **Janet, Female, 40, Kenya, Eastern Region, Humanities, Academia, PhD**

### Work hour dissatisfaction correlates with negative impact career of life and work constraints

For those working in HE and research institutes, job satisfaction is strongly correlated with satisfaction in working hours ($\beta$=0.411 and 0.426, respectively, $P < 0.0001$), whilst it does not correlate with those working in other sectors. Considering the impact that work hour satisfaction has on maintaining a good work-life balance, we investigated career-impacting factors that are associated with work hour satisfaction. We found that those working in HE have the greatest correlation between decreased satisfaction in working hours and experiencing negative career impacts from caring for children and family members ($P \leq 0.0002$), struggling with physical ($P<0.0001$) and mental health issues (P=0.027) and a lack of job resources (staff and materials; $P<0.0001$). Research institutes and HE also showed a significant decrease in work hour satisfaction, a lack of funding opportunities and limitations of academic or intellectual freedom. Finally, across all employment sectors a negative career impact due to restrictions on geographical mobility was also significantly correlated with decreased work-hours satisfaction ($P \leq 0.010$; Table 7.2).

*Table 7.2 – Correlation between factors with a perceived negative career impact and job and workload satisfaction*

| | Satisfaction overall | | | Satisfaction work hours | | |
|---|---|---|---|---|---|---|
| | HE | RI | Other | HE | RI | Other |
| Lack of: | | | | | | |
| Resources: staff, material, etc. | -0.190*** | -0.389*** | -0.120 | -0.184*** | -0.143 | 0.000 |
| Funding opportunities/ research grants | -0.177*** | -0.317** | -0.261* | -0.102* | -0.248* | -0.127 |
| Training opportunities to develop professional skills | -0.175*** | -0.198 | -0.221 | -0.089* | -0.054 | -0.047 |
| Support from institutional supervisors | -0.221*** | -0.315** | -0.256 | -0.102* | -0.030 | -0.002 |
| Support in identifying and applying for funding | -0.120** | -0.211* | -0.203 | -0.073 | -0.133 | -0.084 |
| Job insecurity | -0.155*** | -0.127 | -0.149 | -0.077 | -0.123 | -0.376** |
| Limitation of academic/ intellectual freedom | -0.244*** | -0.380*** | -0.155 | -0.231*** | -0.363*** | -0.133 |
| Caring for children | 0.031 | 0.183 | 0.097 | -0.163*** | -0.006 | -0.114 |
| Caring for family members (not children) | -0.012 | 0.077 | 0.007 | -0.158*** | -0.134 | -0.209 |
| Struggling with your physical health | -0.046 | 0.016 | -0.033 | -0.168*** | -0.108 | 0.094 |
| Struggling with your mental health | -0.076 | 0.117 | -0.006 | -0.096* | 0.029 | 0.002 |
| Restrictions on geographical mobility | -0.051 | -0.265* | -0.221 | -0.156*** | -0.280** | -0.327* |
| Political instability or war | -0.106* | -0.052 | -0.196 | -0.103* | 0.058 | -0.165 |

Note: RI = research institution; Other = private business/NGO/government/self-employed, other; b-value of correlation indicated with significance tested by Spearman correlation; ***, P < 0.001; **, P<0.01; *, P<0.05.
Source: Authors.

### Public vs. Private sector inhibitors

When adjusting for regional differences based on where respondents are currently living, those working in HE indicated a greater negative impact of a lack of resources (including both materials and staff) on their career success than those working in research institutes (P=0.0030) and NGOs (P=0.0217). The perception of this imbalance in resource access between sectors also was evident during our interviews. Particular inequalities in job benefits between interviewees working in private vs public sectors included incentives such as paternity allowances, housing and travel allowances, and access to loans, waiving of school fees during their PhD studies and effective and practical guidance from mentors on how to handle teaching.

> *'I have contact with advanced technology, advanced methods that if I compare to somebody in university in African context may not have access to that.'*
> **Victor, Male, 46, Kenya (from Cameroon), Eastern Region, Life Sciences, Para-public, PhD**

## 7.4 Results – Research output, workloads, task prioritisation, and promotion

Analysis of the workload conditions and the prospect for promotion for many ECRs in or from Africa are so intricately linked that it is difficult to dissect them even superficially without reference to the other. The workload of a young scientist in Africa is generally shaped by the inter-relation of three factors implicit to their role: research, teaching and professional ambition. We will first describe their experiences in managing the multifaceted work priorities of their position, how their current workload and task prioritisations impact their research career aspirations and investigate structural factors which associate with reduced research output. During interviews we investigated how their execution of the various tasks within their current job are evaluated with respect to career advancement.

### 7.4.1 Experienced vs. desired workloads

#### Experienced workloads

Across all regions, the respondents reported 40hr as the usual amount of working hours per week, except for those living in the Southern region who reported a significantly higher median of 45hr/week ($P \leq 0.0165$, compared to those in the Western and Northern regions (Figure 7.3). The highest 25 % of respondents in all regions reported working on average 50hr/week, except those living in the Eastern region where it was 45hr/week. Comparing the respondents' perception of their overall workload, again those living in the Southern region were least likely to say their workload was "about right", at only 43 % of respondents. Those in the Southern region are most likely to say their workload is too high or much too high (49.4 %); high workloads were also experienced in Western (48.8 %), Eastern (48.6 %) and Northern (43.7 %) Africa. Interestingly, 12.5 % of those in Northern region and 7.5 % of those in the Southern region indicated that their workload was too low or much too low (Figure 7.4). There was no significant difference in the number of hours worked based on gender, sector or discipline.

Of those who held a PhD, 51 % indicated that their workload was too high or much too high, compared to 37.2 % of Master's holders, although this difference was not significant when adjusting for the region where respondents are living (Figure 7.3). This is likely due to the fact that more PhD holders live in the Southern region, where the workload is significantly higher, irrespective of the highest degree.

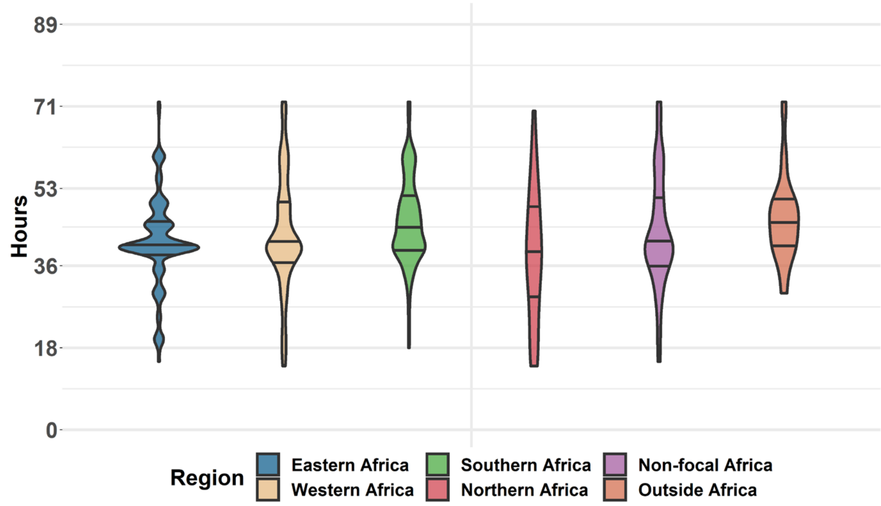

*Figure 7.3 – Usual hours respondents work per week (line at median), stratified by region of residence. (Right) How respondents describe their overall workload, stratified by region of residence (top) and highest degree (bottom)*
*Source: Authors.*

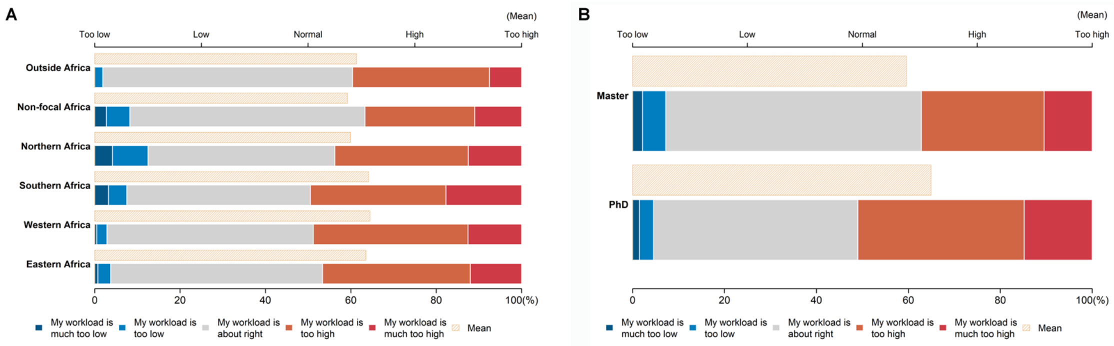


*Figure 7.4 – How respondents describe their overall workload, stratified by region of residence (A) and highest degree (B)*

## Desired time allocation

Respondents working in each sector were asked how they would ideally allocate the time they spend on various tasks within their current roles. Those working in HE and research institutes would like to spend significantly more time on research ($P \leq 0.0001$), followed by writing grants and training/supervision. They would prefer to spend significantly less time on administrative tasks ($P<0.0001$), followed by teaching (Figure 7.5). Off note, those living in Eastern ($P<0.0001$), Western ($P<0.0001$), Northern ($P=0.0063$) and non-focal ($P=0.0022$) regions wanted to spend more time writing and applying for funding, compared to those living in the Southern region.

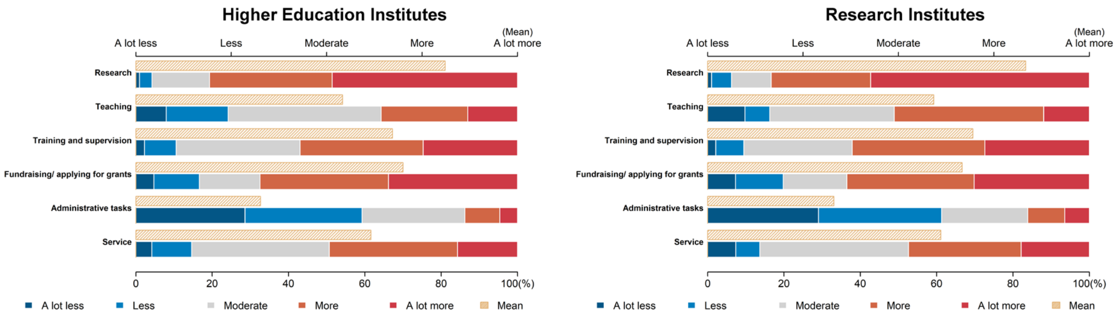


*Figure 7.5 – Desired task prioritisation in an ideal world for respondents employed in HE (left) and Research (right) Institutes*
*Source: Authors.*

*"My biggest obstacle to my research output is that I don't have lots of time to concentrate on my research… There are constant periods of time where I have to focus on teaching and then find time to get back to research. I think that's quite a typical problem in academia around the world."*
**Shane, Male, 31, South Africa, Southern Region, Life Sciences, Academia, PhD**

This desire to spend more time on research and less time on administration and teaching was consistent in our survey responses, irrespective of gender, discipline, or highest degree of the respondents. During our interviews, however, an individual difference in the desired allocation of workload between disciplines and regions emerged. Some interviewees felt their teaching commitments are manageable, and in some cases even enhance their productivity, whilst others in the same discipline felt the teaching workload is overbearing. The challenge for all interviewees was securing a suitable balance in the allocation of their time.

*"Teaching leads you to some possible research questions that you may then go back to the lab to try to solve. However, because it takes some hours to prepare to teach the students, those hours are not being deployed to the lab."*
**Patrick, Male, 40, Nigeria, Western Region, Health Sciences or Medicine, Academia, PhD**

### 7.4.2 Desired support structures to improve research success

**Improved Information Technology (IT) infrastructure to reduce burden of teaching administration**
Interviewees remarked their impression that teaching duties for researchers is an issue in HE globally. Several cited marking and grading assignments as specific tasks that are time-consuming. Two major reasons resonated: 1) the large volume of assignments that need to be graded, and 2) repeated issues with using online reporting systems to return grades to students. The interviewees noted that issues with grades had a high priority for them to resolve because the students relied on having them for graduation and other purposes. Most who raised this issue felt that improved IT and administrative support would greatly reduce the amount of time they spend re-entering data and fault-finding other issues.

**Reducing administration to increase research output**
The need for a fairly distributed workload was raised by many interviewees; separating the distribution of tasks that an administrator could do, from teaching or research tasks among suitably qualified colleagues. Reducing the administrative logistical burden of teaching from researchers aligns with the need for improved IT and administrative support for marking. African researchers working outside of Africa note the positive impacts adequate administrative support has on their capacity to focus on their core teaching and research roles as a specialist in their field.

> *"When I was in South Africa, I was having to do a lot more of organizing other things and functions and looking after the departmental website. A lot of those didn't necessarily require a PhD and extra physics, they just needed somebody to do them. So, I find that it's quite a distinct difference here where the resources are available […] and so you feel like it's an appropriate job to be spending your time on."*
> **Valentina, Female, 42, Oceania (from South Africa), Outside Africa, Physical Sciences, Academia, PhD**

**Valuing high-quality teaching and specialist teaching**
Interviewees also noted limited opportunity academic institutions create for students to formally provide feedback to people with teaching responsibilities. A majority of respondents remarked that they had never received feedback from the students about their teaching ability, and usually for two reasons: 1) there is no requirement for students to give feedback, and 2) when feedback is sought from students by the human resources team it is never forwarded to the teacher.

A further issue raised by interviewees was the challenge of choosing to work in an environment which does not match one's skills. Due to a lack of availability of jobs within their specialty, they end up taking jobs that do not match their research expertise, for which they have trained for nearly a decade. This results in lectures teaching in the field they did not train for. This practise does not only negatively affect the researcher's development and potential for success, but is detrimental to the development of the learners as well.

> *"One thing I find challenging, for example, are the students that come in and ask me questions based on whatever research and processing methods that they're learning about. I don't know the answers because I don't have the post graduate experience in the food processing environment."*
> **Alice, Female, 34, South Africa, Southern Region, Life Sciences, Academia, PhD**

## 7.4.3 Research output

**Discipline, regional and career stage differences in research outputs**

As the key measure of productivity and research excellence by which researchers are assessed during promotion and in funding applications, respondents were asked to quantify the number and types of publications and presentations they have produced and given in the last three years (see Figure 7.6). Understanding the variety of methodologies by which researchers disseminate the outcomes of their work provides insights not only into the requirement of flexibility in assessment criteria, but also the wider social impact of their work. The summary below presents data adjusted by region of birth, if not otherwise indicated.

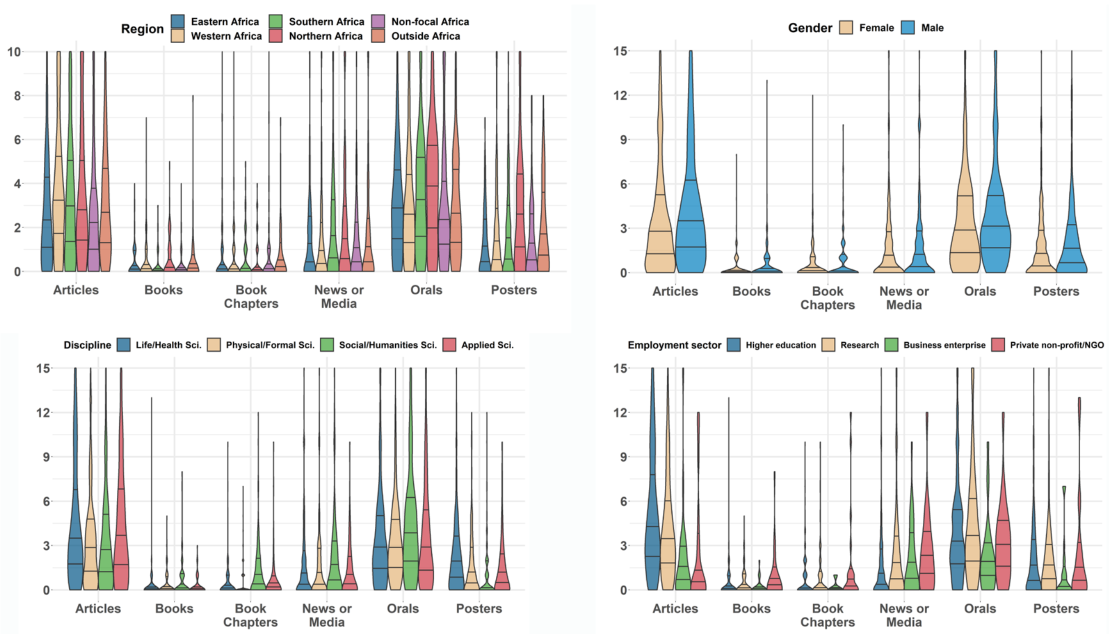


*Figure 7.6 – Productivity of respondents stratified by African region of birth, gender, discipline and employment sector*
*Source: Authors.*

*Journal Articles*: Those in the Life and Health Sciences published more journal articles than those in Social Sciences and Humanities (P<0.0001) and Physical and Formal Sciences (P=0.0114). Females also published significantly less articles than males (P<0.0001). These differences remained significant irrespective of region born, living or where highest degrees were studied. Gender publishing differences are addressed further in section 8.3.

*Books*: Conversely, those in Social Sciences and Humanities published more books (P≤0.0138) and more book chapters (P≤0.0246) than those in Life and Health Sciences, Physical and Formal Sciences and Applied Sciences.

*Conference Posters and Orals*: Those in the Life and Health Sciences have presented more conference poster than those in the Sciences and Humanities, Applied and Physical and Formal Sciences (P≤0.0294). Those living in Northern Africa have also presented more posters at conferences than those living in all other African regions (P<0.0001) and those living outside of Africa (P=0.042) and made more oral presentation than respondents living in all other African regions (P≤0.0240). Female conference attendance for poster presentation was lower than male, irrespective of the region of birth (P=0.0056) or residence (P=0.0036), however this gender difference was lost when adjusting for the location where respondents did their PhD. Conversely, when adjusting for the place where respondents did their PhD, males reported giving significantly more oral presentations than female respondents (P=0.0006).

*Public Policy:* Those in the Social Sciences and Humanities also produce more publications with a focus on public policy than those in Life and Health Sciences (P=0.0006) and Physical and Formal Sciences (P=0.0036), as were those working in Research Institutes compared to those working in HE (P<0.0001).

*Effect of highest degree:* Respondents with a PhD reported to publish more journal articles, conference oral and poster presentations than those with a Master's, irrespective of where they were born or are currently living (P≤0.0003).

*Academy Members*: Respondents who are a young academy member reported giving more conference poster presentations in comparison to non-academy members currently living in their region (P=0.0004) and more likely to have started a company compared to other's who studied their PhD in the same location (P=0.0003).

#### Lack of training and support associated with reduced research output

To understand the structural factors which may impact research productivity, we analysed the correlation between factors perceived to have a negative impact on career success and the level of research productivity (see table 7.3). Lower total research output was significantly correlated with a lack of training opportunities to develop professional skills, lack of support in identifying and applying for funding, job security, and limitation of academic freedom. Decreases in conference oral presentation and published journal articles, books, and book chapters were also significantly associated with these four factors. Fewer conference oral presentations were also correlated with a lack of support from institution supervisors. The only factors positively correlated with research output were the following: works of art performed or exhibited with restrictions in geographical mobility; an increase in published books and chapters for those negatively affected by caring for children; an increase in published books and law-making processes or public policy and total research output by those negatively affected by caring for other family members.

*Table 7.3 – Correlation between research output quantity over prior 3 years and factors which are indicated to have had a negative impact on their careers*

| | Journal articles | Books | Book chapters | Conference Talks | Conference Posters | Law-making processes or public policy | Works of art performed or exhibited | Total research output |
|---|---|---|---|---|---|---|---|---|
| Lack of: | | | | | | | | |
| Resources: staff, material, etc. | 0.017 | 0.006 | -0.073* | -0.038 | 0.038 | -0.056 | -0.004 | -0.029 |
| Training opportunities to develop professional skills | -0.104*** | -0.081* | -0.129*** | -0.174*** | -0.087** | -0.069* | -0.007 | -0.168*** |
| Support from institutional supervisors | -0.046 | -0.027 | -0.054 | -0.074* | 0.012 | -0.039 | 0.056 | -0.048 |
| Support in identifying and applying for funding | -0.128*** | 0.004 | -0.078* | -0.143*** | -0.093** | -0.060 | 0.060 | -0.108*** |
| Not received funding in the last 3yrs | -2.876*** | 0.068 | -0.357** | -2.358*** | -1.400*** | -0.306** | 0.003 | |
| Job insecurity | -0.143*** | -0.050 | -0.052 | -0.088** | -0.001 | 0.015 | 0.044 | -0.085** |
| Limitation of intellectual freedom | -0.178*** | -0.044 | -0.101** | -0.189*** | -0.076* | -0.036 | 0.059 | -0.173*** |
| Caring for children | 0.048 | 0.067* | 0.090** | 0.018 | 0.019 | 0.023 | 0.020 | 0.037 |
| Caring for family members other than children | 0.043 | 0.080* | 0.060 | 0.020 | 0.020 | 0.066** | 0.042 | 0.064* |
| Restrictions on geographical mobility | -0.071* | -0.054 | 0.018 | -0.036 | -0.012 | 0.005 | 0.097** | -0.020 |

Note: β-value of correlation indicated, with significance tested by Spearman correlation; ***, P < 0.001; **, P<0.01; *, P<0.05.
Source: Authors.

### 7.4.4 Experience of the criteria weighted into promotion

**Quantifying metrics impacts the quality of teaching, research and wellbeing**

The professional ambition for promotion was noted by interviewees to be almost exclusively measured on the basis of quantifiable research output alone: the number of publications and the number of supervised students graduated with a Master's or PhD . These expectations predominantly focus on the research and professional development achievements of the individual with little emphasis on their performance as a teacher which runs counter to the time requirements of that role. This creates tension between their teaching duties and their research requirements. Basing decisions of promotion solely on quantity rather than quality implies that neither the quality of their teaching nor the various resources required to conduct research (other than time) are duly recognised or appreciated by the institution.

> *"To be honest universities are only interested in publications. And yet it hasn't made or given an enabling environment for publication."*
> **Fredrick, Male, Nigeria, Western Region, Physical Sciences, PhD**

There was a strong level of dissatisfaction among interviewees regarding the focus on these quantifiable measures and the subjectivity with which they are applied by different departments within the same institution.

> *"It doesn't matter how good you are as a lecturer, you can never be promoted if you do not have good research output […] the whole problem that I have is that 80 % of my time goes to teaching."*
> **Jacob, Male, 37, Ghana, Western Region, Health Sciences or Medicine, Academia, PhD**

The scope of requirements upon them to satisfy the employer and generate opportunities for promotion was overwhelming for many respondents. The promotional criteria and pathway toward such were demotivating to many respondents' peers working in Africa and is influencing their desire to move, in or outside of Africa.

> *"More seminars, more workshops, more conference activities, more publications, more agreements, more PhD students, more Master's students, more volunteering activity."*
> **Ethan, Male, 36, Egypt, Northern Region, Life Sciences, Public, PhD**

The implication of overburden for those who remain is a compromise in the quality of research and teaching work achievable. The narrow scope for reward for quality teaching impacts the attitude towards teaching.

> *"No attention is paid to teaching. People generally ignore the teaching aspects. People would rather be writing papers and getting a promotion than developing themselves in the teaching area."*
> **Edna, Female, 42, Nigeria, Western Region, Physical Sciences, Public, PhD**

**A need for standardised, transparent promotion guidelines which reflect primary responsibilities**

The criteria for promotion from each level of seniority to the next are clear to some respondents whilst others noted a lack of transparency and clearly defined expectations. Formalised criteria were noted as either formalised individually in their own contracts or in institutional guidelines that are applied to each level of seniority irrespective of the department or specific nature of their role.

Even in institutions where the promotional criteria are standardised, several respondents perceive injustice in the promotional process. This includes a lack of consistency in interpreting institutional criteria across all departments or disciplines in the institution on the one hand. On the other hand, standardised criteria are not being appropriately adjusted to the responsibilities and challenges ECRs face in different departments or disciplines.

> *"So this is why I find it a bit disheartening, the fact that everybody interprets the guidelines in their own way and I think it shouldn't be left to interpretation. It should be clearly spelled out in black and white what they want. Because what is considered negatively in my faculty is considered perfectly normal in other faculty."*
> **Eveline, Female, 33, Mauritius, Southern Region, Other (Food Sciences), Academia, PhD**

A delay in assessing promotion applications (in some cases more than one year), amendments of the guidelines and negating previously published requirements (such as excluding certain journals previously accepted as referenceable) were noted as factors further inhibiting timely promotion. Some interviewees also stated that they did not receive feedback on an unsuccessful promotion application from the review committee. This limits their opportunity to address areas which need improvement. It also increased their feeling of a lack of transparency and inherent biases in the process. Many believed the pathway to promotion is unfairly biased and influenced by discrimination. Inequities in research are described in Chapter 8.

> *"All the time in Egypt they ignore the young scientists, they're thinking all the time about professors, and young scientists are totally ignored. Whether it is in the post-doctoral professions they're searching for or in announcements they speak of age limits. For people under 40, actually they're not looking at us; they're not speaking about us."*
> **Emily, Female, 37, Europe (from Egypt), Outside Africa, Physical Sciences, PhD**

## 7.5 Conclusions

In recent decades, enrolment in African HE has increased rapidly and so have the demands on HE and research organisations to contribute to economic growth and solving societal and environmental challenges. Without the resources to adequately respond to these growing demands, the pressure on academic staff, and scholars and scientists more generally, has increased the need to perform at a high level across a wide range tasks (teaching in particular), often resulting in high levels of stress and dissatisfaction with their working conditions. Our analysis provides evidence on the state of work and career satisfaction of ECRs in Africa, including major factors that contribute to satisfaction and dissatisfaction, such as work environment and promotional criteria; overall, we found that 45 % of those surveyed in HE, 41.1 % in research institutes and 40.6 % in other employment sectors were generally satisfied, whilst fewer were very satisfied, only 13.1 %, 12.6 % and 14.1 %, respectively.

First, just of half of our ECRs (54 % to 58 %, depending on employment sector) were generally satisfied or very satisfied with their current research positions. This figure roughly matches the general satisfaction for junior academic staff of 59 % in the CAP study across all participating countries, and is slightly better than the 50 % rate of satisfied junior academics in South Africa as reported by Bentley et al. (2013a). Findings from the GloSYS ASEAN study with respondents from Indonesia, Malaysia, Singapore and Thailand indicated higher overall satisfaction with their working conditions, with 70 % being either satisfied or very satisfied (Geffers et al. 2017).

Second, our results on factors related to working and employment conditions – "hygiene" factors or "dissatisfiers" as defined by Herzberg (1968) – indicate an average rate of satisfaction with job security, with

54 % in HE, 49 % in research institutes and 34 % in other employment sectors being satisfied or very satisfied, while only 24 %, 38 % and 33 % across the same employment sectors would agree that they are either satisfied or very satisfied with their income. The latter value is particularly low in comparison to respondents from the GloSYS ASEAN study, indicating a level of satisfaction with their income of 47 % (satisfied or very satisfied). Given that our findings on the motivation to start a research-oriented career revealed that income is rated as the least influential factor (see Chapter 6), it can be assumed that the expectations of receiving a high income among our respondents are not particularly strong in the first place. Initiatives aimed at raising the satisfaction and increasing the motivation of ECRs will need to address this point.

Third, further improvements in the working environment are required for the research and teaching infrastructures that are currently a major cause of dissatisfaction. Additional improvements that may not primarily depend on additional funding relate to the management or administrative hierarchies as well as criteria and processes of promotion that are currently causes for dissatisfaction among HE staff.

In broad strokes, our findings on the satisfaction or dissatisfaction of ECRs with their work environment align with the results of earlier studies on work and career satisfaction of HE staff in African countries – Nigeria, South Africa, and Zimbabwe – and converge on poor research infrastructure, inadequate salaries, and insufficiencies in the management of HEI as major sources for dissatisfaction (Dorasamy and Letooane 2015; Bigirimana, Sibanda and Masengu 2016; Ineme and Ineme 2016).

Fourth, our findings on the workload of ECRs in Africa, an average of 40 working hours per week, roughly mirror the findings reported in the CAP study, with an average of 44 hours per week for all participating countries and 37 hours per week for junior academics from emerging countries. The authors of the CAP study note that the lower average working hours of junior academics compared to their senior colleagues is partly due to the fact that juniors are more frequently employed on part-time basis (Teichler et al. 2013).

Fifth, our data on the distribution of time spent on different tasks in HE indicates a desire to spend more time on research and applying for funding and less on teaching, and that administrative tasks are a major burden for ECRs. Reducing administrative duties and the workload dedicated to teaching are the two most relevant factors ECRs consider as necessary to improve their situations. The preponderance of teaching in the allocation of time of young academics has also been reported by Beaudry, Mouton and Prozesky (2018) as well as Teichler et al. (2013), with data from 2007. These authors found a generally higher share of time allocated to teaching for junior academics in emerging countries compared to their peers in most economically advanced countries. This latter fact needs to be considered in international comparisons of productivity that are usually assessed based on quantitative indicators of research output (e. g., number of journal articles). At the individual level, when applying for positions or grants, young academics from Africa will therefore be at a disadvantage that may not be as visible or commonly known as the often cited – and no less important – lack of funding or insufficient research infrastructure.

Sixth, ECRs perceive the predominant focus on (research) metrics – for example, the number of publications, graduated Master's and PhDs – in the assessment of their achievements as inadequate with respect to an evaluation of the quality of their research and teaching, and of little help for their career development. Respondents felt that promotion evaluation based solely on quantity, and not quality, would likely lead to diminished teaching quality, and it did not recognise the various resources required to conduct quality research. The arguments our respondents provided are not contrary to evaluations of their work and potential, but seem supportive of the statement of Hicks et al. (2015) in their reflection on the current state of implementation of research metrics: "The problem is that evaluation is now led by the data rather than by judgement. Metrics have proliferated: usually well intentioned, not always well informed, often ill applied," (ibid., p. 429). This is not an issue particular to African HE and research systems. As outlined in our review of the literature, administrative reforms and the introduction of diverse HE rankings during the last decades have led to a proliferation of systems of data collection for performance and evaluation purposes that may do more harm than good to the systems they were designed to improve. A necessary review of the current state of research metrics and other indicators of performance in HE will benefit from keeping an eye on ongoing discussions of the international scientific community as well as continental and national priorities.

Future research and monitoring of the satisfaction of both young and senior scientists and scholars will need to be conducted at the national and institutional levels to provide evidence for policy makers and HE management which of the issues causing dissatisfaction are the most pressing to address. Both conceptual frameworks and research show that satisfaction may depend on and may be nurtured by different types of factors – "hygiene" factors or dissatisfiers and motivators. Given the scarcity of resources, an evidence-based and profound understanding of the perception of the work environment by academic staff is a highly valuable piece of information. Further, the assessment of working hours and the allocation of time on different tasks is indispensable for keeping track of unnecessary work and time that could be used more productively. Improved technical support and standardisation of processes may prove helpful in reducing the workload for administrative tasks but also run the risk of producing the kind of metrics that are otherwise criticised as misleading for the evaluation of performance. Finally, future research is warranted for the ongoing discussion over an adequate assessment of performance across the diverse range of expectations from the HE and research system as well as other societal actors – industry, policy, non-government organisations (NGOs), regional institutions and so on – offering opportunities for collaboration, requiring evidence to substantiate their actions or providing alternative career opportunities.

## 7.6 Recommendations

Recommendations have been formulated at three levels, as follows.

### Higher Education Institutions

- HEIs should implement and maintain structured student evaluations of teaching and graduate supervision, and ensure that feedback is regularly provided and used to improve quality of education and supervision.
- Regular capacity-building trainings have to be designed and implemented regularly and on the basis of students' evaluations and feedback.
- Formally recognise ECRs' supervision of the graduate students; attribute work certificates as well as the job title of "co-supervisors" to PhD students and postdocs who partake the task of supervision and evaluation.
- Increase the staff-to-student ratio, reduce teaching and evaluation burdens and improve quality by creating more part-time Teaching Assistant jobs to current students enrolled at the graduate and post-graduate levels, which would also provide professional experience acquisition for those students and might inspire them to pursue careers in academia once they graduate.
- Reconfigure organisational structures and employment contracts so that there are opportunities for people to take positions specifically intended as teaching or lecturing positions.
- Provide office space and equipment, internet, memberships as well as online access to international libraries as a basic standard. HEIs might allocate proportions of their annual budgets to this purpose.

### Government, institutions, funding bodies and industry

- Governments should enforce policies and employment laws that stipulate precise commitments of time for research, teaching and administration and evaluate productivity against these requirements in every job contract provided by employing organisations.
- Investment in infrastructure of research hubs with trained support staff to run and maintain the equipment should be increased and maintained with long term visions and allocations.
- Link research hubs to industry expertise to support activities and increase academic-industry partnerships.
- Passing to the 4th industrial revolution requires that governments and institutions move into the digitalised era. Therefore, investment in new technologies including IT and the digitalisation of services needs to be updated in order to reduce paperwork, enhance communication and optimise efficacy.

### Institutions and review panels

- Institutions should put in place review manuals that organise and guide the work of review panels. In this regard, evaluation guidelines should emphasise and weigh quality over quantity of research and teaching outputs.
- Promotion criteria also take into consideration the evaluation of societal and/or environmental impacts of research and its dissemination to the public.
- Institutions should allow ECRs to create their own rank of task priorities for evaluation based in their workload and employment agreement.
- ECRs should be evaluated on their individual research outcomes in relation to the available research infrastructure.
- The rationale that guides the evaluation process should be based on the provision of an opportunity for the researcher to describe resource availability and the quality of their output.
- Provide reviewers' comments with promotion outcomes, increase the transparency of the process and increase the applicant's potential for development and future success.

These recommendations also appear as Table 7.4A in Appendix 7.8.

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## 7.8 Appendix

*Table 7.4A – How to implement promotion standards and guidelines*

| **Implement promotion standards and guidelines that are based on quality of work to enable ECRs to conduct impactful research** | |
|---|---|
| **Interlocutors** | **Suggested Policies and Measures** |
| **HEI** | ▪ HEIs should implement and maintain structured student evaluations of teaching and graduate supervision, and ensure that feedback is regularly provided and used to improve quality of education and supervision.<br>▪ Regular capacity-building trainings have to be designed and implemented regularly and on the basis of students' evaluations and feedback.<br>▪ Formally recognise ECRs' supervision of the graduate students; attribute work certificates as well as the job title of "co-supervisors" to PhD students and postdocs who partake the task of supervision and evaluation.<br>▪ Increase the staff-to-student ratio, reduce teaching and evaluation burdens and improve quality by creating more part-time Teaching Assistant jobs to current students enrolled at the graduate and post-graduate levels, which would also provide professional experience acquisition for those students and might inspire them to pursue careers in academia once they graduate.<br>▪ Reconfigure organisational structures and employment contracts so that there are opportunities for people to take positions specifically intended as teaching or lecturing positions.<br>▪ Provide office space and equipment, internet, memberships as well as online access to international libraries as a basic standard. HEIs might allocate proportions of their annual budgets to this purpose. |
| **Government, institutions, funding bodies and industry** | ▪ Governments should enforce policies and employment laws that stipulate precise commitments of time for research, teaching and administration and evaluate productivity against these requirements in every job contract provided by employing organisations.<br>▪ Investment in infrastructure of research hubs with trained support staff to run and maintain the equipment should be increased and maintained with long term visions and allocations.<br>▪ Link research hubs to industry expertise to support activities and increase academic-industry partnerships.<br>▪ Passing to the 4th industrial revolution requires that governments and institutions move into the digitalised era. Therefore, investment in new technologies including IT and the digitalisation of services needs to be updated in order to reduce paperwork, enhance communication and optimise efficacy. |

*Table 7.4A – Continued*

| | |
|---|---|
| **Institutions and review panels** | ▪ Institutions should put in place review manuals that organise and guide the work of review panels. In this regard, evaluation guidelines should emphasise and weigh quality over quantity of research and teaching outputs.<br>▪ Promotion criteria also take into consideration the evaluation of societal and/or environmental impacts of research and its dissemination to the public.<br>▪ Institutions should allow ECRs to create their own rank of task priorities for evaluation based in their workload and employment agreement.<br>▪ ECRs should be evaluated on their individual research outcomes in relation to the available research infrastructure.<br>▪ The rationale that guides the evaluation process should be based on the provision of an opportunity for the researcher to describe resource availability and the quality of their output.<br>▪ Provide reviewers' comments with promotion outcomes, increase the transparency of the process and increase the applicant's potential for development and future success. |

Source: Authors.

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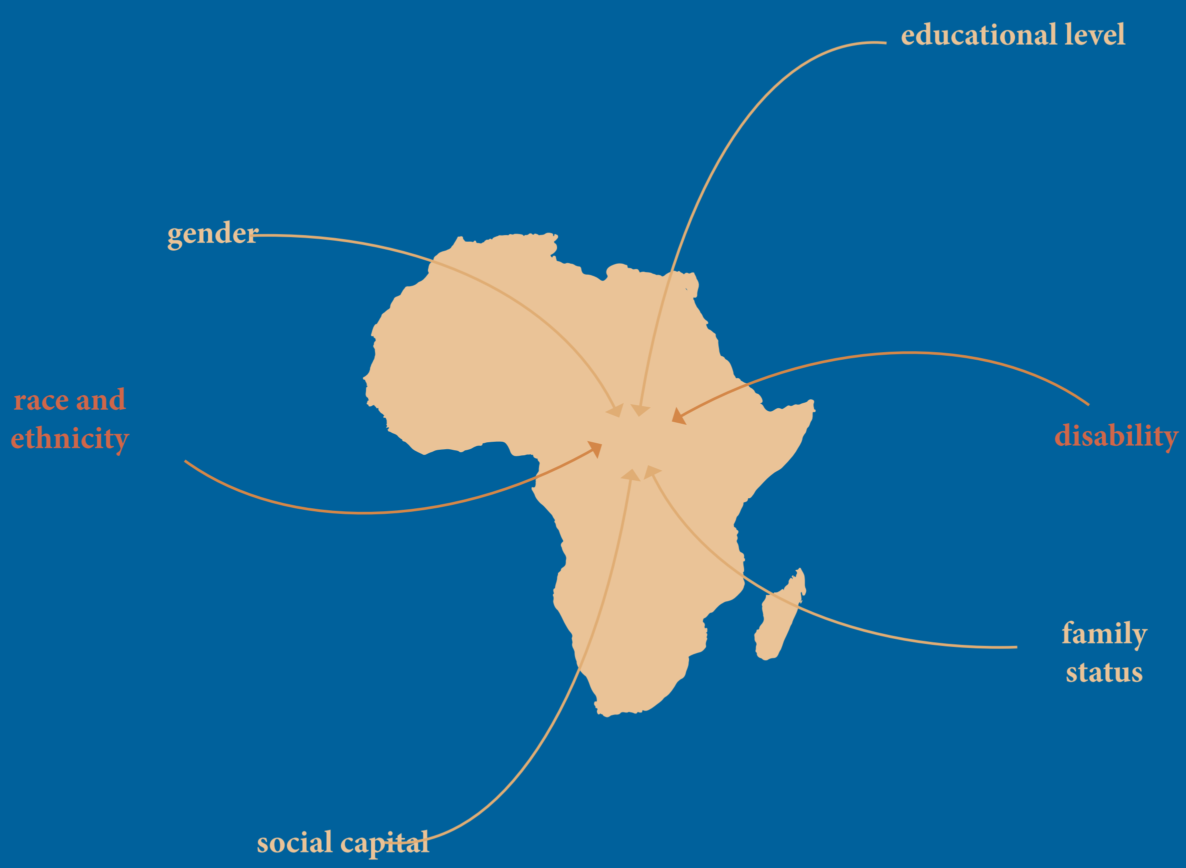
Hsin-Chou Yang, Abdeslam Badre, Abidemi Akindele, and Fridah Kanana Erastus



# 8 Inequities in research

*"You know there's always discrimination in terms of gender also and in terms of race… We would like to have everybody being evaluated based on merit."*
**Agnes, Female, 38, South Africa, Southern Region, Applied Sciences, Academia, PhD**

*"Inequality in science is actually a big thing. And it's quite difficult to identify and pinpoint."*
**Stanford, Male, 33, Oceania (from Uganda), Outside Africa, Life Sciences, Academia, PhD**

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ECR(s) | Early-career researcher(s) |
| HE | Higher education |
| LGBTIQ+ | Lesbian, gay, bisexual, trans, intersex, queer and plus |
| PhD | Doctor of Philosophy |
| RI | Research institution |
| USA | United States of America |

## 8.1 Introduction

In this chapter, we consider the differences in experiences of ECRs with reference to particular personal and social identities or characteristics. Our primary focus is on inequality grounded in gender, race, ethnic or religious grounds. We include inequality manifested face-to-face, as well as in institutional or governmental policies (systemic). Our focus will be on the following research questions:

(1) Which personal identity factors (such as race, gender, religion and sexuality) favour the suffering of inequality or harassment? What effect(s) does inequality have on ECRs' careers?
(2) What mechanisms enable inequality between people? What experiences do ECRs have with inequality driven by practices or policies at the institutional or governmental level?
(3) What factors in ECRs' personal lives are significantly different for men and women?

Whilst the focus lies on these questions, we keep the discussion of the underlying questions of this study in view:

(1) What are the opportunities and challenges that ECRs in Africa face in pursuing a career in research?
(2) Do these differ by region, discipline, employment sector, highest qualification, gender, or academy membership?

Finally, we conclude with some recommendations to address the face-to-face and systemic forms of inequality, inequity and harassment experienced by ECRs in research-orientated careers, whether from (or living in) Africa.

## 8.2 Literature review

Personal or social characteristics of scientists and scholars should not have an effect on how their work is accepted or rejected (Merton 1973), but previous research on career success in higher education (HE) has demonstrated that gender, race/ethnicity, parental background and disabilities have an effect on the chances of succeeding in academia. Success or failure of an academic career need not depend on a single characteristic, but may be the result of an interplay of multiple factors, accumulating advantages or disadvantages leading to different results (e.g. van Balen et al. 2012; Waaijer et al. 2016).

### 8.2.1 Gender

Differences between female and male scientists and scholars has received much attention in research and policy, and previous research has identified a broad range of factors with differences between genders. A major factor of impact on the propensity of women leaving HE more often than their male peers are marriage and childbirth (Goulden, Mason and Frasch 2011) and how men and women relate to it: while men in academia tend to see it as something that will eventually happen, women anticipate the challenges of pursuing a career in science differently and more intensely see the need to fit it into their lives (van Anders 2004; Waaijer et al. 2016). Auriol, Misu and Freeman (2013) have found higher rates of part-time contracts for female Doctors of Philosophy (PhD) than male PhD in most of the Organisation for Economic Co-operation and Development countries included in their study on careers of doctorate holders, but findings from a different study in the Association of Southeast Asian Nations including Indonesia, Malaysia, Singapore and Thailand do not confirm significantly higher rates of part-time employment for female researchers (Geffers et al. 2017). Lower salaries for female PhD holders in the U.S. have been reported by Webber and González Canché (2018). Female researchers seem to have less experiences with international mobility than their male peers (IDEA Consult, WIFO and Technopolis 2017; Boring et al. 2015), but Boring et al. (2015) note that this gender gap may be closing. Previous investigation on international research collaborations has also identified a gender gap, with female scientists or scholars being less likely to be involved in these kinds of collaborations (Abramo, D'Angelo and Murgia 2013; IDEA Consult et al. 2017; Kwiek 2018). Further research on gender differences in research collaborations indicates that women in science seem to experience more collaboration in their early career but face difficulties in establishing collegial, egalitarian collaborations at advanced stages of their career (Sonnert and Holton 1996). A recent study from Brazil reports that female researchers show a higher propensity for egalitarian compositions of gender in research collaborations while men are more likely to collaborate with other men (Araújo et al. 2017). In a recent study on career challenges experienced by African scientists, the general expectation that women face more or severe barriers than men are not supported (Prozesky and Mouton 2019; Beaudry, Mouton and Prozesky 2018). Some challenges were even more often reported by male researchers than by women and there are regional differences to be observed, with career challenges for women more often being reported from Northern African countries (ibid.).

### 8.2.2 Race and ethnicity

Studies on the academic performance of minorities defined by race, ethnicity or colour of skin in the United States of America (USA) have covered topics such as racial experience in the faculty-student relationship and how it has an impact on doctoral student degree completion and success (Felder, Stevenson and Gasman 2014), different salaries between the (white) majority and minorities (Webber and González Canché 2018), and included an inquiry into the reasons for discrimination such as skin tone bias (Abiola 2017). In a study on ethnic diversity in public universities in Kenya, an over-representation of certain ethnic groups has been identified (Kisaka, Jansen and Hofman 2019). In Kenya, according to the National Integration and Cohesion Act and The Constitution of Kenya, the authors claim that no public establishment should have more than one in three of its employees from the same ethnic community. Based on their findings, Kisaka, Jansen and Hofman (2019) recommend a shift from a predominantly legal approach to a planned increase in representativeness and diversity and an affirmative approach, identifying under-represented groups and implementing programmes to support these groups.

Recent studies from South Africa explore variants of discrimination both against non-nationals as well as between different ethnic groups in Africa. Lee (2017) investigates neo-nationalism in HE in South Africa, exploring the complex interplay of race and nationalism, pointing out that black Africans – in particular those from Zimbabwe or Nigeria – felt unwelcome from black South Africans once they were identified as "not local", whereas those preferred whites or those from other continents to their fellow Africans. The negative experiences of foreign academic staff in South Africa reported in the study of Sehoole et al. (2019) such as difficulties obtaining work permits or difficulties with upward mobility may be reflective of these tendencies. Race or self-declared ethnicity and gender also continue to be an issue in academic promotions in South Africa, where white men are still predominant in senior academic ranks (Sadiq et al. 2019). The study of Sadiq et al. (2019) analysed time to promotion as a proxy for fairness. No differences between female and male academics were found, but international staff in junior positions with higher qualifications and in certain faculties seems to have experienced quicker promotion time, and some differences between different groups of self-declared ethnicity were found, but these were not consistent.

### 8.2.3 Disability

Research on academic or research careers for people with disabilities is scarce. Williams and Mavin (2015) report on the experience of impairment effects of academics with disabilities and how they shape career choices and opportunities. Accounts of academics they interviewed for their study tell of different practices and experiences such as narrowing down the choice of academic work that seems feasible in light of increased fatigue, the need to explain frequent shifts from one field of research to another due to illness, reducing travels or the feeling of frustration when trying to meet normative levels of output. Booksh and Madsen (2018) report that people with disabilities account for only about 2 % of Science, Technology, Engineering and Mathematics doctorates in the USA, citing practical issues such as securing suitable accommodation and societal factors such as an inherently negative descriptor for disability and a solo- or token-status among others as barriers to pursuing a research career.

### 8.2.4 Social capital/educational level and professional status of parents

In their study on determinants of success in scientific careers, Jungbauer-Gans and Gross (2013) sampled scholars from the fields of law, mathematics and sociology and found different results for the impact of the social origin of the respondents. Significant impact of either the occupational prestige (measured as the highest occupational position of the parents with respect to social prestige) or years of education were found in the fields of law and mathematics. Yet, in the field of sociology, where a larger share of persons tends to have a lower socioeconomic background, social origin did not result to be influential.

## 8.3 Results

There are at least two important elements to cover in the discussion of inequity and harassment: first, the personal or identity characteristic(s) that form the subject of the event, such as gender, race, and religion (refer to section 8.3.1). Second, the mechanisms by which the inequity and/or harassment are manifested: we focus on differentials in "power" between ECRs and their supervisors or superiors, as well as inequity that is embedded into institutional practice or policy (refer section 8.3.2). While discussing both these elements, we explore the effect that they have on ECRs' careers, specifically in terms of their productivity (represented by numbers of articles published). As inequity between females and males is an issue in science globally and childbearing is often central tothese discussions, we also explore the differences in the career paths of female and male respondents that have children (see section 8.3.3).

### 8.3.1 Personal identity factors that drive inequality

We asked respondents whether they had experienced a number of forms of inequality that stem from personal identity factors to understand the magnitude of inequality along particular dimensions. We present the results in Figure 8.1 for the whole sample population and by gender to provide a sense of to what extent the results vary between female and male respondents.

**Gender**

More female (18.5 %, n=88) than male respondents (8.6 %, n=44) reported that inequality based on gender had negatively impacted their careers. Furthermore, referring to Figure 8.1, a higher share of male respondents (78.5 %, n=402) compared to females (55.0 %, n=262) felt they had either been *minimally* impacted or *not* negatively impacted by gender-based inequality at all. Overall, female respondents were more likely than male respondents ($\beta$=1.005, $P<0.0001$) to report having experienced the negative effect on their career of inequality based on gender. Furthermore, we found a negative association between respondents having experienced gender-based inequality and the number of articles respondents published in the three years preceding the survey ($\beta$= -0.064, $P$=0.0457). The nature of the negative impact of gender inequity on respondents is difficult to capture, however, for a number of female interviewees described situations in which they were treated differently because of their gender:

> *"And usually because you're a female you are always given responsibilities which are considered female roles. For instance, if you're put on the committee and you are the only woman – which is something I get all the time – [then] once we get into the first meeting they all look at you and say, "You should take the minutes because you are a female"… Or for instance in my faculty [there is] a coffee room for the lecturers…And guess who is responsible for running that coffee room? Me."*
> **Tanya, Female, 33, Ghana, Western Region, Health Sciences or Medicine, Academia, PhD**

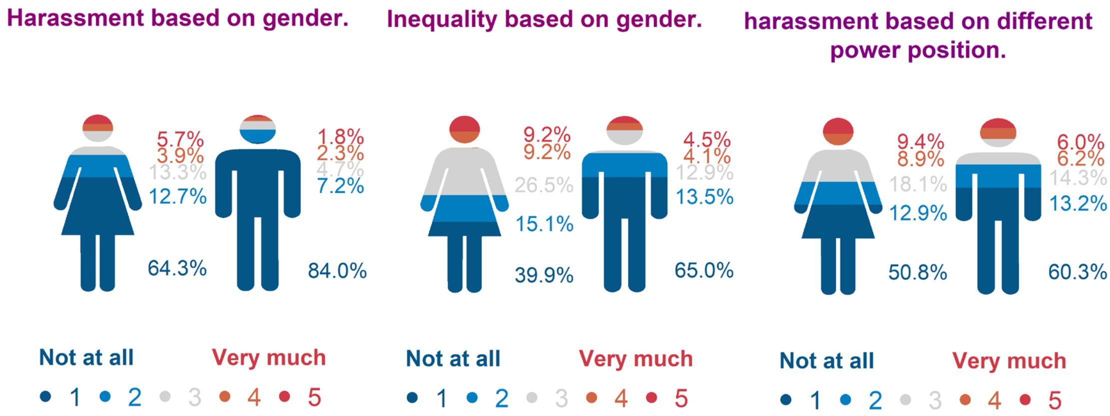



*Figure 8.1 – Negative effect to respondents of gender-based inequality, gender-based harassment and harassment based on different positions of power, stratified by gender*
*Source: Authors.*

The experience described by Tanya might reasonably be considered harassment rather than inequity. Indeed, to accommodate the possible difference in understanding of inequity and harassment among respondents, we also asked them about various experiences of harassment. Again, we found more female than male respondents reporting the impact of gender-based harassment and harassment based on different positions of power having a negative impact on their careers (see Figure 8.2). Overall, 9.6 % [n=44] of females compared to 4.1 % [n=21] of males

s($\beta$=1.316, P<0.0001) reported that harassment based on gender had negatively impacted their careers. Whilst 18.3 % of female and 12.2 % of male respondents perceived a negative career impact of harassment based on different power positions (P=0.0001). Fiona's experience demonstrates the breadth of pressure and expectation gender-based harassment can cause people at a personal level:

> *"I had been in a laboratory where I felt that my boss expected more from me in terms of sleeping with him…I'm a very independent and strong-willed person and I believe in my abilities. I don't believe that I need to have a sexual relationship with a professor just so that I can succeed. I have a lot of belief in my capabilities…I have amazing female mentors and they've really helped me catapult my career. But the presumption is the moment a man is involved, it is because you're having an affair with them. That misconception is common. And that's a major setback for a woman."*
> **Fiona, Female, 41, Kenya, Eastern Region, Life Sciences, Academia, PhD**

It is clear in Fiona's experience that her own self-belief and that of her female mentors are important to her resilience. Considering the challenge female respondents had with gender-based inequality and harassment, we turn now to reflect briefly on what forms of support women may have in the workplace and their community. The three results presented below are also discussed under the theme of mentorship and support in Chapter 9.

In the professional setting, similar proportions of females and males reported having role models of the same gender they look up to for inspiration (66.2 % [n=331] and 67.0 % [n=358], respectively), though a higher proportion of females than males reported not having one (18.4 % [n=92] compared to 9.6 % [n=51]).

In the familial and community setting, females were more likely than males (β=0.521, P=0.0006) to feel that their family supports their career choices (85.3 % [n=430] and 78.3 % [n=422], respectively).[32] While, similar proportions of females and males report that their community values qualified women in the workforce (68.7 % [n=343] and 64.4 % [n=338], respectively). Similar proportions also disagree (8.2 % [n=41] of females compared to 9.9 % [n=52] of males).

### Race and ethnicity

Over one-fifth of the respondents (21.1 %, n=213) reported that inequality based on race and/or ethnicity had negatively affected their careers, including similar proportions of females and males. Inequity based on race/ethnicity has the greatest perceived negative impact on careers for those born in the Southern region or living in the Southern region or outside Africa (Figure 8.2).

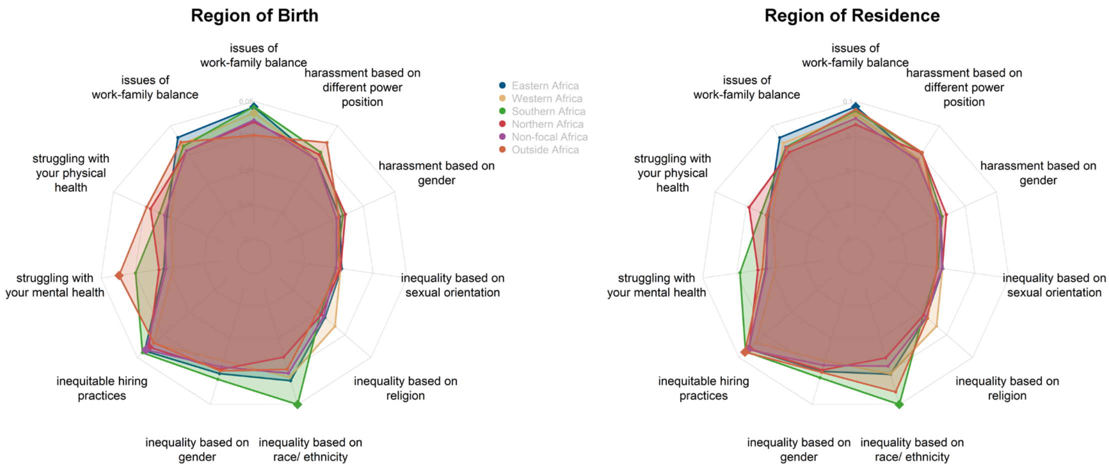



*Figure 8.2 – Perceived negative effect on careers of respondents due to factors relating to inequities, harassment, health and work-life balance, stratified by region of birth and residence*

Furthermore, we found a negative association between respondents having experienced this form of inequality and the number of articles respondents published in the three years preceding the survey (β=-0.065, P=0.0434). Refer to section 8.3.2 of this chapter for further discussion of how respondents' experiences with this form of inequality connect to publication and hiring practices. Daniel, Benjamin and Stanford demonstrate the breadth of pressure racial and/or ethnic inequality (and harassment) can cause people at a personal level:

> *"When you're in an environment where you were not born, you're expected to work harder more than the people [around] you, they just expect you to perform at a higher level. And that's expected anywhere, whether it's Juba, whether it's the US, whether it's Sweden, wherever, because…everybody is looking at you, they want to know how come this person came to this place, what is special about him?"*
> **Daniel, Male, 48, North America (from Uganda), Outside Africa, Applied Sciences, Academia, PhD**

32 This effect is measured on the basis of where respondents were born.

*"I try to avoid going to conferences because of that. It's kind of common, like when you're an African and there is an assumption that we are not good enough. Before you say anything people assume that you're not smart enough, you're not good enough…So it's kind of very common. One of the worst incidences that I had was a guy my boss invited from the US for dinner. He came just to visit our lab to see what we were doing. He asked me where I came from, I told him from Zimbabwe and then he whispered to my boss, "You know that you need to use these people. They're hard workers, they work like horses."*
**Benjamin, Male, 33, Asia (from Zimbabwe), Outside Africa, Physical Sciences, Academia, PhD**

*"They have a preconception that an African wouldn't be as competent as other people. When you do a good job, [then] you have to do it 100 times to prove yourself [and] to have the same equivalency but that affects your productivity…You can't do things and then you end up spending a lot of time in an emotional struggle to do relatively simpler tasks. I also experienced verbal insults because you know you're from Africa…So, that creates a very terrible working environment and isolates a person."*
**Stanford, Male, 33, Oceania (from Uganda), Outside Africa, Life Sciences, Academia, PhD**

For more on Daniel, Benjamin and Stanford's stories and others like them, refer to our publication: "Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective" (McAlpine et al. 2020).

### Sexual orientation

A small number of respondents (4.2 %, n=41) reported that inequality based on sexual orientation had negatively affected their careers. This may seem minimal, however, it is potentially misleading to discuss this form of inequality in the context of the whole sample; for the purpose of discussion only, we suggest that it is reasonable to expect that (mostly) only people who identify as one of lesbian, gay, bisexual, transsexual, intersex, queer or something other than heterosexual (i.e., as Lesbian, Gay, Bisexual, Trans, Intersex, Queer and plus (LGBTIQ+)) are likely to have experienced this form of inequality. However, survey respondents were not asked about their sexual orientation, so it is not possible to form a clear picture of the magnitude of this issue. Still for discussion purposes only, let us first assume that no more than 10 percent of the survey population does identify as one of LGBTIQ+ and only those who identify as such reported this form of inequality. This would then imply that around 35 % of LGBTIQ+ respondents had experienced inequality because of their sexual orientation. This indicates how pronounced the issue may be in the absence of a survey question allowing us to determine this definitively.

### Religion

A limited number of respondents (7 %, n=70) reported that inequality based on religion had negatively affected their careers. A large majority (83.7 %, n=835) felt it had had little or no impact, though survey respondents were not asked about their religious alignment, as such this may be unduly diluted by respondents who are not religious. Emily demonstrates one form inequality based on religion can take:

*"It happens at the beginning of your [working] relationship, everything happens [then] but afterwards they respect you. They found that you're not the terrorist which the media says about you. You're not a terrorist, [but] a good person and actually sometimes I feel pity for them because the media is sending these messages all the time, messages about Muslims, about feminism, about communism, and they're confused."*
**Emily, Female, 37, Europe (from Egypt), Outside Africa, Physical Sciences, PhD**

### Respondents with disability

Finally, respondents were not asked specifically about their experience of inequality in respect to disability. However, in the interviews Timothy gave a sense of his:

> *"I'm young and some people say I look even younger than I am. Ever since I started working in the university, I have met the perception that I'm a student: [my colleagues] are like, "Oh! You teach students okay." I think that perception of me is a barrier because you have a person who already has their opinion of you before you start discussing an issue…but I'm 32, I'm old enough but I'm small bodied."*
> **Timothy, Male, 32, Zimbabwe, Southern Region, Other (Food Science and Nutrition), Academia, PhD**

*Table 8.1 – Effect on respondents of inequality based on personal and social factors*

| | Proportion of Respondents (%) | | | Frequency of Respondents (N) | | | |
|---|---|---|---|---|---|---|---|
| **Personal identity factor related to inequality[33]** | Females | Males | All | Females | Males | All | Statistical differences |
| **Gender** | 18.5 | 8.6 | 13.1 | 88 | 44 | 133 | Females more likely than males to consider gender-based inequality to have had negatively affected their careers ($\beta$=1.005, P<0.0001) |
| **Gender – has had no (or minimal) effect[34]** | 55 | 78.5 | 67.4 | 262 | 402 | 680 | |
| **Gender-based harassment** | 9.6 | 4.1 | 6.7 | 44 | 21 | 66 | Females were more likely than males ($\beta$=1.316, P<0.0001) to consider that harassment based on gender had negatively impacted their careers |
| **Gender-based harassment – has had no (or minimal) effect[35]** | 77 | 91.2 | 84.6 | 352 | 466 | 837 | |
| **Race** | 21.5 | 21 | 21.1 | 100 | 110 | 213 | - |
| **Sexual orientation** | 3.3 | 5.1 | 4.2 | 15 | 26 | 41 | - |
| **Religion** | 5.6 | 8.4 | 7 | 26 | 43 | 70 | - |

Source: Authors.

In the above discussion, we outlined the significant associations that we found between respondents reporting inequality based on gender or race and the number of articles respondents published. We present those in table 8.2 in conjunction with the associations that we determined between employed respondents' experience with inequality (of various types) and their satisfaction with their job, working hours and leave entitlements (for maternity, paternity and family leave). We determined these associations

33 By indicating 4 or 5 on a Likert-scale that ranged from "not at all" (1) to "very much" (5) for each category, unless otherwise indicated.

34 By indicating 1 or 2 on a Likert-scale that ranged from "not at all" (1) to "very much" (5).

35 By indicating 1 or 2 on a Likert-scale that ranged from "not at all" (1) to "very much" (5).

separately for those working in HE research institutions (RI) and other research-oriented organisations (such as private industry or NGO).

The clear outcome is that for respondents working in HE there is a negative association between experiencing inequality based on gender and/or race and both their job satisfaction ($P<0.0001$) and working hours ($P<0.01$). For respondents in HE and RI, we also found a negative association between experiencing inequity based on hiring practices and/or harassment based on position and both their job satisfaction ($P<0.05$) and working hours ($P<0.05$), which are discussed more thoroughly in section 8.3.2 of this chapter.

To this point we have focussed on respondents' own impressions of the effect of inequality on their careers (and the associations of this to certain employment conditions), and it is clear that gender-based inequality and harassment is a considerable concern. The analysis in the preceding discussion relies on the self-assessment of respondents, however, as these self-assessments are subjective it is important to look for signs of inequality through a more objective lens also. To do this and bring into view some of the tangible impacts of gender-based inequality, we turn to discussing the gender-based differences in aspects of respondents' careers. We found no significant differences between genders for mobility or collaboration patterns or funding received. However, we found significant differences in the rate of publication of articles, which is an important dimension to consider as it is both an indicator of how well a researcher is enabled to do research and a metric often used to assess a researcher's suitability for promotion.

Overall, male respondents were more likely than female respondents ($\beta=3.777$, $P<0.0001$) to have published articles in the three years preceding the survey. The mean number of articles ($\bar{x}$) published by male respondents was 7.3 (Q1[36]=1, Q3[37]=8) by comparison to 4 (Q1=1, Q3=5) for female (see Figure 8.3). We recognise that having children could meaningfully impact respondents' output for a number of years, and as such, respondents with children may bias this analysis. As such, we analysed respondents that do not have children only and we still found that in this group the males were more likely than females ($P=0.0390$) to have published more articles in the three years preceding the survey. In the face of these challenges, the strength and determined attitude of female respondents, with and without children, shone through consistently in the interviews, as Caroline demonstrates:

> *"I love my work, I like when I do an experiment and after being very tired with it I get good results…That is what motivates me, even if I feel that everybody is exploiting me, I don't care. I don't accept [it] but I believe…my satisfaction is my work, my experiments [and] results."*
> **Caroline, Female, 44, Tunisia, Northern Region, Applied Sciences, Public, PhD**

Nevertheless, the challenge of balancing family and professional roles is a contributing factor, and this has implications in their careers, including promotion:

> *"Sometimes when you're at work the opportunities are given to men as compared to women, irrespective of the fact that they have the same qualifications and you can even see that you're performing better than men. As a woman and also being in my productive years in terms of having kids after work you go home and you're now busy taking care of the kids. But with the guys after work the next thing they're going to do is go to the bar, they network, they make decisions there and then the next thing they're back in the office and decisions are already made. So, I have discovered that I have to work more and look for myself, because I have realised that the university actually tends to promote the males in comparison to the females."*
> **Cathrin, Female, 35, Zimbabwe, Southern Region, Applied Sciences, PhD**

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36 Refers to the first quartile.

37 Refers to the third quartile.

*Table 8.2 – Spearman coefficients and significance of association between respondents' self-report of inequality and their job satisfaction, working hours and leave employment entitlements*

| Negative effect of inequity based on: | Published Articles | Job Satisfaction | | | Working Hours | | | Leave Entitlements (maternity/paternity/family) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | HE[a] | RI[b] | Other[c] | HE[a] | RI[b] | Other[c] | HE[a] | RI[b] | Other[c] |
| **hiring practices** | -0.086** | -0.206*** | -0.260* | -0.127 | -0.204*** | -0.248* | -0.237 | -0.263*** | -0.169 | -0.137 |
| **gender** | -0.064* | -0.163*** | -0.288** | -0.044 | -0.124** | -0.087 | -0.033 | -0.063 | -0.091 | 0.032 |
| **race/ethnicity** | -0.065* | -0.162*** | -0.152 | -0.115 | -0.156*** | -0.280* | -0.163 | -0.105* | -0.113 | 0.052 |
| **religion** | 0.012 | -0.009 | -0.140 | -0.100 | -0.120** | -0.040 | -0.015 | -0.114** | -0.044 | -0.004 |
| **sexual orientation** | 0.016 | 0.036 | -0.062 | 0.061 | -0.036 | -0.012 | -0.018 | -0.049 | -0.182 | 0.024 |
| **Harassment based on:** | | | | | | | | | | |
| **gender** | -0.017 | 0.027 | -0.211 | -0.029 | -0.067 | -0.007 | 0.024 | -0.033 | -0.012 | -0.015 |
| **different power position** | 0.005 | -0.094* | -0.332** | 0.004 | -0.142*** | -0.276* | -0.182 | -0.068 | -0.133 | 0.115 |

Notes: ***P < 0.001, **P<0.01, *P<0.05
a Participants who are employed in HE.
b Participants who are employed at a RI.
c Participants who are neither employed in HE nor at a RI.
Source: Authors.

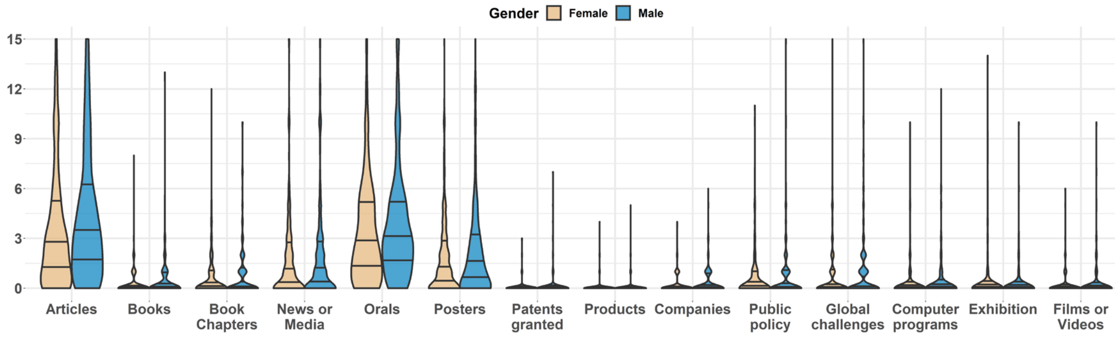


*Figure 8.3 – Productivity indicated by output in the three years prior to survey (female and male respondents)*
*Source: Authors.*

### 8.3.2 The mechanisms that enable inequality to manifest

It is clear from the preceding section that the differences in the rate of publication of articles between females and males warrants further investigation. Additional analyses may include both the flow-on effects of this difference, such as opportunities for promotion, but here we focus on the mechanisms that give rise to the differences between gender. We are limited to discussing harassment based on position of power. Though this is a form of harassment that is not exclusively experienced by female respondents, a higher proportion of females (18.3 %, n=84) than males (12.2 %, n=63) reported having been negatively affected in their careers. Overall, female respondents were more likely than males to have reported this form of harassment (β=0.595, P=0.0002). Additionally, respondents who reported having experienced this form of harassment were more likely than others to feel their workload was too high or much too high (P=0.0311).

> *"[He] would ask me to travel over 500km and when I arrived he was not willing to listen to me or to meet me, he says he's busy and all that. So, actually it used to frustrate me until a friend of mine told me, "I tell you the secret with that man. If you want to graduate, then you really have to give in otherwise you'll never graduate." Yeah, so the guy kept on harassing me: there was a time like I gave him my draft in [and] the guy stayed with the work over a year I think. Actually, that is the harassment till today I felt as a woman. I was fearing to report him to the head of department. Because if I report him you know maybe he'll lose his job, maybe now it will make even things worse."*
> **Janet, Female, 40, Kenya, Eastern Region, Humanities, Academia, PhD**

> *"They use your work but then you don't necessarily appear on the things that matter like publications. I found that a big challenge because in the end I think that counted as output that your work does not appear anywhere [on]…Pretty much nothing [I can do] because the supervisor or the boss pretty much has top authority over your next steps. So, junior staff have to choose to accommodate that sort of treatment…I wrote manuscripts and then they were given to a different person who is perceived to be Caucasian and I didn't have anywhere I could go and report my case because I'm international and doing research."*
> **Stanford, Male, 33, Oceania (from Uganda), Outside Africa, Life Sciences, Academia, PhD**

It is clear from Janet and Stanford that the harassment and inequitable practices of their supervisors have consequences for their longer-term career prospects. In connection to such prospects, we briefly pivot now toward discussing inequality related to hiring practices, as the forms of inequality discussed so far are sometimes entrenched in the policies and practices of departments, institutions, governments and the like.

A quarter of respondents (25.1 %, n=251) felt inequitable hiring practices had negatively affected their careers. A further share of 20.6 % (n=206) felt that such practices had "somewhat" affected their careers. Furthermore, we found a negative association between respondents having been subject to inequitable hiring practices and the number of articles respondents published in the three years preceding the survey ($\beta$= -0.086, P=0.0071). Inequitable hiring practices were reported by interviewees throughout Africa, though they were a particular focus for respondents in South Africa:

> *"As a black female in South Africa I don't think that is much of a challenge in terms of entering the academic institution in South Africa because that is what the call is for… Skills are transferable and everything but the major challenge that one would encounter there is pursuing research that you want to do because it's more like you are here to represent this [diversity] aspect, therefore anything else you must follow what we want you to do."*
> **Alice, Female, 34, South Africa, Southern Region, Life Sciences, Academia, PhD**

There were also a number of Zimbabwean nationals who reported difficulty getting work in South Africa on account of their origin:

> *"Just because I am of Zimbabwean origin, I cannot easily get a position. Yeah, in this country now they also say if you are black and you are South African you are good, it is even better if you are a female. A female is even better, it's an automatic entry."*
> **Ian, Male, 43, South Africa (from Zimbabwe), Southern Region, Physical Sciences, PhD**

In Alice's comments we saw the how black females in South Africa face bias and inequity despite also being considered favourably for employment, and in Ian's comments we get a hint of the attitude that possibly underpins that inequity: black females, in his view, get "automatic entry" into employment. It is conceivable how attitudes like that would undermine the merits of black females in academia in South Africa and drive the sense that they are there to "represent" diversity factors, as Alice points out.

Nevertheless, the preferential treatment of South African nationals (over Zimbabweans) was reported by interviewees in similar ways in other parts of Africa, including Kenya, Cameroon and Nigeria.

> *"At home in Kenya we have around 42 tribes. I think tribalism and nepotism thrive in Kenya… People will deny you jobs or will deny you opportunities simply because you don't come from their tribe."*
> **Jason, Male, 44, Kenya, Eastern Region, Life Sciences, Private, PhD**

> *"Cameroon has over 250 tribes, so all those things come into play. I applied for a job, and I think because of my ethnicity, I didn't get it… I was qualified but sometimes because of ethnicity and because of your tribe, your origin."*
> **Ivy, Female, 41, Cameroon, Western Region, Health Sciences or Medicine, Academia, PhD**

> *"So, I think it's normal, it's the same everywhere, things like this happen. Even back in Nigeria we apply for jobs [and] depending on where that job is located they may decide to say, "Okay, people from this region, have preference." I think it's part of every system."*
> **Dominique, Male, 36, Asia (from Nigeria), Outside Africa, Humanities, Public, PhD**

In Dominique's response, we see how normalised tribal or ethnicity-based preferencing in hiring practices has (or can) become, which points to the sinister nature of inequality that has become so widespread – it can reach a point whereby the possibly most affected people are also part of the process of reinforcing and keeping it as something considered "normal".

Finally, the process of publishing research was also identified in the interviews by a number of participants as a mechanism in which prejudices and inequality manifests:

> *"For the authors from African countries they seem to reject the papers outright without sending it for peer review. That makes it very difficult because published research is put as one of my key indicators for whether I achieve [my goals for] the year or not."*
> **Nathaniel, Male, 28, South Africa, Southern Region, Formal Sciences, Academia, PhD**

The view offered by Nathaniel here aligns with the experience of Stanford detailed in section 8.3.1, whereby he felt that people outside of Africa "*have a preconception that an African wouldn't be as competent as other people.*"

### 8.3.3 Differences in the career paths of female and male respondents

In the preceding sections of this chapter, we deliberately focused the analysis on inequality reported by respondents, as well as the potential traces of inequality between genders revealed in a key measure of a researchers' efficacy as a researcher (i.e. the number of their publications). So far then we have restricted the analysis of the impact of inequality to a time in respondents' careers when they were sufficiently qualified to be active researchers (i.e. publishing work). As discussed further in Chapter 6 of this report though, the path to becoming an active researcher presents a number of barriers as well, and so does the effort to remain in research even once an ECR has begun publishing articles. Here we shift focus to these issues, wherein we present certain significant differences found between genders, namely with respect to the intersection of respondents' longer-term career development with the birth of their children and their parent's level of education.

**The intersection of respondents' academic development with having children**

Overall, 17.2 % (n=176) of all respondents, with or without children, reported that pressures to have children had impacted their career progression, though we found no statistically significant differences between respondents grouped by gender, region, employment sector or otherwise. However, respondents with children were more likely (P=0.0123) than those without children to feel that the pressure to reproduce had negatively affected their careers.

Comparatively more males had children (58.9 %, n=350) than females (41.1 %, n=244), and males were also statistically more likely than females to have children (β=0.670, P=0.0001). However, for respondents with children we found no statistically significant difference between the number of children that female and male respondents had.

We did, however, find important differences in the age at which respondents had their children and also the age of their children. Referring to Figure 8.4, on average female respondents had their first child two years younger than males (at age 33 compared to 35). Agewise this difference may not seem considerable, however, in the context of respondents' Master and PhD education, the real-world impact of this difference emerges: to look at the path from Master's to PhD, we restricted the sample to only those respondents with both qualifications and found 23.4 % (n=26) of females had their first child *before* they completed their Master's compared to 8.0 % of males (n=13). While, 46 % (n=75) of males had their first child *after* they completed their PhD compared to 30.6 % (n=34) females. We found these differences to be statistically significant, such that females were more likely than males to have the first child prior to completing their Master's education, while males were more likely than females to wait until after they completed their PhD (P=0.0006).

Despite these differences in when female and males had children relative to their Master's and PhD completion, the average age at which respondents with children completed both qualifications were comparable (Ms: at age 30 for females and 31 for males, PhD: at age 36 for both females and males). Similarly, the average time difference between respondents with children completing their Master's and starting their PhD was similar (three years for females and two years for males).

The implication of these results for females with children is that they are also more likely than men to have children to care for young children whilst completing their Master's and PhD qualifications. The testing nature of managing children while studying, travelling and working is considerable:

> *"I miss my son very much and I couldn't bring him with me here. My mother is helping me actually, I can't deny that without her I will not do anything actually. She's caring for my son, she's helping me…She's aiding him to start his first words reading…Now it's been six months being abroad, working totally away from the family, it's not easy."*
> **Emily, Female, 37, Europe (from Egypt), Outside Africa, Physical Sciences, PhD**

The weight of the decision by respondents, especially women like Emily, to leave children behind in order to be internationally mobile gives a strong impression of the positive impact ECRs expect from international mobility; refer to Chapter 11 for a detailed discussion of international mobility. Nevertheless, there are lasting ramifications for ECRs who do make the difficult decision to leave young children behind:

> *"When my wife went to do her PhD [in Germany] my daughter was only three months, so we had to make a decision whether she goes or not. I insisted that she goes [although] other people thought that I made a mistake… but I knew that the baby would survive… Although now the problem my wife has is that the daughter doesn't like her because she treats the mother like a stranger."*
> **Jason, Male, 44, Kenya, Eastern Region, Life Sciences, Private, PhD**

Even for those females that had not chosen to travel internationally with young children, there were numerous concerns about access to childcare and other support mechanisms, such as maternity leave:

> *"It has been a very big challenge to me as a mother, with the small children and to balance between my career and taking care of the children and all that. I have had cases where I'm in class and I have left the baby in the car or I have left the baby with the soldier just for one hour because in the local town we have challenges with day-care."*
> **Janet, Female, 40, Kenya, Eastern Region, Humanities, Academia, PhD**

> *"I'm pregnant at the moment…my boss told me to wait before telling [the Director] because we don't know whether I will get my full maternity leave or if I will have to miss some things, whether I will have to cut short on it. I feel it's a little bit unfair because it's like I'm being told to choose between my career and being a mother."*
> **Clara, Female, 29, Mauritius, Southern Region, Life Sciences, Academia, PhD**

It is clear in the experiences of these females that having children before completing a Master's and PhD has serious implications for the development of their family life and career development. That male respondents were more likely than females to have children after completing both qualifications is potentially a considerable advantage, and as such warrants an explanation. In the interviews, one possibility emerged and Clara has already touched upon it above: the timing of having children may be driven by a conscious decision-making process that actively factors in career development.

*"I have a fiancé here in Nigeria and I told him I wanted a PhD before I wed. So, when I finished the PhD I had to come back because he was still waiting and that was the reason why I came back to Nigeria…So I don't want to be move, basically because I just started a family which is relatively young. So, I think it is the only reason why I think I cannot go international for now."*
**Grace, Female, 35, Nigeria, Western Region, Physical Sciences, Unemployed, PhD**

*"And I have decided to delay having children so that I can move. So, that is when the choice between my family and career crushes [and] that can be a big challenge."*
**Jacob, Male, 37, Ghana, Western Region, Health Sciences or Medicine, Academia, PhD**

Though it did not emerge in the interviews explicitly, the fact that that women are more likely than men to have children at a younger age suggests their decision-making gives meaningful weight to their age and fitness for birth, in addition to career development.

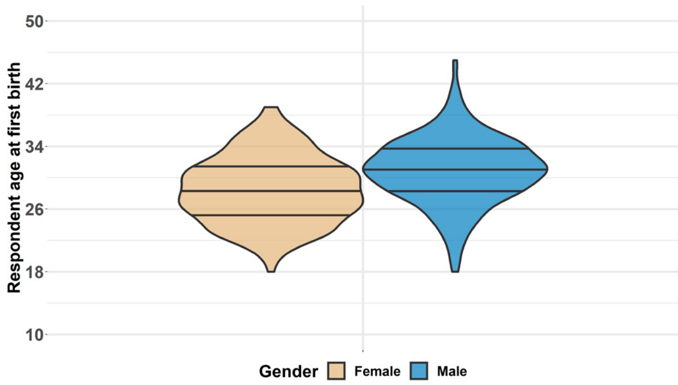


*Figure 8.4 – Respondent age at time of birth of their first child*
*Source: Authors.*

Supporting much of the preceding analysis, we found the oldest child of a female respondent was more likely to be older than that of male respondent (β=2.565, P<0.0001) – a consequence of female respondents being more likely to have had children at a younger age (as discussed above). Similarly, the youngest child of a female respondent was more likely to be older than that of a male respondent (β=2.028, P<0.0001, see Figure 8.5).

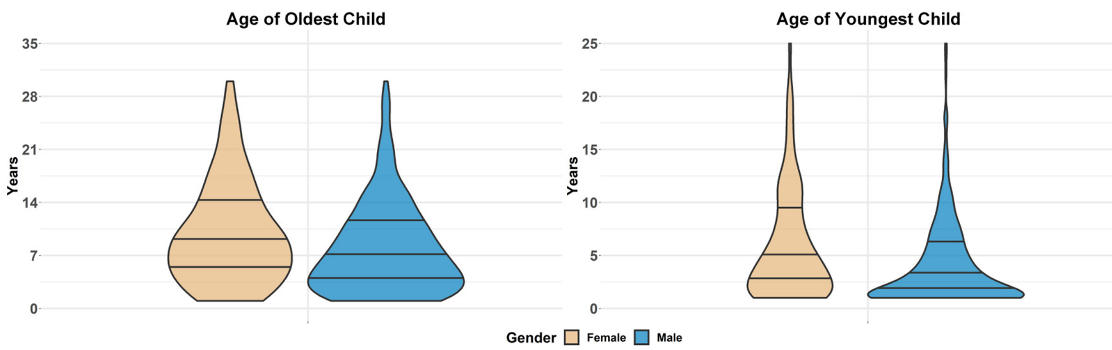


*Figure 8.5 – Age of respondents' oldest and youngest child by respondent gender*
*Source: Authors.*

### Education level of respondents' parents

We found that female respondents were more likely than male respondents (P<0.0265)[38] to have fathers with higher levels of education (PhD, Master's, Bachelor) compared to lower levels of education only (primary or no formal education). Similarly, we found that female respondents were more likely than male respondents (P<0.0111)[39] to have mothers with higher levels of education (Master's, Bachelor, Secondary) compared to lower levels of education only (primary or no formal education). Parental education is described in detail in Section 5.2.5.

## 8.4 Conclusions

Africa is home to culturally diverse societies and a multitude of social identities drawing from components such as ethnicity, culture, tradition, language, religion and nationalism, while some are of African and others of foreign origins. Institutions of HE and research organisations in Africa are both situated in these local contexts and are at the same time influenced by processes of internationalisation (Knight 2004, 2012; De Wit 2011), globalisation (Altbach, Reisberg and Rumbley 2009; Huang 2014) and regionalisation (Sehoole and de Wit 2014; Huang, Teichler and Galaz-Fontes 2014) of the scientific community. We wanted to learn how this interaction of influences plays out for ECRs in their day-to-day work experience and career opportunities.

Our research provides evidence on the different experiences and career outcomes associated with particular personal characteristics and social identities of early-career researchers (ECRs). First, we found gender to be a factor driving inequality between ECRs across a number of indicators, but we also identified factors without significant differences between female and male scientists and scholars. Female researchers compared to their male peers were significantly more likely to have experienced negative effects on their careers due to gender, as well as gender-based harassment. We also found a negative association between respondents having experienced gender-based inequality and both the job satisfaction as well as the number of articles respondents published in the three years preceding the survey. It was beyond the scope of our research to identify a causal relation between the experience of unequal treatment and productivity, which will require further exploration. Our research further indicates that men and women in academia and research tend to have their children at different ages and career stages, with women leaning toward having their children earlier than men and more frequently before finishing their Master's, while men tend to have their children later and after completing their PhD. On the other hand, we did not find significant differences between female and male researchers for international mobility, collaboration patterns or funding received. Reporting on their findings from a similar study on ECRs in Africa, Prozesky and Mouton (2019) report findings that partially match ours, but diverge on some of our findings. Based on their study, female researchers in Africa seem to be more successful in raising research funding in the Health Sciences, Social Sciences and the Humanities, whereas their male peers were more successful in the fields of Engineering, the Natural Sciences and Agricultural Sciences. In contrast to our evidence, the authors report that the women in their study had reported lower rates of recent mobility than their male peers.

Secondly, over one in five of our respondents indicated having experienced unequal treatment based on their race and/or ethnicity, which had a negative effect on their careers. A common theme among

38 This effect is reported on the basis of where respondents were born. See tables 8.3A and 8.4A in appendices for accompanying data.

39 This effect is reported on the basis of where respondents were born. See tables 8.5A and 8.6A appendices for accompanying data.

the reflections on the unequal treatment based on racial or ethnic grounds was the preconception that Africans were not as competent as other people and would therefore need to prove themselves. We also found the same negative association between respondents having experienced unequal treatment based on race/ethnicity and job satisfaction as well the number of articles published in the three years preceding the survey. Various recent studies in Africa (Kisaka, Jansen and Hofman 2019; Lee 2017; Sehoole et al. 2019; Sadiq et al. 2019) have undertaken much more focused studies on individual countries – Kenya and South Africa – and specific aspects such as the implementation and effects of regulations on the diversity of the population in employment of staff or hiring practices of HE institutions. Lee (2017) and Sehoole et al. (2019) similarly report negative experiences of foreign academic staff from other African countries in South Africa related to their race/ethnicity or nationality.

Third, our study has explored unfair treatment and inequalities based on sexual orientation, religion, disabilities or social status (defined as highest education achievement of parents). None of these characteristics or social identities are commonly analysed as part of large-scale surveys on ECRs, and our study cannot claim to be much different as we have little to report beyond descriptive findings and incidental individual accounts that cannot claim to amount to evidence on structural facts. Yet, the study of Williams and Mavin (2015) on academics with disabilities goes beyond describing a minority in the profession of academics, and contributes to an understanding of career boundaries related to impairment effects. In light of the high expectations on ECRs to perform across a wide range of criteria, this line of research may contribute to a better understanding of career decisions, how institutions react to limitations of continual availability and flexibility, and how (disabled) academics negotiate organizing contexts to pursue their work and careers in light of different constraints.

Fourth, our study explored the mechanisms that enable inequalities, focusing on harassment based on power and inequitable hiring practices. Harassment based on power was more often reported by females (about one in six) than by males (about one in eight) and took shape in using the work of ECRs without proper acknowledgement, leaving junior academics to face the difficult choice of whether or not to bring this to the attention of the institution, knowing that their own career might be damaged in the process. Inequitable hiring practices were reported by about one in four respondents, with an additional one in five indicating that these hiring practices at least "somewhat" affected their careers. Our findings align with recent studies in South Africa by Lee (2017) and Sehoole et al. (2019) that indicate the existence of unequal treatment of Africans from other countries – Zimbabwe and Nigeria in particular. Sadiq et al. (2019) investigated promotions at a South African University. Using time to promotion as a proxy for fairness, they found no differences for gender and the differences they found for self-declared ethnicity (taken as synonymous with race) were not consistent nor significant.

There are moral arguments in favour of equality, legal frameworks to give them power, as well as more functional arguments for diversity in innovation process, and there are institutional imperatives as part of an ethos of modern science that demand careers in science be open to various talents. "The acceptance or rejection of claims entering the lists of science is not to depend on the personal or social attributes of their protagonist; his [sic!] race, nationality, religion, class, and personal qualities are as such irrelevant. (…) To restrict scientific careers on grounds other than lack of competence is to prejudice the furtherance of knowledge. Free access to scientific pursuits is a functional imperative. Expediency and morality coincide," (Merton 1973, p. 270, 272). Yet, current distributions of people from different social identities across positions in academia and research, as well as studies on career opportunities related to different demographics provide evidence that inequalities in research are still a common social reality that requires further attention.

In our study, about one in five of our respondents reported to have experienced unequal treatment related to their gender and/or their race/ethnicity that had a negative effect on their career. We also found negative associations with their job satisfaction and their scientific productivity that warrant further exploration. Sadiq et al. (2019) have taken concerns about non-proportional representation of minorities or unrepresentative demography as a starting point for their study on academic promotions at a South African research university. Based on 11 years of administrative data, these authors found no evidence for a gender-based bias and no consistent differences for self-declared ethnicity. What does that tell us? First, evidence from a case study at a single university does negate findings from a study across 14 countries, and there is good reason to take these accounts as representations of valid personal experience. Reports of female researchers, from minorities or otherwise discriminated social identities that have successfully continued their careers in academia often convey accounts of how this was achieved against opposition, barriers and hindrances. The results on a range of output indicators may not provide a clear view on the efforts that were required to achieve them.

Yet it is also gainful to explore the intersection of different approaches, for example, findings from our survey and the analysis of administrative data on promotion. Even if the experience of inequalities reported should not fully reflect the actual promotion or hiring practices, the finding of perceived discrimination is a fact by itself that warrants further attention. The difference may well be an indication that hiring and promotion processes are not perceived as transparent and fair. Studies at the national level (e.g., Kisaka, Jansen and Hofman 2019) and institutional level (e.g., Sadiq et al. 2019) are highly valuable for improving transparency and providing evidence for a bias – or a lack thereof. Whether or not the criteria for the assessment are adequate needs to be part of that ongoing debate.

Many African countries and their institutions, HE included, are in transition. Several countries have implemented legislation seeking to further the representation of the diversity of their populations in the staff of their research and HE systems. Future research will need to clarify the relation between different indicators and methods that can provide insight and evidence on the changing status quo. HE and research should not consider this only as a service to "external" demands of a society, but as an acknowledgement of the fact the extension of certified knowledge needs the best talents to contribute to this endeavour.

## 8.5 Recommendations

The recommendations have been formulated at four levels, as follows.

**Interlocutors Suggested Policies and Measures**

**Institutions and review panels**

- Designing, implementing, and controlling the transparency and application of policies on equity in the hiring, selection guidelines and application assessments should be ensured. Higher education institutions should ensure fair representation of ECR researchers by age, gender and ethnic/racial diversity.
- Members of review panels should reflect equity and diversity; documentations of submitted reviews/decisions should be ensured and validated by an institutional equity panel.

**Government body and equity council**

- Mechanisms and procedures that facilitate the anonymous reporting of inequity, discrimination and/or harassment along any dimension need to be made available and accessible in each and every institution. This may include an independent council at the institutional and/or government level with powers to investigate, moderate and ameliorate where necessary.

- Improve the provision of reasonable support for ECRs that have children, including parental leave, flexible working arrangements, peer and family support services and parental study leave for those enrolled in a Master's or PhD program.
- Professionalise postdoctoral positions as designated staff positions to increase eligibility for funding and staff benefit entitlements.
- Officialise the provision of language support services for visiting ECRs or those not fluent in the country's official language.

### Funding bodies

- Provide time-flexible funding schemes for new parents, including paid parental leave of equal length, irrespective of gender.
- Design tailored international scholarships and fellowships to provide supplemental funding provision for childcare and travel. Childcare could include travel support for an additional caregiver.
- International funders supporting international travel to include supplement funding for language course enrolment.

### Publishing institutions

- International journals should perform a blinded review evaluation to assess systematic biases in reviews based on the institution/location of the authors. Review guidelines should be revised based on the findings.
- Editors of "top-tier" publications should establish links with African institutions to ensure African researchers have equal access to editors to discuss new research findings. These links could be mediated via research offices in African institutions which could assist ECRs to draft submission cover letters.
- Publishers should regularly collaborate with local HEIs in developing and running communication workshops for African ECRs. Journal editors and funding review members should participate in the workshops to gain first-hand experience of the challenges African ECRs face in the current system.
- Continental and regional Research Councils should develop and circulate declarations of "equity in funding access" which research bodies sign up to and evaluate their equity of award against other funding bodies. The Research Councils then publish annual statistics of award recipients and the provisions within the award, including timing flexibility and family support.

These recommendations also appear as Table 8.3A in Appendix 8.7

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## 8.7 Appendix

*Table 8.3A – Remove inequities of institutions and government bodies*

| Remove inequities in the policies and practices of institutions and governments bodies | |
|---|---|
| **Interlocutors** | **Suggested Policies and Measures** |
| **Institutions and review panels** | ▪ Designing, implementing, and controlling the transparency and application of policies on equity in the hiring, selection guidelines and application assessments should be ensured. higher education institutions should ensure fair representation of ECR researchers by age, gender and ethnic/racial diversity.<br>▪ Members of review panels should reflect equity and diversity; documentations of submitted reviews/decisions should be ensured and validated by an institutional equity panel. |
| **Government body and equity council** | ▪ Mechanisms and procedures that facilitate the anonymous reporting of inequity, discrimination and/or harassment along any dimension need to be made available and accessible in each and every institution. This may include an independent council at the institutional and/or government level with powers to investigate, moderate and ameliorate where necessary.<br>▪ Improve the provision of reasonable support for ECRs that have children, including parental leave, flexible working arrangements, peer and family support services and parental study leave for those enrolled in a Master's or PhD program.<br>▪ Professionalise postdoctoral positions as designated staff positions to increase eligibility for funding and staff benefit entitlements.<br>▪ Officialise the provision of language support services for visiting ECRs or those not fluent in the country's official language. |
| **Funding bodies** | ▪ Provide time-flexible funding schemes for new parents, including paid parental leave of equal length, irrespective of gender.<br>▪ Design tailored international scholarships and fellowships to provide supplemental funding provision for childcare and travel. Childcare could include travel support for an additional caregiver.<br>▪ International funders supporting international travel to include supplement funding for language course enrolment. |
| **Publishing institutions** | ▪ International journals should perform a blinded review evaluation to assess systematic biases in reviews based on the institution/location of the authors. Review guidelines should be revised based on the findings.<br>▪ Editors of "top-tier" publications should establish links with African institutions to ensure African researchers have equal access to editors to discuss new research findings. These links could be mediated via research offices in African institutions which could assist ECRs to draft submission cover letters. |

*Table 8.3A – Continued*

| | |
|---|---|
| **Publishing institutions** | ▪ Publishers should regularly collaborate with local HEIs in developing and running communication workshops for African ECRs.Journal editors and funding review members should participate in the workshops to gain first-hand experience of the challenges African ECRs face in the current system.<br>▪ Continental and regional Research Councils should develop and circulate declarations of “equity in funding access” which research bodies sign up to and evaluate their equity of award against other funding bodies. The Research Councils then publish annual statistics of award recipients and the provisions within the award, including timing flexibility and family support. |

Source: Authors.

*Table 8.4A – Educational attainment of respondents’ fathers (proportions calculated for females and males separately)*

| | PhD or doctorate | Master’s degree | Bachelor’s degree | Non-academic post-secondary education | Secondary education | Primary education | No formal education | Total fraction of gender sample (%) |
|---|---|---|---|---|---|---|---|---|
| **% of Females** | 9.0 | 16.4 | 23.9 | 11.7 | 18.2 | 10.9 | 7.1 | 97.2 |
| **% of Males** | 5.9 | 11.6 | 15.9 | 11.4 | 16.6 | 18.8 | 15.4 | 95.6 |

Source: Authors.

*Table 8.5A – Respondents’ fathers level of education for females compared to males*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| No formal education | Bachelor’s degree | Born | 1.171 | 0.0001 |
| Primary education | Bachelor’s degree | Born | 0.985 | 0.0003 |
| No formal education | Master’s degree | Born | 1.126 | 0.0008 |
| Primary education | Master’s degree | Born | 0.940 | 0.0036 |
| No formal education | PhD degree | Born | 1.049 | 0.0265 |

Source: Authors.

*Table 8.6A – Educational attainment of respondents' mothers (proportions calculated for females and males separately, minor categories omitted)*

| | PhD or doctorate | Master's degree | Bachelor's degree | Non-academic post-secondary education | Secondary education | Primary education | No formal education | Total fraction of gender sample (%) |
|---|---|---|---|---|---|---|---|---|
| **% of Females** | 3.1 | 9.9 | 24.0 | 14.3 | 23.2 | 13.2 | 10.3 | 97.9 |
| **% of Males** | 2.0 | 4.7 | 13.5 | 10.0 | 18.2 | 21.6 | 25.5 | 95.5 |

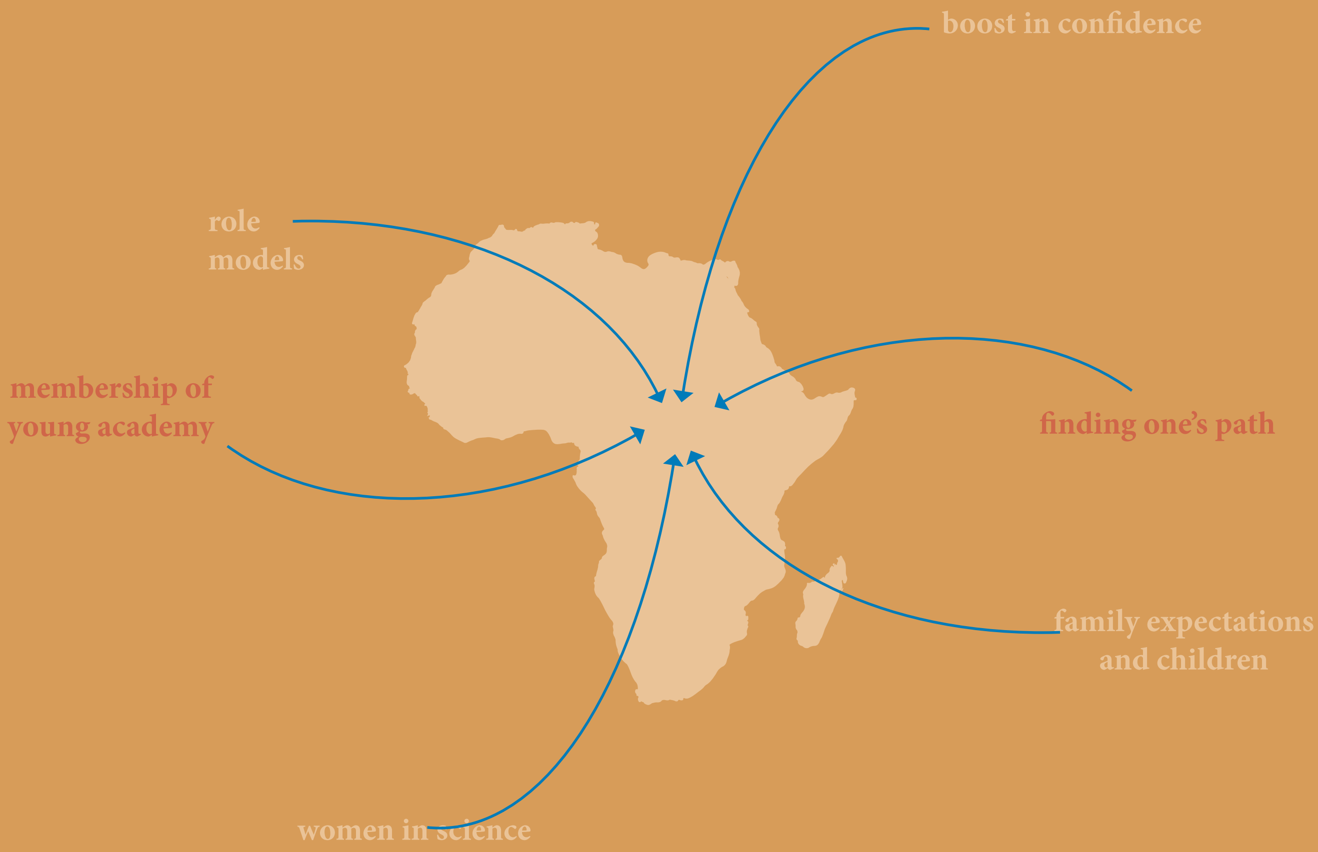
Source: Authors.

*Table 8.7A – Respondents' mothers' level of education for females compared to males*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| No formal education | Bachelor's degree | Born | 1.496 | <0.0001 |
| Primary education | Bachelor's degree | Born | 1.118 | 0.0001 |
| No formal education | Master's degree | Born | 1.655 | 0.0001 |
| Primary education | Master's degree | Born | 1.277 | 0.0031 |
| No formal education | Secondary education | Born | 1.199 | 0.0001 |
| Primary education | Secondary education | Born | 0.821 | 0.0111 |

Source: Authors.

Fridah Kanana Erastus, Johannes Geffers, Matt Keane, Yin-Chun Lin, Hsin-Chou Yang, Abdeslam Badre, Abidemi Akindele, Mona Koury, and Anna K Coussens



# 9 Mentorship and support

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| ECR(s) | Early-career researcher(s) |
| GloSYS | Global State of Young Scientists |
| HE | Higher education |
| PhD | Doctor of Philosophy |
| STEM | Science, technology, engineering and mathematics |

## 9.1 Introduction

In this chapter, we explore the role of mentorship and support in the careers of our ECR respondents. This includes what is available to ECRs in their capacity as a professional, or even as a Doctor of Philosophy (PhD) candidate. This may include formal (or informal) relationships with a supervisor or other colleagues, training, and professional networking opportunities. We also include in our discussion the "softer" or more informal social support structures, such as family, role models, community, and broader social values. We do this because of the intrinsic connection between the realms of one's professional and personal life, as the results themselves reveal.

We explore whether our respondents feel well-supported, and if they feel that mentoring is important to their career progression. Where it is possible, we include the respondents' impressions of the different types of mentorship and support discussed above. In doing this, we address the following questions:

(1) Are mentors available? Are these mentors sufficiently trained to mentor?
(2) What types of mentorship have had the most impact on their career progression?
(3) How does mentorship affect the career progression of ECRs, with respect to funding accessibility, training and employment opportunities, and general career progression?
(4) Do ECRs see themselves as mentors? Do they feel like they receive sufficient training to be good mentors?

Whilst we present information regarding these questions, we keep the discussion of the underlying questions of this study in view:

(1) What are the opportunities and challenges that ECRs in Africa face in pursuing a career in research?
(2) Do these differ by region, discipline, employment sector, highest qualification, gender or academy membership?

Finally, we conclude by making some recommendations on how mentorship and support can be better leveraged to improve career progression for our ECR respondents from (or living in) Africa.

## 9.2 Literature review

The introduction of mentoring programmes in higher education (HE) during the last decades has been fuelled by different factors such as an increased need for professional development of the faculty in light of a growing emphasis on research quality and output (Browning, Thompson and Dawson, 2014), the requirement to improve low completion rates and time to degree in graduate education (Main 2014), and to support women and minorities in realizing their potentials (Gibson 2004; Girves, Zepeda and Gwathmey 2005; Gardiner et al. 2007; Mayer et al. 2008; Patton 2009; Bower 2012; Kalpaziduo Schmidt and Faber 2016; Yun, Baldi and Sorcinelli 2016).

Definitions of the term mentor commonly delineate mentors as senior persons with more experience providing career and psychosocial support to a lesser experienced and usually younger person ("mentee" or "protégé") (Kram 1983, 1985; Haggard et al. 2011). The two broad categories of career support (including aspects such as sponsorship, exposure and provision of visibility as well as the assignment of challenging tasks) and psychosocial support (comprising functions such as counselling, friendship, acceptance and confirmation) are commonly considered central features of the mentoring relationship as identified by Haggard et al. (2011) in their review of literature on mentoring. Jacobi (1991), in a previous literature review, ascertained role modelling as a third core function of mentors distinct from psychosocial support and discusses informal mentoring and formal mentoring programmes. Kram (1983) identified four different phases of the mentor relationship – initiation, cultivation, separation and redefinition – each characterised by specific affective experiences, functions during the course of development and patterns of interaction, evolving in an interplay of individual needs and organisational contexts. Haggard et al. (2011) further discuss key characteristics included in the definitions such as a mentor's place within the organisational hierarchy, supervisory vs nonsupervisory mentor, inside vs outside mentor, and the level of intimacy between mentor and mentee. Related to these additional characteristics of mentors are additional functions, persons or provisions often found in the context of structured PhD programmes such as co-supervising, peer advising, counselling services or extra-curricular activities (Lindén, Ohlin and Brodin 2013). Further, Lindén, Ohlin and Brodin (2013) point to the difference between mentoring and advising, relating the more personal, pastoral or intimate relations to mentoring and identifying advising as more concerned with issues of research tasks.

Lechuga (2014) reflects on the influence of disciplinary backgrounds as contexts and frameworks for individual perceptions and interpretations of mentoring in Science, Technology, Engineering and Mathematics (STEM) fields. Though all participants of this study viewed mentoring as something favourable or helpful, many of the aspects of mentoring that are commonly described as positive in the social sciences and would be expected by mentees (e.g. provision of social and psychological support, stimulating knowledge, enhancement of teaching and grant-writing skills) are often considered intrusive by faculty in STEM, potentially detrimental to the aim of becoming an independent, autonomous and "innovative" researcher that does not rely on advice from senior researchers. The mentoring process, Lechuga (2014) concludes, needs to be approached as a process embedded in the wider process of socialisation into a discipline, with distinct perceptions of autonomy and contexts that allow faculty to feel appreciated, capable and efficacious. In a similar focus on on-the-job socialisation of faculty and informally learned, crucial advice on pursuing a research-oriented career, Hermanowicz (2006) identifies primarily moral, rather than intellectual characteristics as most important attributes for success in the field of physics. In this study, Hermanowicz (2006) asked physicists in an open question "What does it take to be successful?" The single most important individual quality identified by the respondents was "persistence" followed with less than half the number of mentions by "smart", "civil", "creative", "entrepreneurial" and "aggressive" (ibid., p. 139). The high importance attributed to the personal quality "persistence" is interpreted as crucial for a successful career in science, as scientists encounter rejection and failures throughout their careers (e.g., in peer-review processes of papers or grant proposals and while conducting experimental or theoretical work). Looking at the whole picture of qualities identified as necessary for a success in science, Hermanowicz (2006) notes that most of these qualities "are largely unteachable through formal means of instruction" (ibid., p. 149) and need to be acquired through interaction with seniors in their fields (ibid., p. 150).

A common topic of literature reviewed throughout the last decades is the diagnosis that mentoring in empirical studies is commonly not clearly conceptualised and a vast range of definitions co-exist, severely limiting the possibilities to ascertain the prevalence or the precise impact of mentoring relationships (Merriam 1983; Jacobi 1991; Allen et al. 2004; Ehrich, Hansford and Tennent 2004; Crisp and Cruz 2009; Haggard et al. 2011; Boeren et al. 2015).

Assessments of the prevalence of mentoring in empirical studies follow two main approaches (Haggard et al. 2011): In some studies, people are asked whether or not they "have a mentor" and may be provided with a particular definition, whereas in other studies participants are offered multiple-item batteries with a diverse set of "mentoring functions" that the respondents may or may not have received. Haggard et al. (2011) note that these different approaches seem to provide varying measures of effects and the second approach may not be able to ascertain whether or not the support received for a particular aspect or function was part of a developmental relationship that would otherwise qualify as "mentoring".

In a study on the benefits young tenured professors in the Netherlands receive from having a mentor, 69 % of the participants reported to have a mentor (van der Weijden et al. 2015). In their study on ECRs in Africa, Beaudry, Mouton and Prozesky (2018) report the prevalence of mentoring received for particular aspects or tasks related to a scientific career. The authors report that mentoring was more directly related to the research process rather than advice on career-related decisions (ibid., p. 90). Percentages of early-career researchers (ECRs) reporting that they never or rarely received mentoring on particular aspects show a wide range from "research methodology" (22 %), "scientific writing" (27 %), "presenting research results" (31 %) and "introduction to research networks" (49 %) to "attaining a position/job" (63 %), "career decisions" (63 %) and "fundraising" (65 %) (ibid.). Roughly three of four respondents indicated that the lack of advice and mentoring resulted in negative consequences for their career (ibid., p. 97). In the Global State of Young Scientists (GloSYS) Association of Southeast Asian Nations (ASEAN) study (Geffers et al. 2017, p. 60), respondents rated mentoring or support with gaining funding (89 %, including answering options "important" and "very important"), the introduction to relevant professional networks (88 %) and skill training focused on methodology (80 %) as the most important aspects of mentoring or support. Findings from the interviews of the GloSYS ASEAN study confirm the importance of advice on how to apply for funding or being introduced to important networks (ibid., p. 80).

Hindrances to the participation in mentoring programmes reported in the literature are manifold. They-comprise aspects such as limitations of time (both on the side of the mentor as well as the mentee), the notion that mentoring should happen spontaneously, that potential mentors feel unsure of their knowledge on how to mentor, the feeling of involving oneself in a context that is more based on networking and favouritism rather than individual merit, and personality mismatches or concerns of sexual harassment in mentoring relationships including men and women (Ehrich, Hansford and Tennent 2004; Girves, Zepeda and Gwathmey 2005). The issue of mentor-protégé-fit and the pairing process have been subject to research (Baker, Pifer and Griffin 2014; Bell and Treleaven 2011), touching issues such as different types of identities (professional, relational and personal), the importance of choice in the matching process for both mentor and mentee, feelings of "awkwardness" experienced by mentees when they felt they needed "to sell themselves" to mentors, as well as options to facilitate and support the pairing. Another hindrance to participation in mentoring relates to the availability of mentors. In her study on mentoring experiences among African American women, Patton (2009) highlights the fact that finding an African-American mentor who could relate well to the experiences of the protégé and had a deeper understanding of the challenges of underrepresented groups in academia is a difficult task in itself. In the studies on ECRs in Africa (Beaudry, Mouton and Prozesky 2018) and ECRs in ASEAN (Geffers et al. 2017) participants indicated that they were perceiving a insufficiently experienced mentors who failed to provide the support they were looking for.

Research on the impact of mentoring generally indicates positive effects of mentoring on a wide range of work and career related effects (Crisp and Cruz 2009; Allen et al. 2004). In a study on starting group leaders, respondents with a mentor reported a more positive perception of their work environment and were more successful in obtaining personal career grants than those respondents who did not have a mentor (van der Weijden et al. 2015). An increase in scientific productivity, usually measured in published papers, is frequently reported (Steiner et al. 2004; Gardiner et al. 2007; Kamler 2008; Bell and Treleaven 2011; Bennett et al. 2013; Browning, Thompson and Dawson 2014). Kalpaziduo Schmidt and Faber (2016) indicate that mentees in their study reported to have become more focused on their career related goals and gained access to important networks due to the support of their mentors. In the same study, mentors reported benefits such as personal satisfaction, and HE institutions profited from an improvement of the research environment as well as better relations between different generations of scientists and scholars (ibid.). Multiple benefits to protégés, mentors and institutions of HE have also been identified in the literature review by Girves et al. (2005). In addition to the outcomes of mentoring relationships mentioned above, Girves et al. (2005) report benefits for mentors such as a feedback on their ideas and work, a network of mentees across different institutions as potential collaborators, and opportunities for the placement of students. Kirchmeyer (2005) analyses whether career success (measured in terms of academic rank and salary) was primarily a result of increased performance due to the mentoring received (performance perspective) or the increased knowledge of the academic environment and the aptitude to navigate the networks (political perspective). The findings of the study indicated stronger evidence for the political perspective. Negative mentoring experiences are less commonly reported and include distancing behaviour from the mentor or a lack of mentor expertise (Eby et al. 2004). Findings from the mentor's perspective have been described on a continuum from dysfunctional relationship experiences (e.g. malevolent deception, sabotage, harassment) over ineffective relationship experiences (e.g. spoiling, benign deception, submissiveness) to marginally effective relationship experiences, including aspects such as performances below expectations or an unwillingness to learn (Eby and McManus 2004; Eby et al. 2008).

## 9.3 Results – Mentorship and support

We feel it is important to get a comprehensive overview of the role of mentorship and support in the careers of our ECR respondents. To do this, we asked respondents about their access to various types of mentorship and support – including institutional, social, formal and informal forms (refer to section 9.3.1). We also asked about the importance of selective elements of support to their career progression (refer to section 9.3.2), and in contrast, the impact of a lack of certain elements as well (refer to section 9.3.3). Finally, we asked respondents about their patterns of mentoring others, and their impression of their capacity to do so effectively (refer to Section 9.3.4).

### 9.3.1 Availability and effectiveness of mentors

The respondents who consider themselves to be researchers (n=1,081) were asked about patterns of mentorship: 76.5 % (n=827) indicated that they have mentors in their professional life, while 23.5 % (n=254) did not. The results varied by region (see Figure 9.1): at the higher end, 86.2 % (n=287) of respondents born in the Western were more likely to report having mentors, compared to 63.2 % (n=48) born in the Northern, 67.9 % born in the Southern and 64.1 % (n=25) born outside of Africa (P≤0.0469).

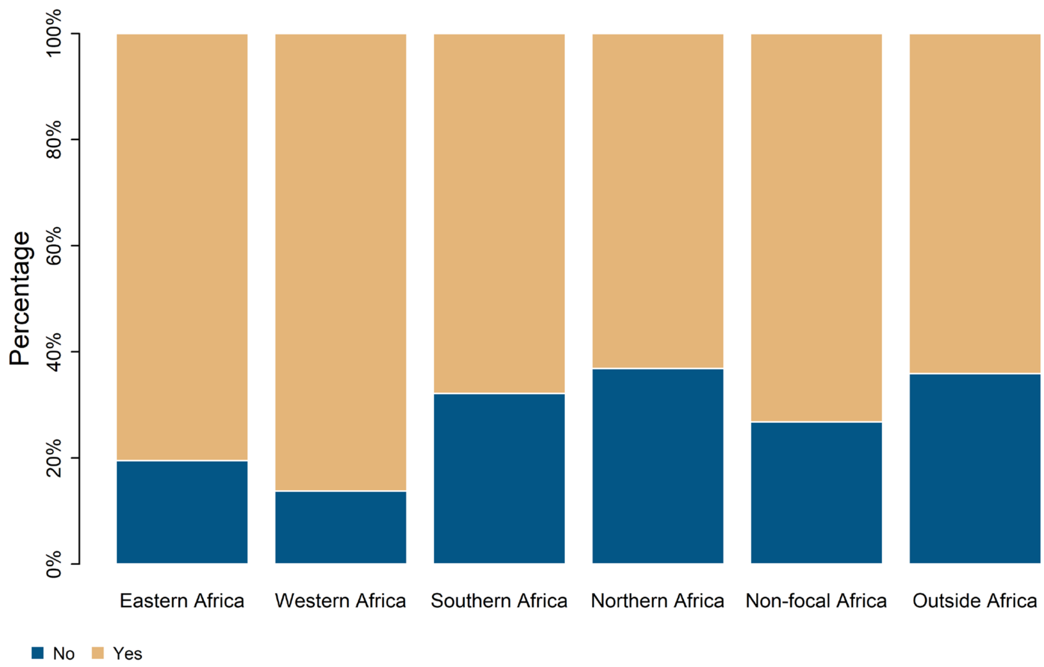



*Figure 9.1 – ECR respondents with mentors, by region born*
*Source: Authors.*

Of those that reported having mentors, 93.5 % (n=765) indicated that their mentors have the required skills to do so, meaning 70.7 % of all respondents in research have a mentor that they consider as adequately skilled to fulfil this role. We found no statistically significant differences in the respondents' perception of their mentor's skill for mentoring them effectively; however, this level of satisfaction with availability and quality of mentorship contrasts mildly with the general dissatisfaction reported in the interviews. As we proceed through the analysis in this chapter, that contrast will become apparent, and we offer some reasons for the difference.

One such reason may be that respondents to the survey applied a rather loose definition of "mentorship" when they answered the questions about availability and skills of their mentor. They may have had in mind their institutional superior(s), such as supervisors or formal mentors, as we would expect. The review of the literature revealed the co-existence of various definitions of mentorship that would loosely agree on a few core functions or criteria to distinguish a mentor or mentorship from other sources of support or training. This may well be reflected in the responses to our survey. Nonetheless, the responses may also include other forms of "mentorship", such as social and familial structures – things we do not consider as mentorship per se, but forms of "support" in this study.

To that end, we turn now to discussing other factors akin to support – institutional, social, familial or otherwise – that are available for our respondents. To be holistic in this discussion, we include in this section social attitudes that may meaningfully shape (or pressure) respondents decision-making with respect to their career. We asked respondents (1,022≤ n ≤1,075) to rate numerous possible contributors on a five-point scale, and the results are presented in Figure 9.2 (below). We provide further discussion and the statistically significant results of each in turn.

## General support

The majority of the respondents *agreed* or *strongly agreed* that they had support structures, such as family (81.7 %, n=872), and supervisors and other colleagues (67 %, n=714) that support their career. Female respondents were more likely than males (β=0.521, P=0.0006) to feel that they have family support for their career choices (85.3 % [n=430] of females and 78.3 % [n=422] of males ).[40] No statistically significant differences in responses were found with respect to support from supervisors and other colleagues. For further discussion of the experience of ECRs of different genders, including of their family life and support, please refer to Chapter 8.

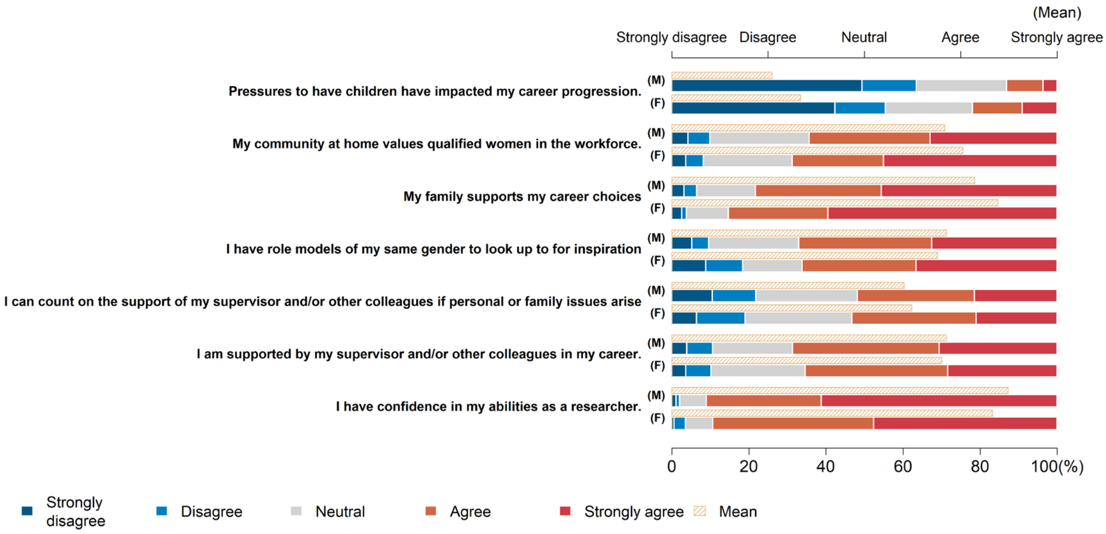



*Figure 9.2 – Perceived experience of mentorship and support structures which impact careers, stratified by female (F) and male (M) respondents*
*Source: Authors.*

## Support for family issues

Referring again to figure 9.2, a slight majority (52.5 %, n=559) *agreed* or *strongly agreed* they could count on their supervisor, colleagues, or both, if family issues arise. In contrast, 20.6 % (n=220) *disagreed* or *strongly disagreed* to this, and 26.9 % (n=286) were neutral. Respondents born outside of Africa were more likely (P≤0.0304) than those born in the Northern (β=1.686) or Eastern (β=1.173) regions to feel supported in the same way. Additionally, respondents living in the non-focal (β=1.272) or Southern (β=1.270) regions were more likely (P≤0.0034) than those living in the Northern region to feel supported by their supervisor and (or) colleagues with respect to family-related issues. This was also observed for respondents living in the Southern region by comparison to the Eastern (β=0.671, P=0.0219).

40 This effect is measured on the basis of where respondents were born.

There were no statistically significant differences in responses with respect to gender, with 51.9 % (n=280) of males and 53.3 % (n=266) of females *agreeing* or *strongly agreeing* they had this form of support. It is interesting to consider what factors drive males requiring this form of support, and we get a sense from the interviews: females more frequently reported issues with accessing childcare and the like on campus, however, males also raised concerns about balancing their role responsibilities with their desire to be present for their family. An example of this challenge is given here by Benjamin, a researcher in the international diaspora:

> *"My supervisor told me that I waste a lot of time with my family. I told him that I don't go to the lab on weekends, that's the time I spend with my kids."*
> **Benjamin, Male, 33, Asia (from Zimbabwe), Outside Africa, Physical Sciences, Academia, PhD**

Benjamin demonstrates aptly here that support for family issues from supervisors, colleagues and the like is an issue that cuts across genders, and that supporting researchers adequately in this respect requires a multi-faceted approach – including things such as childcare facilities, and clear boundaries between work and personal time. For further discussion of gender-based analysis of these issues, refer to Chapter 8.

### Role models – same gender

66.9 % (n=709) of the respondents *agreed* or *strongly agreed* that they have role models of the same gender that they could look up to for support (refer again to figure 9.2). On this point, a further 19.1 % (n=203) were neutral, and 14 % (n=148) *disagreed* or *strongly disagreed*. We found no statistically significant differences in responses in regard to this, including by gender. Anna highlights the importance of having such a mentor for us here:

> *"I think if you have a strong professional woman to look up to that really helps a lot… having like a strong female role model [has] probably made a big difference to me staying in this position as well."*
> **Anna, Female, 37, Europe (from Zimbabwe), Outside Africa, Social Sciences, Academia, PhD**

Anna is clear that having a female role model has helped keep her in her role, which illuminates the importance of considering different types of mentorship and support – those inside and outside the workplace. To this end, we asked about social attitudes towards women participating in the workforce.

### Social attitude – women in the workforce

66.8 % (n=700) of respondents agreed or strongly agreed that their community at home supports women in the workforce. Notably, 24.1 % (n=253) were neutral on this, and 9.1 % (n=95) *disagreed* or *strongly disagreed*. We found no statistically significant differences in responses. An example of this support is given by Janet:

> *"I'm speaking as the only woman holding a PhD [from my minority ethnic group], so these people look upon me… to help solve problems, even political ones. The old men and women in the village call me and say, "Please come and help us, even draft a memorandum, please go and speak on our behalf."*
> **Janet, Female, 40, Kenya, Eastern Region, Humanities, Academia, PhD**

We see here in Janet's response that she is both supported and expected to operate in a leadership capacity by her minority ethnic group. In spite of the privilege of such expectations, the bearer carries a certain weight of responsibility.

The expectations of one's local community, or others reproduced through broader social structures can be even more personal than the example given by Janet; these may also be better understood as "pressures" rather than support, and one such that we consider here is the expectation to have children.

### Social attitude – expectation to have children

More than one-in-six of all respondents (17.2 %, n=176) *agreed* or *strongly agreed* that pressures to have children have impacted their career progression, while 22.8 % (n=233) were neutral on this, and 60 % (n=613) *disagreed* or *strongly disagreed*. We found no statistically significant differences in these responses. In the interviews we found that respondents were also subject to social expectations around marriage. This is demonstrated here by Stephen and Elizabeth:

> *"I didn't want to stay away again from my relatives and also I wanted to get married… Going without getting married, it wasn't good. So, I declined the offer [for a post-PhD researcher position in Asia]."*
> **Stephen, Male, 36, Rwanda, Eastern Region, Life Sciences, Academia, PhD**

> *"Being a girl was an obstacle for me to follow my study in the USA. After I studied in my country, the question of marriage was always a debate: "When are you going to be married? One day you'll find no one," people would say."*
> **Elizabeth, Female, 40, Morocco, Northern Region, Social Sciences, Public, PhD**

In Stephen and Elizabeth's responses, we see how social expectations can have tangible and career-defining outcomes for women and men – this goes beyond having children to include being married, which gives us a richer perspective of how social pressures affect respondents' decisions and career development. We return to Elizabeth's response again below to comment on the social attitudes that provided the background to her experience as a woman.

### Confidence as a researcher

For now, returning once more to Figure 9.2, a clear majority of respondents *strongly agreed or agreed* (54.8 % and 35.4 %, respectively, n=970/1075) that they have confidence in their abilities as a researcher. Those born in the Western (P=0.0001), Northern (P=0.0101), and non-focal (P=0.0077) regions had greater self-confidence in their abilities as a researcher than those born in the Southern region. However, this regional difference was lost when adjusting for where researchers are currently based. This may suggest that the confidence people have in their own research abilities is influenced more by their background and personal journey, than where they are currently living. What is important here is to view this result simultaneously with all those discussed above as it reveals the tenacity of respondents: they have a strong sense of belief in their individual abilities in spite of the varying degrees of support (or lack thereof) from supervisors, institutional superiors, mentors, colleagues, family and their community. The resolute attitude of respondents is captured here by Fiona:

> *"I have a lot of belief in my capabilities. You do encounter situations where bosses have certain expectations of you. And when you don't fulfil those expectations as a woman, then they sort of frustrate your effort. I have been a victim of that… But of course I managed to overcome it, but because of my strong will."*
> **Fiona, Female, 41, Kenya, Eastern Region, Life Sciences, Academia, PhD**

The steadfast attitude on display in Fiona's response was characteristic of many of the interviewees. For Fiona, the expectations of her leader that she refers to were of a sexual kind and constitute gender-based harassment and discrimination, and her attitude was characteristic of interviewees that had overcome or were experiencing any form of harassment or discrimination. Returning to Elizabeth, the prohibitive attitude that she encountered was enveloped in the values that her ethnic group holds toward women; her case provides an example of the discrimination people can experience at the intersection of different dimensions of their identities – in this case ethnicity and gender. Refer to Chapter 8 for further discussion of discrimination along various dimensions.

### Membership of young academy

Finally, membership to a young academy is another formal support structure that people may engage with for mentorship, capacity building and networking opportunities. A small percentage of the survey respondents (16.7 %, n=185) were members of a young academy.

## 9.3.2 Positive effects of mentorship to career development

The respondents actively involved in research (n=1,062) were asked to rate the importance of various types of support from senior colleagues or mentors towards their career progression (see Figure 9.3). The skills that respondents identified as *important* and *very important* for their career progression include: introduction to important networks (80.1 %, n=851), training on scientific writing (79.9 %, n=848), methodology and technical skills (78.9 %, n=837), advice on career decisions (74.4 %, n=789), and grant writing and fundraising (70.5 %, n=747). Additionally, 50.3 % (n=529) of the respondents said that it was at least important to their career development to attain a position through direct intervention of a mentor or senior colleague.

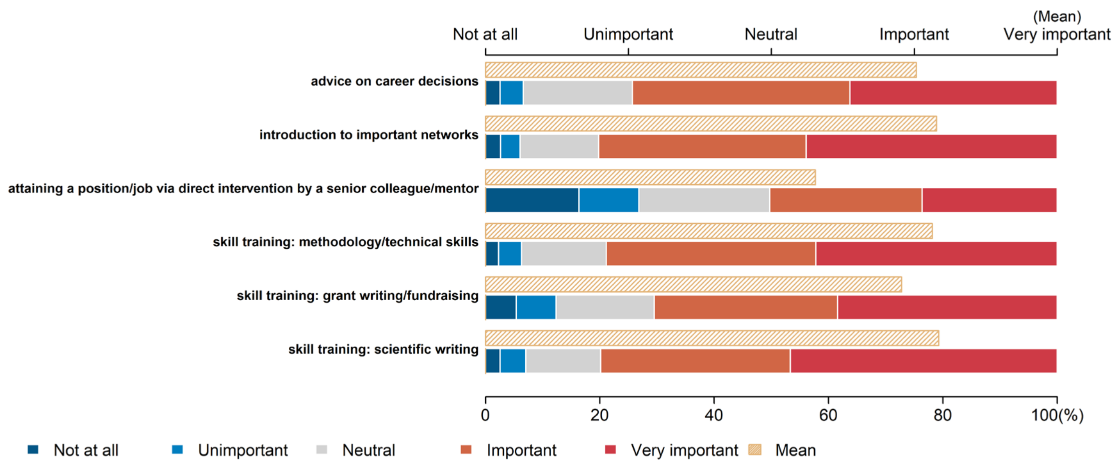



*Figure 9.3 – Importance to career progression of support from senior colleagues and mentors*
*Source: Authors.*

On the five-point scale, “scientific writing training”, “introduction to important networks”, “methodology and technical skills training”, and “advice on career decisions” were all similarly placed (refer to Table 9.1). They were also ranked as more important influences (P=0.0001) to career progression than “grant writing/fundraising” and “attaining a position through a colleague or mentor”.

*Table 9.1 – Mean values for importance to career progression of support from colleagues and mentors (five-point scale)*

| Component | Mean ($\bar{x}$) |
|---|---|
| **Skill training: scientific writing** | 4.17 |
| **Introduction to important networks** | 4.15 |
| **Skill training: methodology/technical skills** | 4.13 |
| **Advice on career decisions** | 4.01 |
| **Skill training: grant writing/fundraising** | 3.91 |
| **Attaining a position/job via direct intervention by a senior colleague/mentor** | 3.31 |

Source: Authors.

We found no statistically significant results in respect to any of the respondents' desired skills acquisition and support from mentors outlined in figure 9.3. The role supervision and mentorship can have in enabling the respondents is made clearer by those that described positive experiences in their interviews – though most often in respect to their experience in their PhD, as Sam and Kenneth demonstrate below:

> *"And even if [PhD funding] is not enough, the supervisor is well known and is able to attract extra funding that can be used by a student to do their work, so it's not a problem."*
> **Sam, Male, 37, Oceania (from Nigeria), Outside Africa, Applied Science, Academia, PhD**

> *"When I was a PhD student, I went to [Western Europe]…This has had a positive impact on my career…Thanks to my supervisor at that time…for giving me this opportunity, he shared so much information and knowledge, and I'm still working with him."*
> **Kenneth, Male, Morocco, Northern Region, Health Sciences or Medicine, Public, PhD**

It is clear in Sam and Kenneth's responses that having a supervisor who is "well known", to use Sam's words, enables access to funding (Sam) and opportunities for international mobility (Kenneth). These interviewees give us a sense then of why "introduction to important networks" is ranked the second most important form of support from colleagues and mentors. For further information on funding, and international mobility and collaboration refer to Chapters 10 and 11, respectively.

### 9.3.3 The effect of a lack of mentorship and support on career development

We asked respondents what had negatively impacted their career: we included factors related to employment, training and support, social values, health, politics, harassment, and so forth. By considering a broad range of factors, we get a better sense of what respondents consider the limiting factors to their development as ECRs. The results are presented in Figure 9.4.

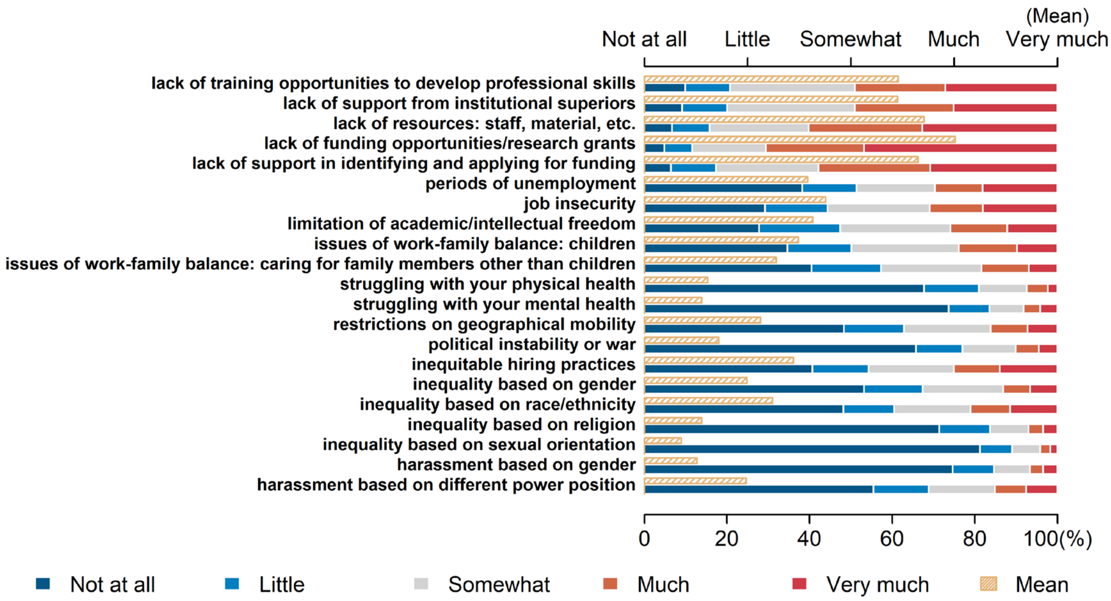



*Figure 9.4 – Negative (potential) impact of various factors on respondents' careers*
*Source: Authors.*

From the pool of respondents (945≤n≤1,081), there was clear consensus (*agree* or *strongly agree*) that a lack of funding opportunities (70.6 %, n=756) had a negative effect on respondents' development, which is discussed in detail in Chapter 10, and also Chapter 7. Secondly, 60.3 % (n=649) *agreed* or *strongly agreed* that a lack of resources (staff, material, etc.) was another factor, which is discussed in Chapter 7. We discuss here those relevant to support and mentorship, lack of support for identifying and applying for funding, lack of support from institutional supervisors and lack of opportunity for training.

#### Lack of support – identifying and applying for funding

Of all the factors considered, the respondents ranked a lack of support in identifying and applying for funding as third (57.9 %, n=624) highest negative impact to their careers (see Figure 9.5). Respondents born in non-focal Africa, or the Northern or Western regions were more likely (P≤0.0241) than those born outside of Africa to feel that a lack of support in identifying and applying for funding has negatively affected their careers (β=1.447, 1.352 and 1.312, respectively).

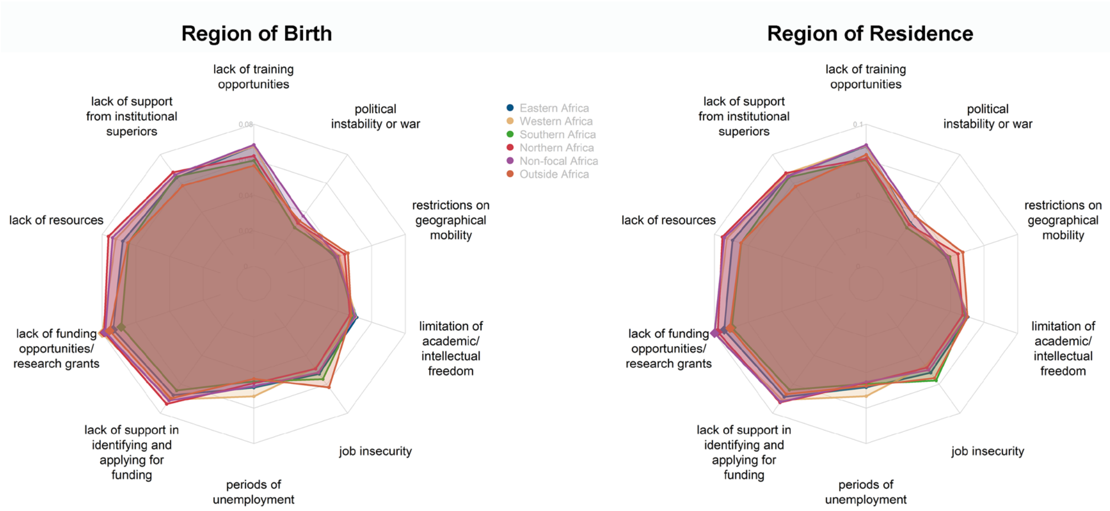



*Figure 9.5 – The degree to which work, and political factors have had a negative impact on careers, stratified by region of birth and residence*
*Source: Authors.*

Additionally, those respondents who were living in the non-focal or Western regions were more likely ($P \leq 0.0005$) than those in the Southern to feel the same ($\beta=1.030$ and 0.873, respectively).[41] The extent of this lack of support, for some respondents, is indicated here by Hunter and Moses:

> *"I was told in order to get such prestigious funding, someone has to recommend you to a host before you can be accepted. So, I tried colleagues who have been [successful before]. None of them showed up. None of them were ready to connect me to anybody. So, I kept trying, and at one point I gave up."*
> **Hunter, Male, 38, Cameroon, Western Region, Humanities, Academia, PhD**

> *"There is a conference that took place in [North America]. They required my head of department to give me a letter of recommendation [for a scholarship application]. I met him one-on-one, talked to him, sent him an email, I called him later to remind him…He never did it until the deadline went by...so I don't know what their decision will be."*
> **Moses, Male, 45, Nigeria, Western Region, Health Sciences or Medicine, Para-Public, Master**

We see in Hunter and Moses' responses that the lack of support in applying for funding can occur in spite of their own active efforts to secure such support. A breadth of people failed to honour their requests for help, including both their colleagues and their institutional leaders, whom we turn to specifically now.

### Lack of support – institutional superiors

Almost half the respondents *agreed* or *strongly agreed* that a lack of support from institutional superiors (49.1 %, n=526) had a negative effect on their careers (see Figure 9.4 and Table 9.2). Furthermore, the respondents born in the Northern, Western, non-focal and Eastern regions were more likely than respondents born outside of Africa to feel the same ($\beta=1.813$, 1.552, 1.411, and 1.324, respectively). The

41 No statistically significant results were obtained for comparisons between respondents born or living in the East and respondents born or living in any of the other regions of Africa, nor outside of Africa.

result was sustained for respondents living in the Northern or Western regions by comparison to those living outside of Africa ($P \leq 0.0250$). Finally, the result was also observed for respondents living in the Northern ($\beta = 0.993$) and Western ($\beta = 0.904$) regions compared to the Southern region ($P \leq 0.0209$).

*Table 9.2 – Negative impact on career of a lack of support from institutional superiors*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Northern Region | Outside Africa | Born | 1.813 | 0.0004 |
| Western Region | Outside Africa | Born | 1.552 | 0.0003 |
| Non-focal Africa | Outside Africa | Born | 1.411 | 0.0043 |
| Eastern Region | Outside Africa | Born | 1.324 | 0.0061 |
| Northern Region | Outside Africa | Live | 1.273 | 0.0250 |
| Western Region | Outside Africa | Live | 1.184 | 0.0034 |
| Northern Region | Southern Region | Live | 0.993 | 0.0209 |
| Western Region | Southern Region | Live | 0.904 | 0.0001 |

Source: Authors.

To expand on this, in section 9.3.1 we outlined that 70.7 % (n=765) of respondents felt they had mentors that were suitably skilled to fulfil the role. There is a disparity, it seems, between this result and the 49.1 % of respondents (n=526) that felt a lack of support from institutional superiors had negatively affected their careers. We discussed in section 9.3.1 that this may be related to respondents' interpretation of "mentorship" – in that they may include (as we do) formal supervision and institutional superiors, but also familial and social structures more naturally understood as "support" structures. Another possible contributing factor to this difference is the question of the mentor's availability: in the interviews it emerged that, irrespective of the skills of the mentor or supervisor, they were often unavailable to fill this role. This is demonstrated here by Amina:

> *"I have never heard about any PhD candidate who finished their dissertation within a period of three years… one of the reasons for this impossibility is that the supervisors are not being very helpful and I do blame them that's true, but I also understand that they have piles of other stuff to do… sometimes you have a supervisor who supervises like 30 candidates at the same time."*
> **Amina, Female, 38, Tunisia, Northern Region, Humanities, Academia, PhD**

It is also possible that respondents were satisfied with the academic supervision, though still felt relatively unsupported for navigating their professional development and career decisions beyond completing a Master's or PhD qualification, as Amos points to:

> *"While I think supervisors concentrate most of their time on the PhD as the product. They hardly concentrate on these other [skills], like how to prepare for an interview, how to write an application for a job, it's taken for granted. She was just a brilliant supervisor in terms of supervising, [but] she never asked me after submitting my thesis, "what are you plans after your PhD?"*
> **Amos, Male, 39, Northern Europe (from Zimbabwe), Outside Africa, Social Sciences, Academia, PhD**

For others, the lack of support from institutional superiors was more critical, as Hunter and Moses demonstrated above in describing their attempts to secure support for funding applications. This absence of support can relate to the simple fact that there are a limited number of senior academics to fill this role, as Nathaniel and Cleopas demonstrate below:

> *"In South Africa currently, there are only four full professors in my discipline. And I think South Africa has 23 universities. So there is really a lack of mentorship and people with experience that are willing to share ideas and to show what works and what doesn't, including with teaching, research and community engagement. It is a very big problem and especially for someone like me, I'm an emerging researcher and it's a big problem to have a complete lack of senior support."*
> **Nathaniel, Male, 28, South Africa, Southern Region, Formal Sciences, Academia, PhD**

> *"We need senior lecturers, we need professors, to help us, to show us the way we normally research. I was expecting to form teams with senior lecturers, professors and then move in their footsteps. [To] see what they do and try to imitate them… for the time being this is not the case."*
> **Cleopas, Male, 38, Rwanda, Eastern Region, Social Sciences, Academia, Master**

In light of Amina's, Amos' and Cleopas's insights, it might be that for some respondents their supervisors and mentor(s) are skilled, but their availability – or even willingness – to fulfil that role is limited. This may help explain some of the disparity in the results of regarding the availability and skills of a mentor, and the sense that a lack of support from institutional superiors had negatively affected respondents' careers.

Another dimension to this institutional support emerged in the interviews, whereby the availability of a mentor or institutional superior can be both beneficial and problematic, as Fiona describes below, and Bernard adds to:

> *"Mentoring plays a significant and major role in terms of growth in a research career… Because it is your mentors who guide you, who direct you in the right places, who show you the best research grant to apply for, who stimulate you into developing ideas. I feel it is actually impossible to grow in research if you do not have a proper mentor… What you find is that certain mentors end up wanting to crowd you out. They feel that you're their junior. And so, if you have research ideas, they tend to take those ideas and own them, and so they suppress your growth… They should propel you into higher heights. But you do encounter a few who just want to take advantage of you."*
> **Fiona, Female, 41, Kenya, Eastern Region, Life Sciences, Academia, PhD**

> *"I have access to him because we work together. Every day we have meetings, we talk, we share something… That's why it's too difficult here, we haven't got independence… We haven't got the freedom for taking some decision, the supervisor takes the last decision."*
> **Bernard, Male, 42, Senegal, Western Region, Physical Sciences, Academia, PhD**

Fiona reiterates the importance of mentoring and support from institutional superiors in general. Her and Bernard also reveal a less visible dimension to mentoring and support that indicates the imbalance in power or influence can limit the academic freedoms of respondents, and even lead to unfair (perhaps even exploitative) circumstances. To read their stories in full, refer to our publication: "Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective" (McAlpine et al. 2020).

### Lack of training opportunities to develop professional skills

Finally, referring to Figure 9.4 once more, almost half of the respondents also *agreed* or *strongly agreed* that a lack of training opportunities to develop professional skills (49 %, n=530) negatively affected their careers. To put this firmly into context, in Chapter 6, we highlighted that having the "opportunity for continuous learning and training" was the most common motivating factor for entering a research career (92.6 %, n=1,009) for respondents. It is clear that – for just under half of our ECR respondents – their expectations of a research career are not being met, at least in this sense.

The respondents living in the Southern region were *less likely* ($P \leq 0.0001$) than those in the non-focal, Western, and Eastern regions to consider they had been negatively affected by a lack of training opportunities for professional skills development ($\beta=1.373$, 1. 361, and 1.080, respectively, see table 9.3). This difference is substantiated by the interviewees who regularly regarded South Africa (not all countries in the South region) as being better suited for conducting research and securing a high-quality education, as is demonstrated here by Timothy who moved to there to do his PhD:

> *"Going to South Africa [for my PhD] helped me a lot in my career. I think I learned a lot, [and it] was the first time I could present in a conference, and I presented quite a number of conferences, in South Africa you are able to apply for a quite a number of funding [opportunities]… South Africa helped me get mentors in [my] field… they helped me to see what I could do with my skills, and how far I can go. Which I think if I was in Zimbabwe I probably wouldn't have learned some of those things."*
> **Timothy, Male, 32, Zimbabwe, Southern Region, Other (Food Science and Nutrition), Academia, PhD**

The difference in access to mentorship, training and funding that Timothy speaks to here is also discussed in Chapter 6 with respect to PhD completion times. There we make the point, and reiterate it here, that the result pertains specifically to South Africa – and does not reflect the beliefs of interviewees regarding other countries in the Southern region of this study (Mauritius, Mozambique and Zimbabwe). Further to this result, respondents born outside of Africa were *less likely* ($P \leq 0.0287$) than those born in the Western, non-focal, Eastern and Northern regions to feel that they have been negatively affected by a lack of training opportunities ($\beta=1.833$, 1.728, 1.632, and 1.332, respectively).

### Insufficient training during Master's degree in certain regions

Investigating career-inhibitory factors which differ between respondents with a Master's vs PhD as their highest degree, Master's holders indicated that a lack of training opportunities to develop professional skills had a significantly greater negative impact on their career success than PhD holders indicated. This was significant when adjusting for differences between regions where respondents were born or currently living ($P \leq 0.0009$). However, the difference was lost when adjusting for where respondents completed their Master's ($P=0.2317$). This indicates that the limited professional skills training experienced by Master's holders is associated with where they completed their Master's degree. As such, when adjusting the same analysis by highest degree, we found that a lack of professional training had the greatest negative impact on those who completed their Master's in Eastern, Western, and non-focal African countries compared to those who completed their Master's in the Southern region, or outside of Africa ($P \leq 0.0001$).

*Table 9.3 – Negative impact on career of a lack of training opportunities to develop professional skills*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Western Region | Outside Africa | Born | 1.833 | 0.0001 |
| Non-focal Africa | Outside Africa | Born | 1.728 | 0.0002 |
| Eastern Region | Outside Africa | Born | 1.632 | 0.0002 |
| Northern Region | Outside Africa | Born | 1.332 | 0.0287 |
| Non-focal Africa | Southern Region | Live | 1.373 | 0.0001 |
| Western Region | Southern Region | Live | 1.361 | 0.0001 |
| Eastern Region | Southern Region | Live | 1.080 | 0.0001 |

Note: See also Table 8.4A in appendices.
Source: Authors.

Across the pool of factors respondents rated as having had a negative impact on their careers, we considered three in detail in this chapter, those being lack of support identifying and applying for funding, lack of support from institutional superiors and lack of training opportunities to develop professional skills. In each of these, we found that respondents born in the Northern, West or non-focal regions were more likely to feel that these had negatively affected their careers compared to people born outside of Africa (see Figure 9.5 and Tables 9.2 and 9.3). This was also true for the East region, though only with respect to the latter two factors (a lack of support from institutional superiors and training opportunities). This indicates that across a range of factors, respondents born outside of Africa were more likely to feel supported than those in the Northern, Western, and non-focal regions – and the East, to a lesser degree. Though Sylvia is the only one of our interviewees who was born outside of Africa, she personifies this sense of feeling supported:

> *"I don't need a mentor, I [only] need to confirm with experienced [researchers that] I am going in the right direction. Otherwise I can easily lead a project without mentoring. I do have support, I have always had any support that I need."*
> **Sylvia, Female, South Africa (born in Middle Eastern), Southern Region, Life Sciences, Academia, PhD**

Though Sylvia corroborates the observation about respondents being born outside of Africa feeling (generally) more supported than those born in the Northern, Western, non-focal and Eastern regions, it is not possible to draw conclusions about causality at this stage. However, throughout this report we discuss a number of elements that may be significant contributors.A deeper analysis of individual's educational development by location, which exceeds the scope of the present study, is a necessary first step in understanding the root of this difference.

### 9.3.4 Respondents as mentors

In Chapter 6, we highlighted that 79.5 % (n=867) of respondents considered the opportunity to train the next generation of students as a motivating factor in pursuing a research-orientated career. The importance to respondents of having this opportunity was reflected in the manner that it was consistently raised by interviewees as important to their own satisfaction in their role, as demonstrated here by Christine and Tanya:

*"I have this passion to give the younger generation hope as well… Actually encourage the younger generation, let's keep on trying to see what we can do with the little equipment we have, we improvise with the little instrument and of course the right facilities. So it's the ability to encourage the younger ones that's actually keeping me [from] just giv[ing] up hope."*
**Christine, Female, 40, Nigeria, Western Region, Physical Sciences, Academia, PhD**

*"I like to identify those students that have an interest in academia and help them to find their way. So one thing I do which I take a lot of pride in, is I try to find students internships in research labs outside the country."*
**Tanya, Female, 33, Ghana, Western Region, Health Sciences or Medicine, Academia, PhD**

Christine and Tanya illuminate the significance to many of training the next generation of scientists, and for Christine, how this interacts with the shortage of infrastructure – for research and otherwise – that many interviewees faced. See Chapter 7 for further discussion of access to infrastructure for respondents.

Here we explore their role as mentors further; collectively, 80.2 % (n=864) of the respondents considered themselves mentors, while 19.8 % (n=213) did not. However, over one in every five (20.5 %, n=174) of the respondents who are mentors consider themselves inadequately skilled to be so. Respondents with PhDs were more likely than those with a Master's as their highest qualification to consider themselves as being a mentor (β=0.747, P=0.0014).

The results also varied by region (Figure 9.6): at the higher end, 100 % (n=58) of respondents born in the Northern and 90 % (n=27) of those born outside of Africa reported being mentors and having the skills to do so effectively. While at the lower end, 65.5 % (n=123) of respondents born in the Eastern region reported the same.

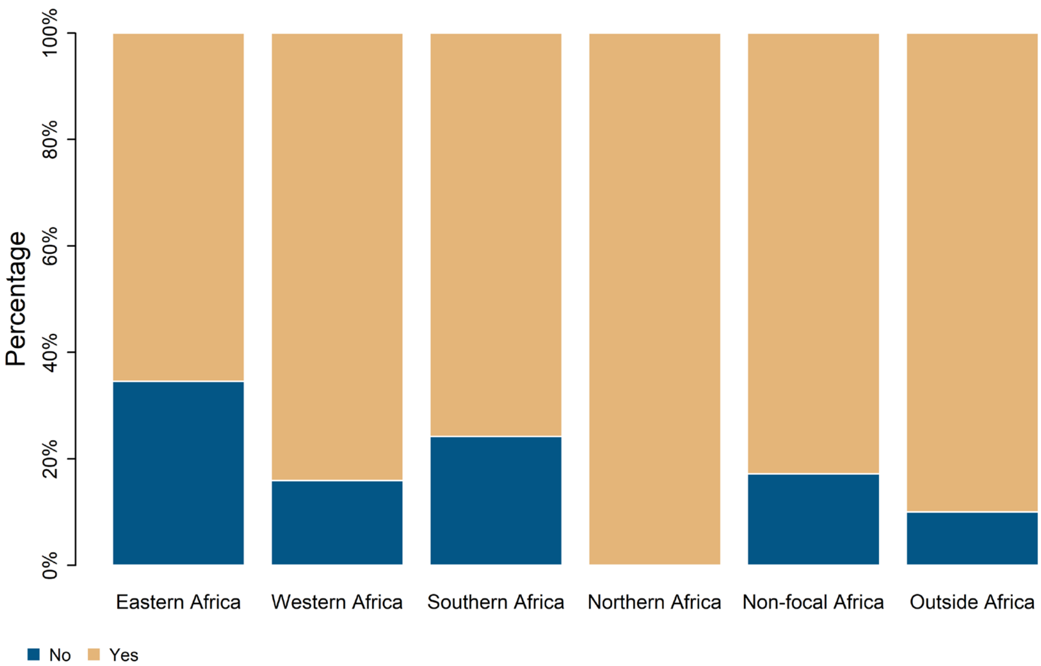



*Figure 9.6 – ECR respondents that are mentors and believe they are effectively skilled, by region they were born*
*Source: Authors.*

In respect to these regional results, respondents born in the Eastern region were more likely ($P \leq 0.0482$) than those born in the Southern ($\beta=1.110$) or non-focal regions ($\beta=1.061$) to consider themselves as being a mentor. This was also observed for respondents born in the Western region by comparison to the Southern (0.975, $P=0.0152$).

## 9.4 Conclusions

The HE and research sectors are at times characterised as an environment dominated by challenges and rejections (Hermanowicz 2006). Previous research and our findings have shown that a broad range of support both in the professional area of research and academic work are needed for them to thrive. Our review of the literature has revealed the complexity of different functions and forms of support – from the more pastoral, intimate or personal relations identified with a mentor, to the more functional, research-oriented provisions of the supervisor or advisor, as well as other forms of assistance such as co-supervising, peer advising, counselling services or extra-curricular activities. Our study cannot and did not aim to provide an in-depth analysis of the underlying concepts or various forms of mentoring and support. Our aim was a more general, rough assessment of the availability of different forms and functions of support, their quality and impact on the careers of ECRs, as well to ascertain how the ECRs gauge their role as the future supervisors and mentors of the next generation of students and researchers.

First, our analysis on the availability of qualified mentors for ECRs reveals a complex setting. A clear majority of 76.5 % of the respondents indicated that they have a mentor in their professional life, a figure that is well within the range of those 69 % of respondents in a study on young tenured professors in The Netherlands who reported having a mentor (van der Weijden et al. 2015). Further, almost all (93.5 %) of our respondents were satisfied with the skills they perceived in those mentors. Yet, these rather positive findings are in contrast to a reported lack of support from institutional superiors, a lack of support when applying for funding, and a picture emerging from our interviews, namely that the mentors were often unavailable to fill the role that ECRs expected. This interpretation would be supported by the findings of Beaudry, Mouton and Prozesky (2018) reporting "an absence of experienced staff who are able to act as mentors or role-models, or a disinclination of available (often overburdened) senior staff to do so in an encouraging manor," (Beaudry, Mouton and Prozesky 2018, p. 102). The situation will require further investigation at the national level, possibly starting with an analysis of administrative data on the relation of senior and junior scholars or surveys on senior faculty and their allocation of time for supervision and mentoring.

Second, our findings provide insight on the availability of various other sources of support both in the private and the professional realm. The results reveal a very high level of support that our respondents receive from their families and in their communities. This support for ECRs, in particular from their families, should not be taken for granted. A research-oriented career is a highly demanding career, time-consuming and often coupled with the expectation to be mobile (McAlpine 2012). It is not within the limits of our research to ascertain whether or not the high level of support from the families is a precondition for a successful career in academia, at least for all those scientists and scholars not giving up on having a family. Within the professional sphere, superiors and other colleagues are generally perceived as a source of support for their career. To a markedly lesser extent, our respondents would expect support from their superiors or colleagues if personal or family issues arise. This finding emphasises the importance of the unwavering support the ECRs receive from their families and communities, without whom they would probably not be able to pursue their work and career in this highly competitive field. Another finding of our study is the importance of having a role model of the same gender that may be available for support, a factor that has been shown to have a positive impact on academic work and careers (Patton 2009).

Third, our findings from both the survey and interviews on the relevance of different aspects of mentoring and training align with the dimensions of psychosocial support and career guidance primarily attributed to the role of a mentor and the more research and technical skills that are commonly related with the role of a supervisor or advisor. Approximately four out of five respondents considered the introduction to important networks, guidance on scientific writing and methodological skills as (very) important. Orientation on career decisions and fundraising were considered only slightly less important, with approximately seven out of 10 respondents marking these aspects as relevant. As noted above, the importance attributed to these skills or factors does not directly translate into support received from mentors, supervisors, superiors or other services of the institution. The lack of support to acquire funding, the lack of support from institutional superiors and insufficient opportunities for the training of professional skills reported earlier delineates the tension between the importance attributed to a factor and the actual assistance received.

Fourth, the vast majority (79.5 %) of the ECRs responding to our survey do not only see themselves in a receiving role, but consider the opportunity to train the next generation of students and researchers as a motivation for pursuing a research-oriented career, and many of them are passionate about this task. However, one in every five of those in a mentoring role report that they would benefit from further training and experience to adequately fill the role of a mentor.

Our research has been successful in providing a rough assessment of the state of mentorship and other forms of support for ECRs in Africa. The review of the literature as well as the empirical findings reported highlight the need for future research. First of all, questions remain related to the concepts of mentorship, the roles of various forms of mentors and supervisors, the impact of training, as well as other forms of institutional support (e. g., funding, career guidance). Second, the embeddedness of mentoring in the broader process of socialisation into the community of researchers in different fields of research has received little attention (Hermanowicz 2006; Lechuga 2014) but is of high relevance for the provision of support that is considered acceptable in these disciplines. Third, thorough assessments at the national and institutional settings of the different forms of support are required to identify gaps and promote an efficient provision of mentorship, supervision, training, and other support.

## 9.5 Recommendations

The recommendations have been formulated at four levels, as follows.

### All stakeholders

- Reduce the load of mentorship and supervision on the current generation of senior researchers while diversifying support structures to include industry professionals and alumni and leveraging international networks.

### Government bodies, HEIs, funders and publishers

- Train mentors and supervisors on how to successfully share their knowledge and experience with ECRs and actively listen to the ECRs own experiences. Mentorship should be a two-way relationship; senior colleagues can learn from the ECR.

- Policies and practices should stipulate the provisions for distinct mentors and supervisors during doctoral and post-doctoral research training. Supervisors should focus on research training and mentors on career training.
- Facilitate the use of online communication platforms as places for the development of support networks, mentoring relationships and collaboration. This is specifically intended as a supplement to face-to-face contact and to open the opportunity for African ECRs to interface with colleagues and support services elsewhere in Africa or abroad.
- Previous fellowship recipients should be encouraged to remain linked to their international network by providing both time and logistics for them to travel and network during international conferences and meetings
- Support short training fellowships for skills development that are relevant to the availability of equipment in the home country or institution of the ECR.

### Institutions and supervisors

- Train senior staff to facilitate the implementation of new structures for ECR mentoring, training, evaluation and promotion; provide ECR opportunities to "lead" projects.

### Industry and non-government organisations

- Establish public-private partnerships and internships for ECR to gain experience in other research-related fields and contexts.

These recommendations also appear as Table 9.4A in Appendix 9.7.

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## 9.7 Appendix

*Table 9.4A – How to improve the provision of mentoring, supervision and capacity building programmes*

| Improve the provision of mentoring, supervision and capacity building programmes to support the professional development and research skills for ECRs at ALL levels | |
|---|---|
| **Interlocutors** | **Suggested Policies and Measures** |
| **All Stakeholders** | ▪ Reduce the load of mentorship and supervision on the current generation of senior researchers while diversifying support structures to include industry professionals and alumni and leveraging international networks. |
| **Government bodies, HEIs, funders and publishers** | ▪ Train mentors and supervisors on how to successfully share their knowledge and experience with ECRs and actively listen to the ECRs own experiences. Mentorship should be a two-way relationship; senior colleagues can learn from the ECR.<br>▪ Policies and practices should stipulate the provisions for distinct mentors and supervisors during doctoral and post-doctoral research training. Supervisors should focus on research training and mentors on career training.<br>▪ Facilitate the use of online communication platforms as places for the development of support networks, mentoring relationships and collaboration. This is specifically intended as a supplement to face-to-face contact and to open the opportunity for African ECRs to interface with colleagues and support services elsewhere in Africa or abroad.<br>▪ Previous fellowship recipients should be encouraged to remain linked to their international network by providing both time and logistics for them to travel and network during international conferences and meetings<br>▪ Support short training fellowships for skills development that are relevant to the availability of equipment in the home country or institution of the ECR. |
| **Institutions and supervisors** | ▪ Train senior staff to facilitate the implementation of new structures for ECR mentoring, training, evaluation and promotion; provide ECR opportunities to “lead” projects. |
| **Industry and non-government organisations** | ▪ Establish public-private partnerships and internships for ECR to gain experience in other research-related fields and contexts. |

Source: Authors.

*Table 9.5A – Negative impact on career of a lack of training opportunities to develop professional skills*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Western Region | Southern Region | Born | 1.179 | 0.0001 |
| Non-focal Africa | Southern Region | Born | 1.075 | 0.0002 |
| Eastern Region | Southern Region | Born | 0.979 | 0.0001 |
| Non-focal Africa | Outside Africa | Ms | 1.370 | 0.0001 |
| Western Region | Outside Africa | Ms | 1.335 | 0.0001 |
| Non-focal Africa | Southern Region | Ms | 1.345 | 0.0001 |
| Western Region | Southern Region | Ms | 1.310 | 0.0001 |
| Eastern Region | Outside Africa | Ms | 1.158 | 0.0001 |
| Eastern Region | Southern Region | Ms | 1.133 | 0.0001 |
| Western Region | Northern Region | Ms | 0.969 | 0.0225 |
| Non-focal Africa | Southern Region | PhD | 1.347 | 0.0047 |
| Western Region | Southern Region | PhD | 1.054 | 0.0002 |
| Non-focal Africa | Outside Africa | PhD | 1.198 | 0.0182 |
| Western Region | Outside Africa | PhD | 0.905 | 0.0017 |

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# 10 Funding for research

*"The major hindrance to achieving any goal in research is funding and once that is solved, I think the sky is the limit."*
**Edna, Female, 42, Nigeria, Western Region, Physical Sciences, Public, PhD**

**List of Acronyms and Abbreviations**

| | |
|---|---|
| AIO | African Innovation Outlook |
| AOSTI | African Observatory of Science, Technology and Innovation |
| ECR(s) | Early-career researcher(s) |
| GDP | Gross domestic product |
| GERD | Gross domestic expenditure on research and development |
| HE | Higher education |
| OECD | Organisation for Economic Co-operation and Development |
| PhD | Doctor of Philosophy |
| R&D | Research and development |
| UIS | UNESCO Institute for Statistics |
| UNESCO | United Nations Educational, Scientific and Cultural Organisation |

## 10.1 Introduction

In this chapter, we present the experiences that our ECR respondents have had with finding, applying for and securing funding for their salary, research, equipment, mobility, professional development or the like. We focus particularly on the factors that enable and limit ECRs from securing funding. Elsewhere in this report we discuss the critical role funding has in enabling these specific elements of an ECR's responsibilities and development; we encourage the reader to see Chapters 6, 7, 9 and 11 for those discussions.[42]

It is clear in Edna's words above that a thorough understanding of the funding landscape for ECRs is critical to unlocking the latent potential of African researchers and research systems. To this end, in this chapter we address the following research questions directly:

(1) How successful have ECR respondents been with securing different types of funding? Is the funding ECRs receive sufficient for their research activities and professional development?

42 See Chapter 6 for discussion of funding in the context of seeking and completing a PhD. See Chapter 7 for discussion of funding with respect to ECRs everyday work environment and capacity to conduct research. See Chapter 9 for discussion of the role supervisors and mentors have in helping ECRs secure funding. Finally, see Chapter 11 for the discussion of how funding and international mobility interrelate.

(2) What sources of funding do ECRs access and how do they seek those? Do ECRs feel trained and supported in applying for different types of funding, and do they receive feedback if an application is unsuccessful?
(3) What factors affect funding availability and success? And what are some of the impacts on ECRs' careers when they have difficulty with funding search?

Whilst these questions are our focus, we keep the discussion of the underlying questions of this study in view: (1) What are the opportunities and challenges that ECRs in Africa face in pursuing a career in research?
(2) Do these differ by region, discipline, employment sector, highest qualification, gender, or academy membership?

Through the literature review and the results, a distinction between local and international sources of funding emerges as its own point of inquiry, particularly for the economic sustainability and autonomy of research and researchers in Africa. Our focus here though is on building a perspective of funding from the view of ECRs working in or from Africa, rather than the mechanics of research systems at the macro-level. As such, we bring attention to this distinction between local and international sources of funding only insofar as they contribute or detract from ECRs' capacity to meaningfully engage in research and global research community.

Finally, we conclude by making some recommendations regarding funding ECRs in or from Africa, and for further research on the role of international funding sources in African research systems.

## 10.2 Literature review

The higher education (HE), research and innovation sectors are critical to the provision of a critical mass of professionals and researchers involved in the sustenance of nations, including their economic and technological advancement (The World Bank 2010; United Nations Educational, Scientific and Cultural Organisation (UNESCO) 2016a; Hydén 2016; Kimenyi 2011; Auriol, Schaaper and Felix 2012; Toakley 2004). Science will be indispensable to follow up on the sustainable development goals set down in the Agenda 2030 of the UNESCO (UNESCO 2016b; Hackmann and Boulton 2016). In the Agenda 2063, the African Union Commission (2015) states the aspiration to elevate the role of Africa in the global context of research, innovation and knowledge production. Funding, in terms of adequacy and timeliness, is critical to training, sustaining and advancing the needed manpower to drive the educational sector in fulfilling the clearly defined roles of tertiary institutions, including universities and research institutes. For the individual researcher, being funded either through recurrent funding, external career or research grants is the precondition to pursue an academic career (Laudel 2006; Horta, Cattaneo and Meoli 2018). Different types of funding have been shown to result in diverse outcomes with regard to productivity and career success (Horta, Cattaneo and Meoli 2018). The allocation of career grants is also a relevant instrument in the process of selecting the next generation of scientists and scholars, raising questions if and how scientific excellence and talent can be properly identified (van Arensbergen and van den Besselaar 2012). The following parts of this chapter will first address the state of funding for research and innovation in Africa before reviewing literature on funding and the impact on early-career researchers (ECRs).

In recent years, African leaders and the public recognised the need to formulate and revise national policies for science, technology and innovation, and to increase investments for the purpose of achieving economic growth, fight diseases, stem ecological destruction and to achieve the aspiration of integrating the African countries in the global knowledge economy (African Observatory of Science, Technology and Innovation (AOSTI), 2013). The figures for the gross domestic expenditure on research and development (GERD) as a percentage of the gross domestic product (GDP) presented in table 10.1 indicate that many African countries spend less than 0.5 % of their GDP on research and development (R&D). The share is slightly higher in Northern Africa (0.61 %) than in Sub-Saharan Africa (0.49 %) and there are distinct differences between countries. Yet, even those African countries reporting the highest rates of investment in R&D (Kenya: 0.98 %; South Africa: 0.82 %; Senegal: 0.75 %; Burkina Faso: 0.67 %; Egypt: 0.61 %; Tunisia: 0.60 %) range considerably below the world average (1.68 %), the Organisation for Economic Co-operation and Development (OECD 2019) total (2.37 %) and the leading countries Korea (4.55 %), Israel (4.54 %), Sweden (3.40 %), Switzerland (3.37 %), Japan (3.21 %), Denmark (3.05 %) and Germany (3.04 %).

*Table 10.1 – GERD as a percentage of GDP*

| Country/Region | AIO[a)] | UIS[b)] | OECD[c)] |
|---|---|---|---|
| *African Countries* | | | |
| Algeria | | 0.53 | |
| Burkina Faso | 0.20 | 0.67 | |
| Democratic Republic of Kongo | | 0.41 | |
| Egypt | 0.43 | 0.61 | |
| Ethiopia | 0.24 | 0.6 | |
| Ghana | 0.38 | | |
| Kenya | 0.98 | | |
| Mali | | 0.29 | |
| Mauritius | | 0.36 | |
| Mozambique | | 0.34 | |
| Namibia | | 0.34 | |
| Senegal | 0.54 | 0.75 | |
| South Africa | 0.76 | 0.82 | 0.82 |
| Togo | | 0.27 | |
| Tunisia | | 0.60 | |
| Uganda | 0.50 | 0.17 | |
| *Sustainable Development Goal Regions (selected regions)* | | | |
| Africa (Northern) | | 0.61 | |
| Africa (Sub-Saharan) | | 0.42 | |

*Table 10.1 – Continued*

| Country/Region | AIO[a)] | UIS[b)] | OECD[c)] |
|---|---|---|---|
| *UIS Regions* | | | |
| World | | 1.68 | |
| Arab States | | 0.59 | |
| Central and Eastern Europe | | 0.98 | |
| Central Asia | | 0.18 | |
| Eastern Asia and the Pacific | | 2.06 | |
| Latin America and the Caribbean | | 0.66 | |
| North America and Western Europe | | 2.42 | |
| South and West Asia | | 0.55 | |
| Sub-Saharan Africa | | 0.42 | |
| Small Island Developing States | | 1.10 | |
| *OECD countries (selected countries only)* | | | |
| OECD total | | | 2.37 |
| Australia | | | 1.88 |
| Denmark | | | 3.05 |
| Finland | | | 2.76 |
| France | | | 2.19 |
| Germany | | | 3.04 |
| Israel | | | 4.54 |
| Japan | | | 3.21 |
| Korea | | | 4.55 |
| Sweden | | | 3.40 |
| Switzerland | | | 3.37 |
| United Kingdom | | | 1.66 |
| United States | | | 2,.9 |

Sources: Selected data retrieved from the following sources: a) AIO – African Innovation Outlook II (2014), data from 2011 or latest year available; b) UIS – UNESCO Institute for Statistics, data from 2017 or latest year available, retrieved online on 7 October 2019; c) OECD – Main Science and Technology Indicators (Volume 2019/01), data from 2017 or latest year available.

The figures for African countries need to be assessed in knowledge of the history of HE in Africa (Mohamedbhai 2008, 2014; Woldegiorgis and Doevenspeck 2013; Afoláyan 2007). Institutions providing forms of HE in Africa can be dated back to the establishment of the Al-Quarawiyyin University at Fez in Morocco in 859 AD. A second type of institutions of HE was established during the colonial period (Woldegiorgis and Dovenspeck 2013), but the history of the modern African University date from the time between 1930 and 1960 (Mohamedbhai 2008). During the first decades after most African countries became independent, many African universities grew in importance and gained recognition, until budget cuts during the late 1970s and 1980s in light of weakening African economies combined with national and intra-national conflicts resulted in a first deterioration of African HE (Mohamedbhai 2014). During the 1990s, the World Bank and subsequently other donors, based on findings that were later assessed to be false, decided to dedicate funding to primary education in economically weak African countries (Mohamedbhai 2014; Mouton 2018).

The effects of this shift in funding resulted in profound financial strains of the HE system and a severe impact not only on the HE system itself, but they also stifled the human capital resources required to solve other developmental challenges of the African continent (ibid.). The impact of these manifold events interrupting the development of a HE and science system in relation to other societal institutions resulted in a de-institutionalised science system with weak scientific institutions, dependence on international funding, individualism in research, inadequate reproduction of the academic and scientific work-force and a weak inscription of science in African societies (Mouton 2018). Recent developments related to both a broader recognition of the need to reformulate science and research policies in Africa (AOSTI 2013) and evidence of small, but robust universities and research centres (Mouton 2018) may warrant hope that HE and research in Africa are regaining the needed acknowledgment in policy and consequently the funding required.

Previous research on the relevance of funding for research careers has focused on the effects of different kinds of funding on productivity and career success, the process of allocating funding via review councils and how researchers react to their funding environments. In a study on principal investigators in the United Kingdom, Acton et al. (2019) investigated funding with regard to the two most frequent career paths, the recruitment as a fixed-term researcher or as a permanent lecturer. Though the externally-funded research fellows are usually fully funded and have better resources for long-term projects and the recruitment of lab members, their position seemed more precarious than that of their peers pursuing the teaching-oriented track. Also, 57 % of the externally funded research fellows in this study reported that they were expected to teach even though the university did not cover their salaries. In an earlier study on the impact of different types of funding on Doctor of Philosophy (PhD) completion, Ampaw and Jaeger (2012) found that students with research assistantships were more likely to successfully pass through different stages of doctoral education than students with any other type of financial support.

Students with teaching assistantships were reported to be equally successful managing the transition into PhD education (taking doctoral classes, adjusting to new expectations) and developing their skills and research agenda, but were less likely to complete their research and to defend their dissertation. A study on the effects of different PhD funding sources in Portugal (Horta, Cattaneo and Meoli 2018) highlighted that PhD grants did positively affect research productivity during the PhD and the following career, while PhD students funded by research project grants were less successful than their peers. The authors argue that PhD grants allow students to focus on their doctoral research, while students funded by research project grants may need to shift their research foci more often, preventing the establishment of a coherent research agenda.

Given the importance of career grants, van Arensbergen and van den Besselaar (2012) investigated multiple quality dimensions (proposal, researcher, and societal relevance) and stages of the selection process (peer review, committee review, interview). Based on data from The Netherlands, their findings indicate that the scores for the different quality dimensions change considerably between phases, possibly resulting in some applicants that received top scores by external referees being scored differently by the committees and not even be invited for interviews. The authors conclude that evaluations were contextual, suggesting that the transparency, quality and legitimacy of the selection process would need to be improved. In another study in The Netherlands on application evaluations for a prestigious grant for personal research funding, van der Lee and Ellemers (2015) identified a gender bias resulting in a 4 % "loss" of female researchers during the grant review procedure.

Most countries have seen a shift in recent decades in how university research is funded, from recurrent funding (provided yearly by universities) to external funding from different sources (Laudel 2006). In her interview-based study comparing experimental physicists from Australia and Germany, Laudel (2006) identified different strategies on how researchers adapted to the new funding environments. The findings indicate that the strategies employed by the scientists mainly fall into two categories: strategies targeting the resource base and strategies targeting the research content. Strategies relating to the resource base were targeting "easy" sources (based on an assessment of the effort to write an application, the usual success rate and the size of the grants), targeting all sources (applying at different sources and as many schemes as possible to combine the sources), targeting "appropriate sources" (designing the project first and then searching for funding sources) and other strategies such as commercialising research findings or selling services to customers. Among the adaptions of applications relating to the content of the applications were strategies such as selecting externally predetermined topics, avoiding risky research (i.e. topics that were assumed to have too little chance of being funded, based on previous experience or requirements of funding agencies to prove the credibility of the project based on previous work) or avoiding "hot" topics where competition was expected to be high. Current funding conditions, the author summarises, tend to entice researchers to pursue low-risk, mainstream, applied, "cheap" and often inflexible research. Due to the different funding conditions, the strategies differ between Australia and Germany, and though all researchers were affected, some of the top researchers in the sample were able to avoid the worst effects.

Recent studies on ECRs in Africa still outline the issue of funding as one of the most severe challenges for research as well as ECRs. Based on findings from a cross-sectional survey encompassing six Sub-Saharan African countries, Ngongalah et al. (2018) identify the lack of resources to carry out research as the topmost key challenge affecting research in Africa. The participants of the study identified a lack of interest or commitment to research by African governments and lack of facilities to conduct good quality research as part of the major reasons influencing research output in Africa and responsible for the production of very little scientific research knowledge. In another recent study on ECRs across the African continent by Beaudry, Mouton and Prozesky (2018), a general lack of research funding and funding for equipment were reported as the numbers 1 and 2, respectively, of 10 challenges impacting negatively on their career as scientists/academics. In terms of sources, the authors report that there was a direct relationship between proportions of funding received, the amounts respondents received and international sources. The sources of funding were found to be very heterogeneous (public, private and non-profit organisations; local, national, international, and overseas institutions) but the South African National Research Foundation followed by the European Union were reported to be the most cited funding organisations. The consequences of insufficient funding included less productive researchers and the need to devote more time to searching for funding, resulting in less time for their core tasks and increased stress.

Findings from a study on building PhD research capacities in Africa, coordinated by the African Network for Internationalisation of Education and carried out by the British Council and the German Academic Exchange Service (2018), indicate that funding for HE in general is under strain, with institutions prioritising funding for their undergraduate provision, consequently resulting in low proportions of university budgets allocated to research and PhD provision. Nega and Kassaye (2018) report that the main source of funding for Ethiopian universities is from the government treasury, income generated by universities and partners (local and international). The proportion of the HE budget was reported to be relatively high with the largest share being allocated to staff salaries and technical requirements rather than research; in general, research funding from the government was deemed inadequate. Consequently, this impacted research capacity of universities in Ethiopia negatively. Conclusively, Nega and Kassaye (2018) averred that funding remains a major limitation to research and PhD training in universities in Ethiopia. Barasa and Omulando (2018) report that the government of Kenya plans to increase research funding to 2 % of the GDP and hopes to achieve this measure through strategic partnership with the private sector, foundations and other relevant stakeholders.

The authors note that most academics in Kenya engaged in PhD studies have grants or scholarships from dedicated funds, but this was considered inadequate by most respondents. Furthermore, the authors identify government agencies, employers (staff development funds ), local and international donors, regional governments, the industrial and business sectors as being alternatives sources of funding. In a study on PhD capacities in Ghana, Alabi and Mohammed (2018) identify funding as one of the major constraints to research and PhD production in Ghanaian universities, with significant dependence on the government for financing of research activities. The authors also report a paradigm shift in the disbursement of research budget allocation through the National Council for Tertiary Education following the adoption of a funding model which takes into consideration equity, efficiency, transparency and accountability, with disbursement based on base grants, institutional factor grants, innovation grants, performance funding grants and research grants. Alabi and Mohammed (2018) highlight two issues. First, research grants are allocated to universities based on research publications, numbers of doctoral graduates and research master graduates. Second, academic staff, including ECRs, receive support that only covers book and research allowances. However, this support is considered grossly inadequate (Alabi and Mohammed 2018). External partners and donors have been identified as major alternate sources of funding to push up research capacity development and research activities in Ghanaian universities.

## 10.3 Results

The results in this chapter are separated into three sections: first, we present the overarching results regarding respondents' rate of success with securing funding and the sufficiency thereof (section 10.3.1). We present the sources of funding that respondents access, and their impressions of the support they have with finding and applying for funding (section 10.3.2). We close the chapter by discussing the intersection between funding and other factors of an ECR's role and professional development (section 10.3.3). This section is intended as a complement – but not supplement – to the themes in other chapters of this report.[43]

### 10.3.1 Access and adequacy of funding

#### Funding access

It is both clear from the literature review and widely understood that funding for research, education, professional development, equipment and the like is crucial for ECRs based anywhere in the world. Despite

43 Refer to Chapter 6 for discussion of funding in the context of seeking and completing a PhD. See Chapter 7 for discussion of funding with respect to ECRs everyday work environment and capacity to conduct research. See Chapter 9 for discussion of the role supervisors and mentors have in helping ECRs secure funding. Finally, see Chapter 11 for the discussion of how funding and international mobility interrelate.

this, 42.3 % (n=375) of respondents that required funding had not received any in the three years prior to the survey. The breadth of respondents' issues with securing any form of funding – and further, funding that is sufficient for their needs – was a central concern in almost all of the interviews:

> *"Well the problem is always funding and I think especially in the African environment…there's not a lot of focus on research-related work at all and I think that's probably one of the main challenges across Africa."*
> **Agnes, Female, 38, South Africa, Southern Region, Applied Sciences, Academia, PhD**

The contributing factors to this and implications for respondents are discussed throughout this chapter. Here we focus on the 57.7 % (n=512) of respondents who had received funding. PhD holders were more likely than respondents with a Master's as their highest degree (β=0.757, P=0.0004) to have received funding (PhD: 64.3 %, n=303, and Master's: 50.2 %, n=209). Regionally, respondents were more likely (β=1.305 – 1.537, P≤0.0157) to have received funding if they were living in the Southern region (75.7 %, n=159) compared to those in the Western (38.7 %, n=96) and Northern regions (45.3 %, n=29, see Figure 10.1 and Table 10.2). Similarly, respondents living in the Eastern region (64.4 %, n=105) were more likely (β=1.042, P=0.0010) than those in the Western to have received funds. Finally, respondents that received their PhD in the Southern region or outside of Africa were more likely (P≤0.0002) to have received funding than those that received theirs in the Western region.

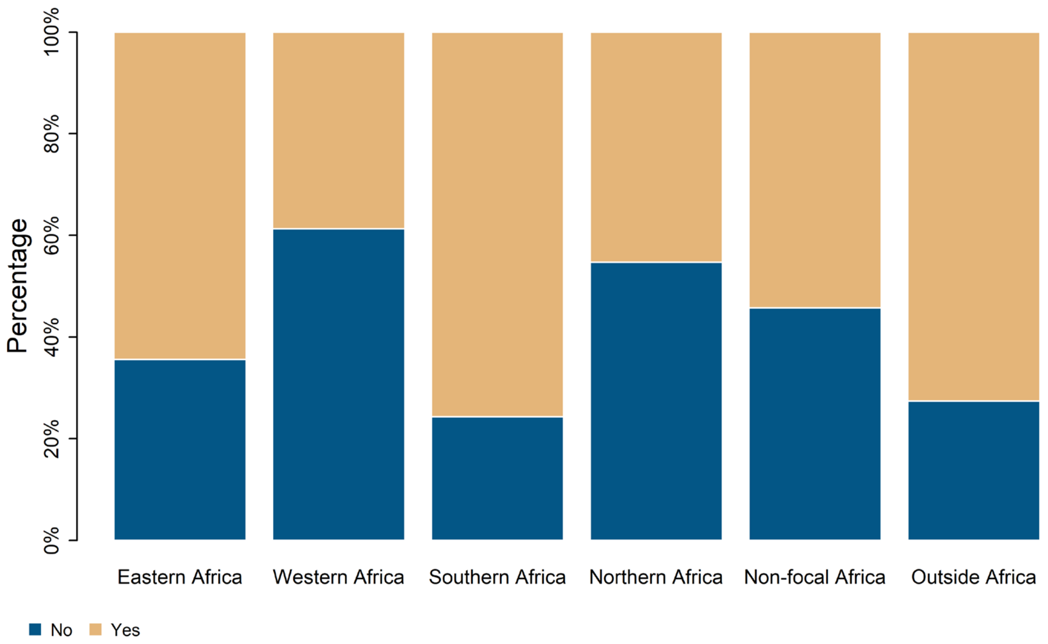



*Figure 10.1 – Funding received by region where currently living in the three years preceding the survey*
*Source: Authors.*

*Table 10.2 – Funding received in three years prior to the survey*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Outside Africa | Western Region | Born | 1.847 | 0.0456 |
| PhD | Master | Live | 0.757 | 0.0004 |
| Southern Region | Western Region | Live | 1.537 | <0.0001 |
| Southern Region | Northern Region | Live | 1.305 | 0.0157 |
| Eastern Region | Western Region | Live | 1.042 | 0.0010 |

Note: See also Table 10.7A in appendices.
Source: Authors.

These regional differences were also reflected in the interviewees' answers. Those respondents who had moved to South Africa to do their PhD regularly reported that it was related to being offered funding there, while other respondents cited South Africa (and to a lesser extent Kenya) as examples of countries where the actions and policies of the national government help provide funding for researchers:

> *"In terms of accessibility to grants and funding, you tend to see South Africa, Kenya and Uganda getting it. So, I don't know what Nigeria isn't doing that is working for those countries. At least for South Africa, I know that the government is really doing a lot."*
> **Trevor, Male, 33, Nigeria, Western Region, Life Sciences, PhD**

In making these regional comparisons, it is important to highlight three things: (1) although respondents in the Southern region were more likely than respondents elsewhere to have received funding, the sufficiency of any funding received remains to be discussed; (2) the analysis above refers to the "Southern region", which includes Mauritius, Mozambique and Zimbabwe, in addition to South Africa. However, it was quite clear in the interviews that respondents from Zimbabwe considered South Africa as a much more promising country to receive funding for research:

> *"If I compare Zimbabwe [to South Africa], I think in Zimbabwe we have the Zimbabwe Research Council but they do not make opportunities [for funding] available the way NRF [in South Africa] does. I don't know if it is a structural issue or is it a funding issue but definitely it's evident that the two are different."*
> **Timothy, Male, 32, Zimbabwe, Southern Region, Other (Food Science and Nutrition), Academia, PhD**

And (3), even those in or from South Africa detailed considerable funding challenges, as such the results do not suggest there are not improvements to be made in South Africa also. Agnes' view given at the start of this section demonstrates this, and further detail from Agnes here reveals the complexity of sufficiently funding all facets of a HE and research system:

> *"Recently, there's been an introduction in terms of support for post graduate studies and research and so on, and in terms of additional lecturers et cetera. So because we have implemented free tertiary education [in South Africa] recently obviously a lot of the money from the government would rather go to funding of student fees rather than research and projects."*
> **Agnes, Female, 38, South Africa, Southern Region, Applied Sciences, Academia, PhD**

### Funding applications

Overall, 72.9 % (n=709) of respondents had applied for funding in the three years prior to the survey, including 81 % (n=426) of PhD holders and 63.3 % (n=447) of those with Master's as their highest degree. PhD holders were more likely than Master's holders to have applied for funding ($\beta$=1.127, P<0.0001). There was no statistical difference in the submission of funding applications between regions, after adjustment for other factors (Figure 10.2)

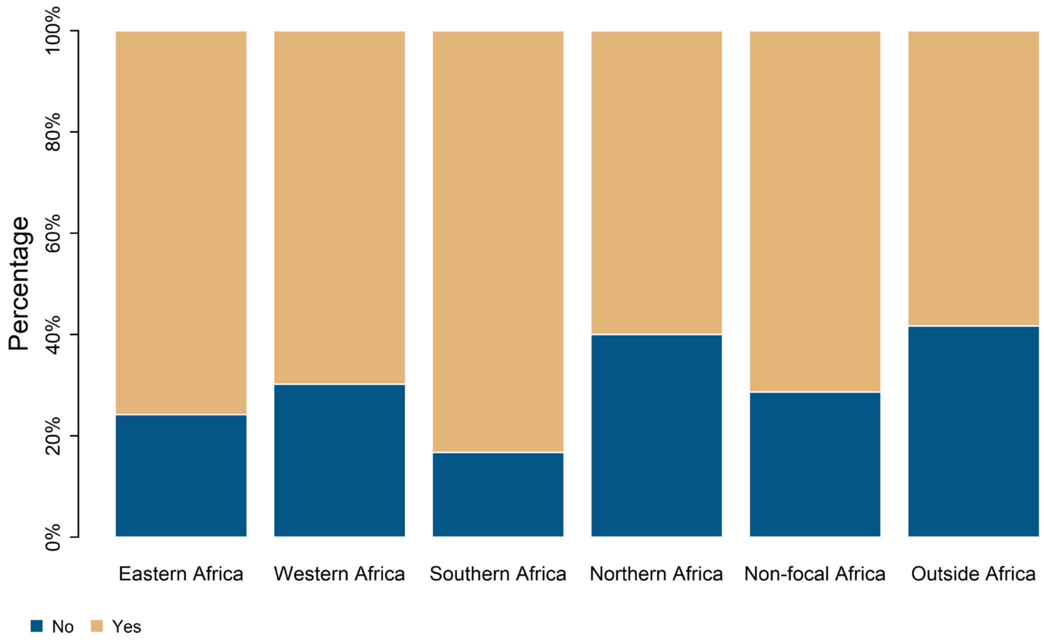



*Figure 10.2 – Application for funding in the prior 3 years, stratified by region where living*
*Source: Authors.*

The number of applications for funding submitted by respondents also varied slightly across the regions, beginning with an average of 2.94 in the Northern and non-focal Africa regions and reaching an average of 3.61 in the Southern Africa region (see Figure 10.3). The average across all respondents was 3.3 applications over the prior 3 years.

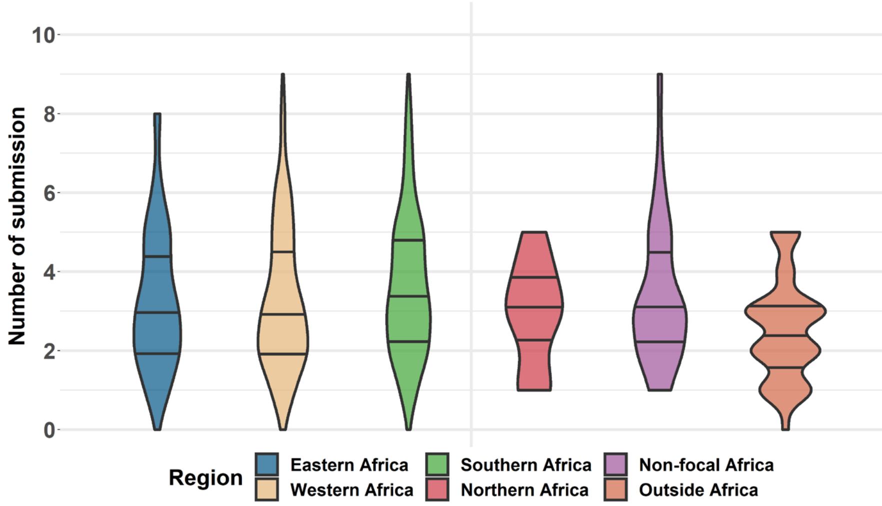



*Figure 10.3 – Number of funding applications submitted in three years prior to survey, stratified by region where living*
*Source: Authors.*

There was more variability across the regions in the number of funding applications that were successful in the three years prior to the survey. On average, respondents had been successful with one application ($\bar{x}$=1.1) in the three years prior to the survey. However, respondents living in the Southern region delivered the most successful funding applications on average ($\bar{x}$=1.56). Respondents living in other regions within Africa and beyond all made one successful funding application ($\bar{x}$=1.05–1.07), with the exception of those in the Western region where the average was appreciably lower than one ($\bar{x}$=0.77) (see Figure 10.4). Respondents living in the Southern region were more likely to be successful than respondents living in the Western region ($\beta$=0.702, $P<0.0001$). There was no significant difference by gender or discipline for the number of successful funding applications

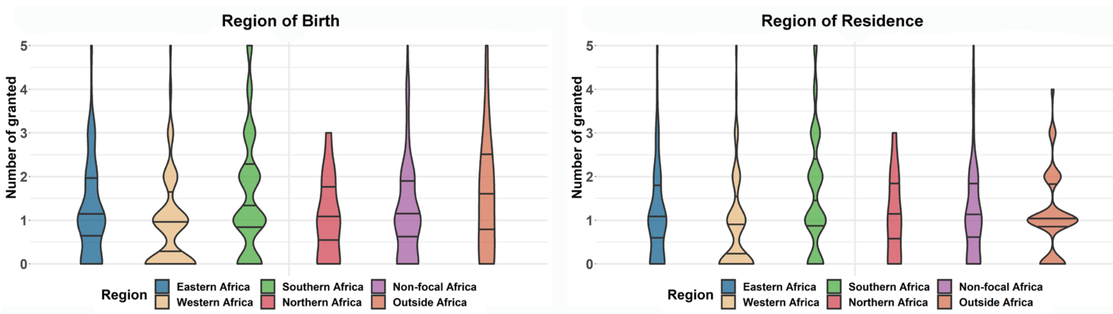



*Figure 10.4 – Number of successful funding applications, stratified by region of birth and residence*
*Source: Authors.*

A considerable amount of funding for our respondents came from sources outside of Africa, as we discuss further in section 10.3.2 of this chapter. This is important in the context of respondents living in the Northern and Western regions who face difficulties in successfully applying for funding; in the interviews, particularly respondents from Northern and Western Africa reported to have trouble applying for funding from international sources because English (a widely used language among international funding agencies) is not their first language:

> *"Our language is blocked [elsewhere]…if I participate in a project [and] speak [my language] it's a big discrimination to be…accepted."*
> **Bernard, Male, 42, Senegal, Western Region, Physical Sciences, Academia, PhD**

> *"Getting international grant, for example, with an international project, it has become very competitive. So, for example, we have applied for 10 projects and we can be very lucky if one of them is accepted. So this is a very big challenge."*
> **Gertrude, Female, Tunisia, Northern Region, Life Sciences, Academia, PhD**

We explore additional challenges respondents had with the funding search and successful grant applications in section 10.3.3 of this chapter.

### Funding sufficiency

In the three years preceding the survey, 44.6 % (n=227) of respondents who had received funding considered their funding insufficient for expenses related to research, travel and salary. Overall, only 21.4 % (n=109) considered their funding to be sufficient. Combining the first result with an earlier one puts this into context: 68.1 % (n=602) of all respondents who had required funding for their research had either not received any in the three years prior to the survey (42.3 %, n=375) *or* the funding received was insufficient.

Breaking this down by highest degree, it includes 66.6 % (n=313) of PhD holders who indicated that they require funding; this is important to highlight, as these PhD holders are most likely of all respondents to be involved in research and employed in positions for which funding is a non-negotiable requirement. It also included 77.1 % (n=289) of Master's holders that indicated that they require funding. There was no statistical difference in receiving sufficient funding between regions or discipline, after adjustment for all other factors (Figure 10.5) The impact of this reality for respondents took centre stage at the interviews, and it is reflected throughout this chapter in almost every quote. It was also clear that this reality frustrated and undermined the motivations of interviewees:

> *"I don't know any good foundation in Africa who really provides funding for research within Africa. Even our governments pledged to put two or few percent of the GDP into research and innovation. A very few have done that, I think for me this is the greatest challenge that rarely reduces."*
> **Victor, Male, 46, Kenya (from Cameroon), Eastern Region, Life Sciences, Para-public, PhD**

> *"Funding facilities, equipment, chemicals, instruments or operators will inspire people and would motivate them to deliver."*
> **Grace, Female, 35, Nigeria, Western Region, Physical Sciences, Unemployed, PhD**

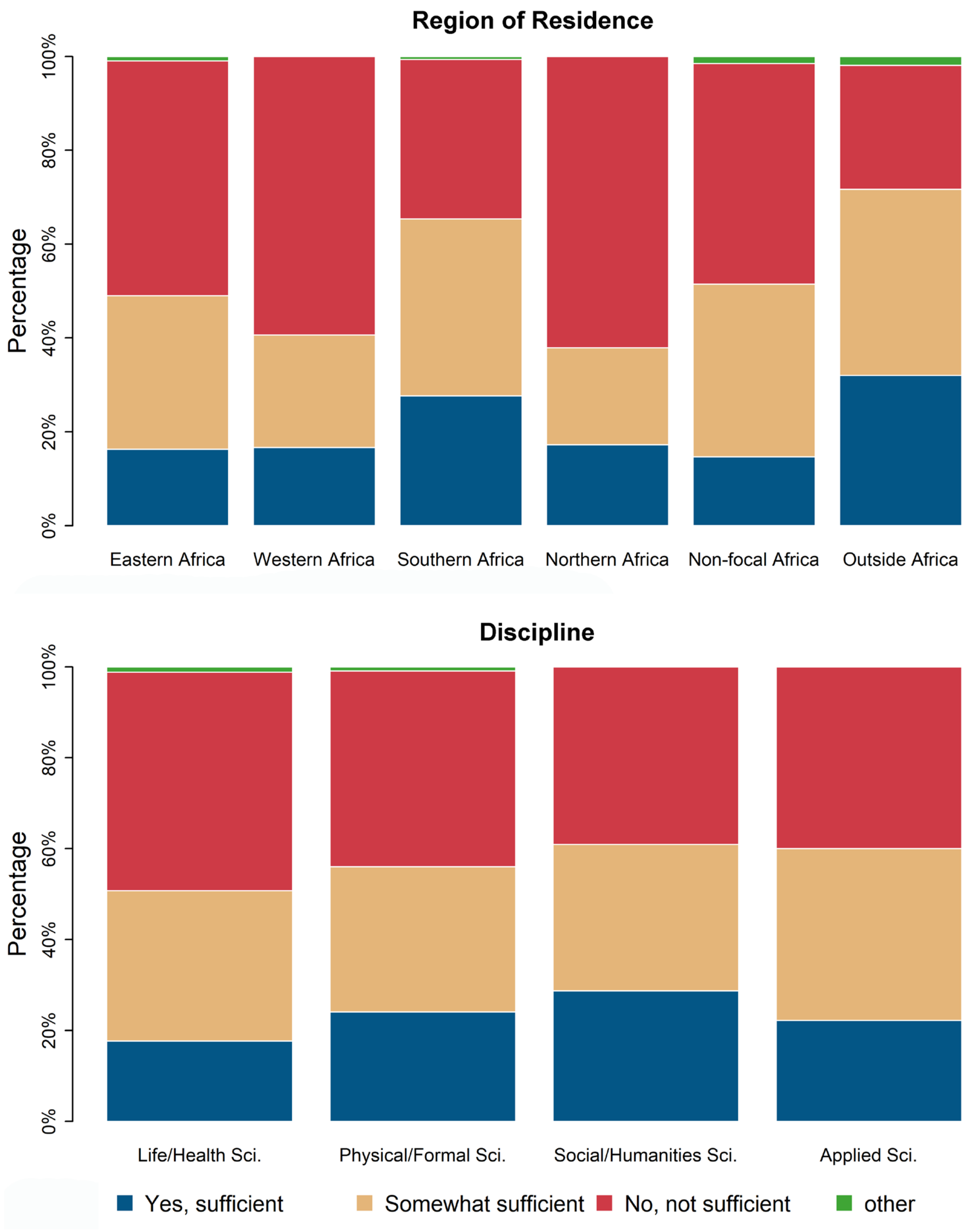



*Figure 10.5 – Funding sufficiency (three years preceding survey) for salary, research costs and/or travel, stratified by region where living and discipline*
*Source: Authors.*

The interviews made clear that, irrespective of where the respondent lived or worked, it was an ever-present issue to secure funding that was sufficient for their research activities, travel to conferences, salary and the like. The extent of the challenge is exemplified by those respondents who – despite having one source of funding – were compelled to seek others:

*"I got research grants from the university where I did my PhD…I got two research grants and I also got industry funding as well…the funds were not enough but I then pulled the three funds together [and that] was enough."*
**Sam, Male, 37, Oceania (from Nigeria), Outside Africa, Applied Science, Academia, PhD**

Sam speaks of his experience with funding in the diaspora, and in section 10.3.3[44] of this chapter we discuss some of the reasons that contribute to the difficulties that respondents in the diaspora face regarding funding. The underlying concern in Sam's response (that single grants are insufficient to cover all research-related activities) was reflected by respondents living and working in Africa as well. It was common for interviewees that lived in the Northern and Western regions, in particular, to report self-funding of their research activities:

*"You should pay for chemicals by yourself, you should pay for the equipment or the machine you work on by yourself. It's a lot of our money, especially as we get small salary."*
**Charity, Female, 47, Egypt, Northern Region, Life Sciences, Academia, PhD**

*"And then I realised there are universities where somebody can be funded to go in the field, somebody can be funded to attend a conference, somebody could be funded to publish a paper. To me it is just a miracle because it's something that actually I've never experienced, if I have to go to a conference, you fend for yourself."*
**Janet, Female, 40, Kenya, Eastern Region, Humanities, Academia, PhD**

To provide context to the impact of a lack of funding on respondents' careers, we asked them how it (if at all) and a variety of other factors had negatively impacted their career: alongside a lack of funding, we included factors related to employment, training and support, social values, health, politics, harassment and so forth. By considering a broad range of factors, we get a better sense of how strongly respondents feel that each factor has limited their development as ECRs. The results are presented in Figure 10.6.

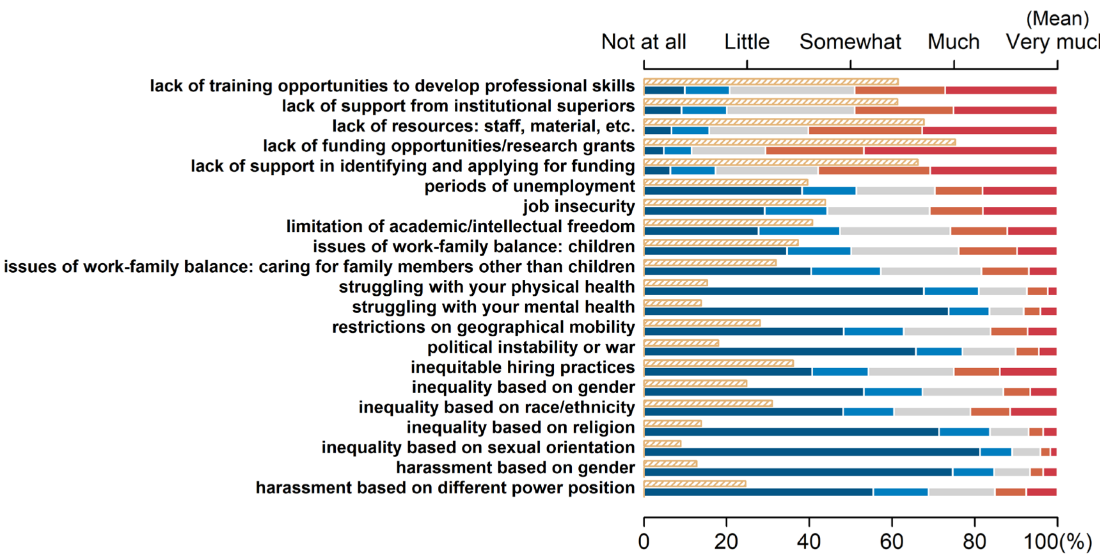



*Figure 10.6 – Negative (potential) impact of various factors on respondents' careers*
*Source: Authors.*

44 See Stanford, Shadreck and Fiona in section 10.3.3.

Of all factors, respondents ranked a lack of funding opportunities as having the most negative impact on their careers (P<0.0001) with an average of weight of 4.01 (on a five-point scale).[45] A majority of respondents (70.6 %, n=756) *agreed* or *strongly agreed* that a lack of funding opportunities had had a negative impact on their career. Regionally, this included 85.7 % (n=240) of respondents living in the Western, 76.8 % (n=53) in the Northern, 76 % (n=111) in the non-focal countries, 70.2 % (n=139) in the Eastern and 55.1 % (n=90) in the Southern regions. Significant differences were found among the regions: those living in the non-focal, and Eastern regions were more likely than those living in the Southern to feel a lack of funding opportunities had negatively affected their careers (β =0.651–1.384, P≤0.0294). Similarly, respondents born outside of Africa were less likely (P≤0.0030) than any respondent born in Africa, with the exception of those in the Southern region, to consider a lack of funding to have negatively impacted their careers.

### 10.3.2 Seeking funding opportunities and support applying

**Funding sources**

International organisations based outside of Africa were the most common source of funding (31.1 %, n=252) for respondents that had received funding (from one or more source) in the three years prior to the survey (see Figure 10.7). This was supplemented (10.4 %, n=84) by funding from international organisations based *within* Africa; overall, international funding sources were clearly the primary source of funding for respondents (combined: 41.5 %, n=336). Funding from their own institutions was second most common (27.4 %, n=222), followed by government organisations from within their own country (23.2 %, n=188). Respondents received minimal amounts of funding from private not-for-profits and businesses (or industry-type funding).

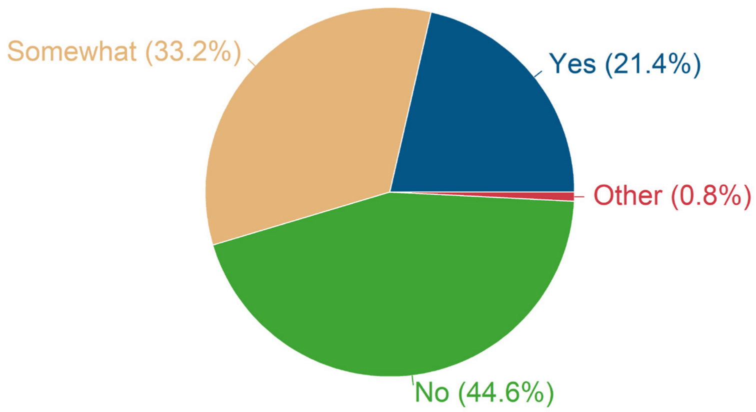



*Figure 10.7 – Sources of funding*
*Source: Authors.*

Zooming in on the composition of funding sources on a regional basis provides further insights into the differences that began to emerge in section 10.3.1 of this chapter. Respondents living in Africa most commonly received funding from organisations outside of Africa, with the exception of those in the Southern

45 Refer to Chapter 6 for the discussion of a "lack of resources" and a selection of other factors, and to section 9.3.2 of this chapter and Chapter 10 for a discussion of lacking support for identifying and applying for funding.

region (see Figure 10.8). In the non-focal African region, international sources of funding (in or oustide of Africa) were respondents' most common source of funding (59.2 %, n=61). This was also the case in the Eastern (56.4 %, n=88), Western (47.8 %, n=66) and Northern (41.4 %, n=17) regions. We note, however, that it would likely be higher still in the Northern region if respondents in this region had less issues with language while trying to access international funding (refer to section 10.3.1, specifically to Bernard and Gertrude). In contrast, in the Southern region, government organisations (34.2 %, n=102) in respondents' home countries and their own institutions (29.2 %, n=87) were the most common source of funding (international sources constituted 25.8 %, n=77).

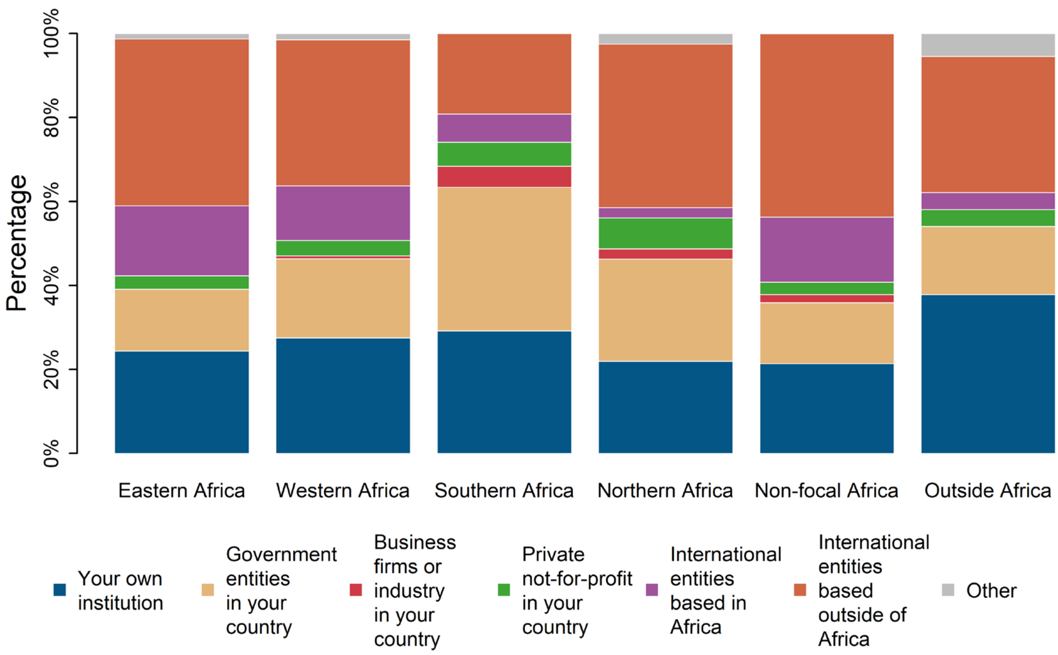



*Figure 10.8 – Funding sources for respondents, by region where living*
*Source: Authors.*

The statistical analysis revealed numerous significant differences between regions; respondents living in the Southern region were more likely ($P \leq 0.0031$) than respondents living anywhere else in Africa to have received funding from government entities in their country ($\beta=1.205–1.793$: see Table 10.3). Furthermore, those respondents living outside of Africa or in the Southern region were more likely ($P \leq 0.0099$) than those in the Western region to have received funding from own institution ($\beta=0.993–1.003$).

*Table 10.3 – Funding from government organisations in home or host country*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Southern Region | Western Region | Live | 1.793 | <0.0001 |
| Southern Region | Non-focal Africa | Live | 1.633 | <0.0001 |
| Southern Region | Northern Region | Live | 1.430 | 0.0031 |
| Southern Region | Outside Africa | Live | 1.411 | 0.0010 |
| Southern Region | Eastern Region | Live | 1.205 | <0.0001 |

Note: See also Table 10.8A in appendices.
Source: Authors.

Together, these two results corroborate the interviewees' perceptions, including Timothy and Trevor in section 10.3.1, that the government in South Africa provides funding for research at a level that exceeds many other national governments in Africa. However, researchers in South Africa were still generally concerned about their level of funding, including Agnes in section 10.3.1. Numerous interviewees described the type of funding support they receive as ECRs in South Africa, including ECRs from abroad:

> *"Also South Africa has a National Research Foundation that provides a quarter of its funding for international researchers and I have been privileged to have been chosen for one of those grants."*
> **Olivia, Female, 33, South Africa (from Zimbabwe), Southern Region, Life Sciences, Academia, PhD**

> *"You finish your PhD [in South Africa and] you are given 15000 [Rand]46 as a research fund that you can use for your conferences, or to buy maybe the equipment for your research, things like that."*
> **Dorothy, Female, 53, South Africa (from Zimbabwe), Southern Region, Humanities, PhD**

Finally, respondents in the life and health sciences were more likely (P≤0.0222) than those in the applied sciences, social sciences and humanities, and physical sciences to have received funding from international organisations outside of Africa (β=0.573–1.001, see tables 10.4 and 10.5).

*Table 10.4 – Funding from international organisations outside of Africa (see also table 9.9A in appendices)*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| PhD | Master | Live | 0.737 | <0.0001 |
| Life and Health Sciences | Applied Sciences | Live | 1.001 | 0.0069 |
| Life and Health Sciences | Social and Humanities | Live | 0.679 | 0.0070 |
| Life and Health Sciences | Physical Sciences | Live | 0.573 | 0.0222 |

Source: Authors.

46 Equivalent to around €925 or $10,20 (conversion: 05.02.2020).

*Table 10.5 – Percentage of funding received from different funding sources in the prior three years, by discipline*

| Discipline | Own institution | Government entities in own country | Business firms or industry in own country | Private not-for-profit in own country | International entities – in Africa | International entities – outside Africa | Other |
|---|---|---|---|---|---|---|---|
| **Life and Health** | 29.7 | 20.8 | 1.4 | 6.5 | 6.5 | 34.5 | 0.7 |
| **Physical and Formal** | 25.7 | 28.6 | 2.3 | 0.6 | 13.1 | 28.57* | 1.1 |
| **Social and Humanities** | 25.8 | 23.2 | 2.0 | 4.0 | 15.9 | 27.81** | 1.3 |
| **Applied** | 21.7 | 24.6 | 8.7 | 2.9 | 14.5 | 24.64** | 2.9 |

Note: Spearman correlation compared to Life and Health Sciences; ***, P < 0.001; **, P<0.01; *, P<0.05.
Source: Authors.

This difference is at least partly illustrated by the interviewees; among them it emerged with some consistency that the priorities of national and international funding organisations that support research in Africa tend to be in the area of health and medical sciences, including specific transmittable diseases (rather than non-communicable diseases or those that are of limited risk to developing countries):

> *"[If] it's only some disease that is specific to poor countries, [then] some companies or funding agencies that give big money [overlook] this kind of disease. It's [different], for example, to an infectious disease because these kinds of new diseases can emerge from an African country and can travel to Europe, the US, Japan or other countries. That's why funding agencies put a lot of money to support all research related to this new disease."*
> **Kenneth, Male, Morocco, Northern Region, Health Sciences or Medicine, Public, PhD**

### Finding funding, support applying and feedback

It was common among the group of interviewees to seek funding opportunities through a number of online sources, including search engines such as Google and Yahoo, directly accessing a funding organisation's website, and even LinkedIn. It was also common for participants to receive emails from organisations to which they were subscribed, such as funding organisations themselves and less frequently academies and other professional groups. Many respondents were also members of informal WhatsApp and email groups that were founded to share information. To improve their chances of success, some interviewees described upskilling their grant writing skills watching YouTube tutorials, or applying for funding in collaborative partnerships with researchers elsewhere inside or outside of Africa, which is discussed in more detail in Chapter 11.

Though all of these things were common among interviewees, the formal support interviewees had in their institutions was a clear point of difference; a number of interviewees described the importance of their institution's research office for finding and helping them apply for funding, while for other interviewees a research office had not been established at their institution, or they were ineffective:

*"I know some universities or some research institutions will have a proper research office where if there's a call they will communicate it to staff – if there is an issue of applying for a certain kind of funding then they will assist in the preparation. But that is completely lacking here. So, if I see something online it's up to me to find out how to best succeed in that."*
**Cecilia, Female, 33, Kenya, Eastern Region, Life Sciences, Academia, PhD**

The concern some interviewees had with the lack of support for identifying and applying for funding reflects the same concern of the broader survey respondents. Referring again to figure 10.6, over half (57.9 %, n=624) of the survey respondents *agreed* or *strongly agreed* that a "lack of support identifying and applying for funding" had negatively impacted their careers. This factor was ranked the third highest of the 21 possibly negative impacts, and closely related a "lack of funding opportunities" which was ranked as number one (as discussed in section 10.3.1). The inclusion of funding in two of the top three factors that had negatively affected respondents' careers was also reflected in the way interviewees repeatedly came back to talking about funding when answering questions about mobility, productivity, collaboration and the like. It also captures the blunt reality that underpinned so much of the message interviewees were conveying:

*"We cannot do research without good money."*
**Bernard, Male, 42, Senegal, Western Region, Physical Sciences, Academia, PhD**

Respondents born in non-focal Africa, or the Northern or Western regions were more likely ($P \leq 0.0241$) than those born outside of Africa to perceive that a lack of support regarding the search and application for funding had negatively affected their careers ($\beta = 1.312–1.447$, see table 10.6). Additionally, those respondents who were living in the non-focal or Western regions were more likely ($P \leq 0.0005$) than those in the Southern to feel the same ($\beta = 1.030$ and 0.873, respectively).

*Table 10.6 – Negative impact on career of a lack of support identifying and applying for funding*

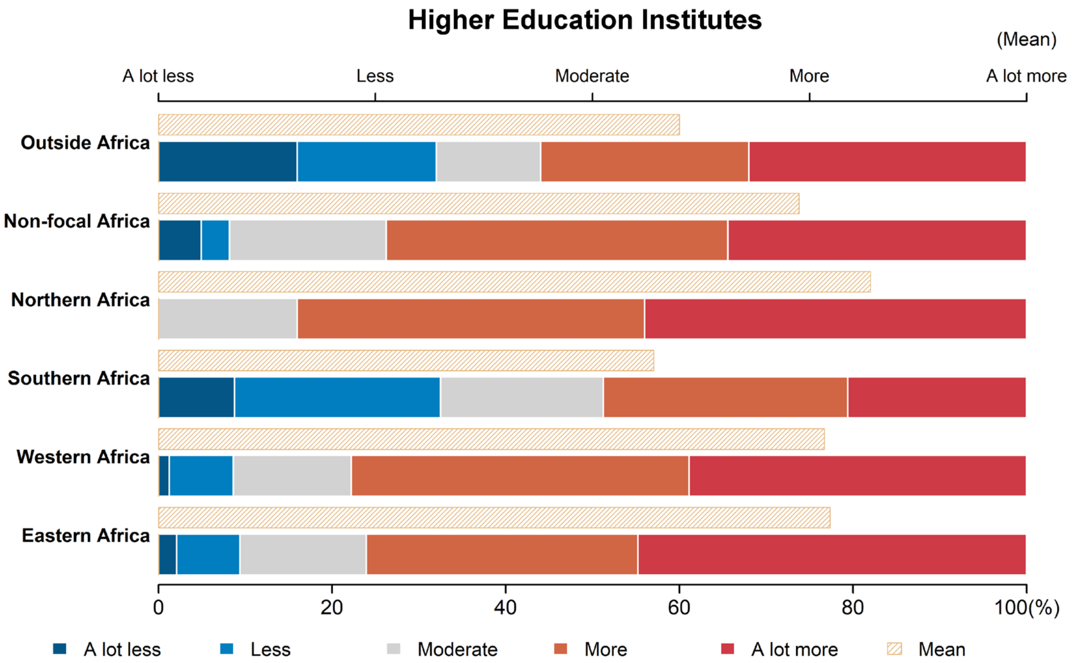
| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Non-focal Africa | Outside Africa | Born | 1.447 | 0.0030 |
| Northern Region | Outside Africa | Born | 1.352 | 0.0241 |
| Western Region | Outside Africa | Born | 1.312 | 0.0045 |
| Non-focal Africa | Southern Region | Live | 1.030 | 0.0005 |
| Western Region | Southern Region | Live | 0.873 | 0.0001 |

Source: Authors.

Part of this lack of support regarding the search and application for funding relates to respondents formal mentorship and institutional support structures, which is discussed as a broader theme in Chapter 9. What is discussed further in that chapter and is relevant to a recurring result in this chapter – that respondents living in the Western region have significant difficulties with securing funding – is the extent of the difficulty respondents in the Western region sometimes face with securing institutional and leadership support for securing funding:

*"I was told in order to get such prestigious funding, someone has to recommend you to a host before you can be accepted. So, I tried colleagues who have been [successful before]. None of them showed up. None of them were ready to connect me to anybody. So, I kept trying, and at one point I gave up."*
**Hunter, Male, 38, Cameroon, Western Region, Humanities, Academia, PhD**

Further to the types of institutional and leadership support discussed, a clear majority of respondents (64.9 %, n=450) reported to require *more* or *a lot more* time in their roles to seek and write applications for funding. Regionally, this was driven by those living in the Northern (77.8 %, n=35), Western (75.9 %, n=148), non-focal Africa (71.4 %, n=120), and the Eastern regions (67.9 %, n=93) (see Figure 10.9); the respondents living in the Southern region were less likely to desire more time for funding applications (46.4 %, n=90) than those from all other regions in Africa (β=1.149–1.528, P≤0.0063, see also table 10.9A in appendices).



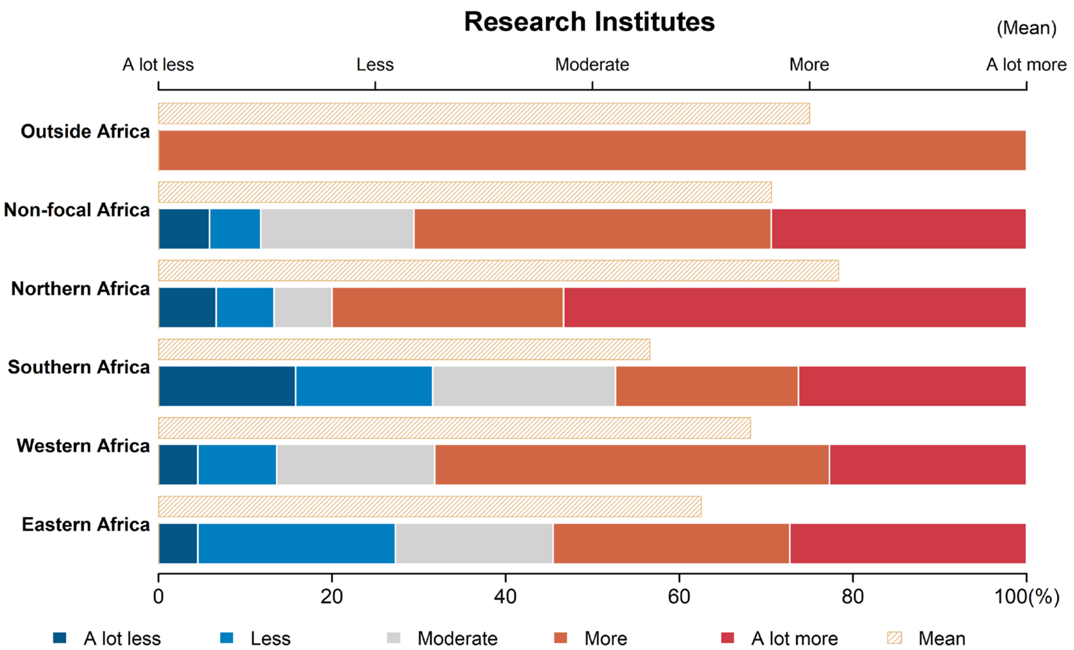




*Figure 10.9 – Respondents desire for "more" or "a lot more" time to write funding applications*
*Source: Authors.*

For many respondents living in Africa the lack of time to write funding applications intersected directly with their teaching commitments:

> *"Because in mine you have to mark over 300 scripts of students and there's probably a deadline for a call for funding. I can't meet up with the deadline because the results of my exams are expected to be given within a short period of time."*
> **Edna, Female, 42, Nigeria, Western Region, Physical Sciences, Public, PhD**

The time limitation teaching responsibilities create for some researchers in Africa is also reflected in the experiences of African researchers who live in the international diaspora and aspire collaborations with other researchers back in Africa:

> *"I even offered to help the person [in Africa] with the applications, everything, but most of them just said they had a lot of teaching commitments so they can't apply for the grants."*
> **Benjamin, Male, 33, Asia (from Zimbabwe), Outside Africa, Physical Sciences, Academia, PhD**

The workload issues of respondents, including teaching commitments, are presented in more detail in Chapter 7. Finally, some interviewees added that it is difficult to improve the quality of their funding applications as funding organisations provide limited feedback to the applicants regarding the reasons why their application was successful or not:

> *"Yes there are lots of foundations [offering funding] but it's not easy because they only choose a limited number of scientists that fulfil their requirements… sometimes you succeed but you don't know exactly why, sometimes you fail and you don't know exactly why you failed [either]."*
> **Emily, Female, 37, Europe (from Egypt), Outside Africa, Physical Sciences, PhD**

### 10.3.3 Factors which influence and are influenced by access to funding

It is clear from the two preceding sections of this chapter that funding accessibility is an integral component of respondents' capacity to meaningfully engage in research activities and the global research community. This is reflected also in the results of the other thematic chapters in this report, in particular in Chapters 6, 7, 9 and 11. To explore this further, we present an overview of issues that emerged in the interviews. We begin with the factors that influence the success rate of respondents' funding applications. In a separate subsection, we follow with the factors that are affected by respondents with(out) access to funding. In each of these subsections we begin with factors that revealed statistical significances; however, there is no particular order of the remaining factors' presentation. We close with a brief reflection on the impact of a lack of funding for ECR respondents.

**Factors influencing funding success**

We found a significant positive association ($P<0.0001$) between respondents that were mobile in the ten years prior to the survey and had received funding in the three years prior to the survey, which is presented in more detail in Chapter 11. Though the association is likely to work in both directions and is reflected in the interviews, there were a number of interviewees who described the importance of mobility (and collaboration) specifically for securing funding:

*"I didn't know much about funding opportunities before [going abroad] but after that time… I've been able to [encourage] other younger people to also look for these funding opportunities. But before I left I didn't have any idea."*
**Grace, Female, 35, Nigeria, Western Region, Physical Sciences, Unemployed, PhD**

*"If a grant is not in my research background, I usually look for others [to collaborate with]. For example, if its funding related to agriculture, I usually look for someone from agriculture to combine and work together with."*
**Charles, Male, 35, Kenya (from Ethiopia), Eastern Region, Health Sciences or Medicine, Para-Public, PhD**

We also found a significant positive association (P=0.0021) between respondents' level of satisfaction with their access to infrastructure (equipment, for example) and the achievement of funding in the three years prior to the survey. The importance of equipment availability for successful funding applications was reinforced by interviewees:

*"Because we do not have equipment it becomes difficult to convince [a funder] because…it means you have to include equipment as part of the requirements…While there is probably a person from a well-equipped institution [also applying]. In their application they can state that they have the equipment and all they want [is funding] to collect the samples and other things. If I was the one who was evaluating, I think the one who is already equipped stands a better chance to get funding than the one who is including equipment as part of his needs."*
**Timothy, Male, 32, Zimbabwe, Southern Region, Other (Food Science and Nutrition), Academia, PhD**

One of the issues most consistently raised by interviewees regards the competitiveness of funding applications, and the connection of this to their perception of an outright lack of funding.

*"I see the quality of proposals that are coming through and the relatively small amounts of money that people are asking for, but it's just so oversubscribed that there's just no chance of being able to fund these things. So, I'm seeing really good researchers who aren't getting funding and I really worry that I'm going to sort of fall into that category."*
**Valentina, Female, 42, Oceania (from South Africa), Outside Africa, Physical Sciences, Academia, PhD**

Respondents were clear that – because of the competitiveness and the limited number of funding opportunities as discussed by Valentina – their ability to secure funding rested on how well their research aligned with the priorities of the funding organisation. Although this is expectable to a certain degree, it is a challenge for researchers from a number of areas – such as the physical, formal and life sciences – to align their research with topics that have demonstrably immediate benefit to their communities, which receive privileged treatment by the funding organisations (including governments):

*"In most cases it's very hard to convince these funders that your research is actually valuable, or your research is going to help the community because it… cannot directly help in the community but it can help the community in the long run."*
**Faith, Female, 38, Uganda, Eastern Region, Physical Sciences, Academia, PhD**

Refer to the quotes from Kenneth in section 10.3.2 and Ian further into this section for examples of the effect the priorities of funding organisations have on interviewees' research strategy. For other respondents, the eligibility criteria set by funding organisations had limited their ability to apply. On one side, interviewees declared themselves as ineligible for many forms of ECR-targeted funding until they had received their PhD. Whilst upon having done so, interviewees described how many ECR-targeted funding streams are limited to people who have received their PhD within three to five years prior to the application (variation depending on the funder). Together these factors create a narrow window of opportunity for ECRs to competitively apply for funding:

> *"There are many others, where I have not been eligible because of my qualification. For example, I don't have a PhD now and most of the calls will say, the Principle Investigator should be a PhD holder and those kind of things."*
> **Jack, Male, 38, Uganda, Eastern Region, Life Sciences, Public, Master**

> *"I'm now 37 and actually all the time they're searching for the younger people. Secondly, until this moment I have been eligible because I received my PhD [less than] five years ago, but later on I will not have this. They're going to refuse me…because I will not be within the five year [window] since receiving my PhD degree."*
> **Emily, Female, 37, Europe (from Egypt), Outside Africa, Physical Sciences, PhD**

Whenever ECRs fall outside of these narrow eligibility requirements, they can only compete for funding open to people of all levels of seniority. A good example of how this patchwork system creates prolonged periods of ineligibility (or at least increased difficulty securing funding) is described by Dorcas, who finished her PhD four years prior to the interview:

> *"I am between two funding possibilities, so there are specific funds that target people who have finished their PhD within three years and then there are funds that target people five years after [they complete] the PhD, so I fall in that gap. So right now…I have to compete with people who are much more senior."*
> **Dorcas, Female, 41, Mozambique (from Kenya), Southern Region, Social Sciences, Academia, PhD**

Interviewees also spoke frequently about funding organisations that required them to be affiliated with an institution in Africa in order to get funding. This affected respondents living outside of Africa as well as those living inside Africa. It was particularly difficult for persons who were employed on short-term contracts or even unemployed:

> *"To be able to get funding you need to be affiliated to a research institute. Which I'm trying to get… with an institution back home… I went to that university because I was already there… I was trying to get a letter from them but I couldn't get any help from anyone. The [funder] needs to know that there is an established institution that will receive the funds and be able to administer the funds. I couldn't even get that."*
> **Monica, Female, 35, South Africa (from Zambia), Southern Region, Applied Sciences, Unemployed, PhD**

In more detail, 30.7 % (n=203) of respondents' positions were soft-funded, meaning that they rely on funding from grants for the continuation of their position. Respondents employed in the research sector were more likely ($P \leq 0.0032$) than those in business enterprise ($\beta=2.127$) and HE ($\beta=1.114$) to have soft-funded positions (see table 10.11A in appendices). Interviewees in these kinds of positions had two primary concerns, first they are inherently insecure, and second, they were sometimes ineligible for other forms of funding because funding agencies require permanent employment as well as institutional affiliation (as discussed above):

*"I will soon be leaving my current job because the project is out of funding and I need to look for another job somewhere…Definitely this is the biggest challenge and unfortunately we don't have national funding. We don't have African based funding within the continent."*
**Victor, Male, 46, Kenya (from Cameroon), Eastern Region, Life Sciences, Para-public, PhD**

*"The hiccup is the issue of being on contract because sometimes they would say full-time employees only. Because you're on five-year contract, although you might have been here seven years on contract, it means that you don't qualify."*
**Dorothy, Female, 53, South Africa (from Zimbabwe), Southern Region, Humanities, PhD**

Many of the factors discussed to this point in this section apply to ECRs both inside and outside of Africa, however, those in the diaspora had some specific challenges with securing funding. There were three primary concerns that emerged, which we step through in turn: the first being that ECRs in the diaspora were ineligible for funding on account of not being a citizen of their host country.

*"Here funding opportunities which are mainly targeting locals, most of internationals don't have openings for funding."*
**Stanford, Male, 33, Oceania (from Uganda), Outside Africa, Life Sciences, Academia, PhD**

The second being that they were ineligible because they had already left Africa, and most international funding for African researchers targets those researchers who are still in Africa:

*"There is a situation whereby you're already in the US to do your post-doc or whatever…[and] then you want to apply for opportunities while already in the US. It's almost impossible because there are no opportunities like that…they are meant [only] for researchers currently in Africa [to also come over]… People that are in Africa really need this opportunity to get experience or whatever in a developed country, yes. But also what about Africans that are doing research [there already], they also need to be given opportunities also."*
**Shadreck, Male, 36, Northern America (from Nigeria), Outside Africa, Life Sciences, Academia, PhD**

And the third challenge of ECRs in the diaspora was particular to those in countries where the official language was not their own, thus creating a considerable barrier to their ability to write the application:

*"I found it too challenging to be able to settle in Japan and attract grants. And, of course, majorly because of the language barrier…You must have a secretary who is Japanese so that they can translate those documents for you. And it's quite difficult. You can imagine trying to translate a scientific [application] to Japanese from English. It's really difficult."*
**Fiona, Female, 41, Kenya, Eastern Region, Life Sciences, Academia, PhD**

This applied widely to interviewees in or who had been in Asia for research purposes. Though it was not detected directly in interviews, it is also possible that this effect applies to respondents whose mother tongue is French, Portuguese, or another language, and who are in one of many countries within or outside of Africa with different official languages to their own.

### Factors influenced by successfully securing funding

We saw in the section above that respondents who were more satisfied with their equipment and infrastructure were also more likely to have received funding, with the quote from Timothy illuminating this further. Though that relates to the likelihood of respondents securing funding at all, we also found that funding (once secured) had a positive effect on ECRs' productivity. In particular, we found a significant positive association (P<0.0001) between respondents who had received funding in the three years prior to the survey and the number of journal articles they had published in refereed or peer-reviewed academic journals:

> *"Funding has become very limited this last year and this is also affecting our productivity. If we do not have funds we cannot carry out projects and consequently we cannot produce and we cannot publish… It's very difficult too nowadays because it's very competitive…[But] funding allow us to buy equipment and in my case I cannot work if I don't have equipment."*
> **Gertrude, Female, Tunisia, Northern Region, Life Sciences, Academia, PhD**

### Impact of lack of success with funding

The impact a lack of funding for ECRs has was presented throughout this chapter – from limited access to equipment and supplies, limited productivity and even increased stress for some as they were forced to self-fund their research activities. The impact of a lack of funding also features in discussions in Chapters 6, 7, 9 and 11 of this report. Here we touch on the implications this lack of funding has for a researcher's area of focus – and arguably their autonomy – and briefly return to the very pressing concern from respondents of international mobility, collaboration and conference attendance.

One of the respondents' strategies to improve access to funding was to shape their research area and topic and to align it with the funding agencies' interests. Overall, 37.4 % (n=388) of respondents indicated that access to funding is one influence factor, among several, determining their choice of research topic (3 %, n=31 indicated funding exclusively).

> *"I'm in physical sciences and my interest in the electro properties of nanomaterials… Now, most [of] the African governments of course have got limited resources… they want to fund fields which they see that there's direct benefits of the projects to the African people… So as a result I'm moving towards health applications. I say "okay, if we do this we will be able to diagnose diseases like TB and diabetes."… Then that way they see "okay, this has an immediate application"."*
> **Ian, Male, 43, South Africa (from Zimbabwe), Southern Region, Physical Sciences, PhD**

Naturally, when researchers considerably shift their focus in order to attract funding, this has implications for the autonomy of researchers. Consequently, this may result in affecting the larger macro level (see section 10.3.2). Although this topic exceeds the scope of this study, we emphasize the need and encourage further research.

As already discussed briefly above, international mobility inside and outside of Africa was another strategy respondents frequently used to secure funding, in particular for their Master's and/or PhD studies. These stages of respondents' academic careers are discussed further in Chapter 6 and international mobility is discussed further in Chapter 11 – including, in each chapter, the role of funding with respect to these themes. Those chapters clarify that it is untenable for many (if not all) respondents to rely on mobility and collaborations as primary means to secure funding. Furthermore, a lack of funding had a negative impact on a number of interviewees' possibilities to attend conferences, whether in Africa or abroad:

> *"We can't interact with other people… I'm supposed to be [at another Nigerian university] for a symposium. But the truth is it's about 40,000 Naira, which is about $110 [and] I can't afford it, I just cannot afford it. I've contributed to the book [and] if I had gone to the symposium… I would interact with new people… but the challenge is I cannot pay for [it]."*
> **Judy, Female, 33, Nigeria, Western Region, Social Sciences, Academia, PhD**

## 10.4 Conclusions

First, the analysis of our data has shown that acquiring the funding necessary to pursue research remains a severe barrier for ECRs in Africa. More than two out of five respondents (42.3 %) in need of funding had not been able to successfully apply for the required financial resources in the three years preceding the survey. PhD holders were more successful than holders of a Master's (64.3 % vs. 50.2 %) and respondents living in Southern Africa were significantly more successful than in any other region. Of those respondents who had received funding, almost half (44.6 %) stated that the funding was insufficient for expenses related to research, travel and salary. These figures generally confirm the findings of Beaudry et al. (2018), who report that 55 % of ECRs in Africa were able to acquire funding over the preceding three years. Ngongalah et al. (2018), Nega and Kassaye (2018), Barasa and Omulando (2018), as well as Alabi and Mohammed (2018) had reported the lack of sufficient funding for research to be a major constraint to research and PhD production in African countries.

Our second major finding is a high dependency on international sources for funding of research and training. More than three out of ten (31.1 %) of our respondents reported to have received funding from international organisations based outside of Africa, and an additional 10.4 % successfully acquired funding from an international organisation from within Africa. Funding from their own institutions or government institutions within their own country was reported by 27.4 % and 23.2 % respectively. In particular researchers from the fields of life and health sciences were successful in receiving international funding. Both findings support the results of Beaudry et al. (2018) stating that more than 50 % of their respondents had acquired funding from international sources, and a median of 80 % of funding for research in the health sciences were received from international organisations. This high dependency on non-national financial support may prove particularly critical as the interests of international funding partners seem to focus on issues with a potential to have an impact beyond Africa, e. g. in the case of infectious diseases, as one of our interviewees reported.

Similar conclusions might be derived from research on international research collaborations in Central Africa with partners from abroad (Boshoff 2009; Owusu-Nimo and Boshoff 2017). Owusu-Nimo and Boshoff (2017) report that collaborators from outside of Africa were often found to be instrumental to secure research funds (55 %) or providing other resources (49 %) whereas data collection or field work seemed to be the most frequent role of the Ghanaian co-authors involved in the research projects, a finding that was considered as a particular form of neo-colonial science (Boshoff 2009). The authors call for close monitoring of these international research projects to ensure that participation in all stages and key project activities are conducted as equally as possible.

A third finding is the large share (37.4 %) of respondents stating that access to funding is an important influence on how they shape their research area and topic. To some degree, adapting research to meet the focus of funding programmes and organisations is to be expected from researchers and within the legitimate interest of a state or other organisation to orient research towards a particular aim or goal. For researchers, ECRs in particular, and at the level of the scientific community, the high dependency on external funding may have several unintended side effects.

For instance, some responses of our interviewees on how they adapt their approach to funding match those strategies identified by Laudel (2006) in her study on German and Australian scientists. Examples for strategies such as "targeting all sources" to combine the funds or "selecting externally predetermined topics" feature frequently in the interviews conducted for this study. A particular strategy used by African ECRs to secure funding was national and international mobility. Though Laudel (2006) notes that some of the Australian scientists in her study sometimes spent several months abroad in the labs of their better funded research partners, because they could not afford to equip their labs as required, the mobility reported in this study goes beyond temporary movements, often blurring the boundary to migration. The particular importance of funding for research from international organisations on the African continent has already been discussed and needs to be highlighted as a strong influence both at the level of the individual researcher as well as at a systemic level.

Further unwanted side effects of current funding conditions characterised by a particular form of competitively funded projects may be a trend toward increasingly applied, mainstream, low-risk and inflexible research (ibid.). In her concluding remarks on the adaptive strategies of researchers to their funding environments, Laudel (2006) emphasises that these adverse effects are an effect not of external funding itself, but the particular situation of a lack of recurrent funding and the special conditions attached to external funding.

For ECRs in the early phases of their career, the high degree of dependency on external funding has been shown to have a negative impact on their professional development. Horta, Cattaneo and Meoli (2018) report that a need to work on multiple research project grants may have detrimental effects on PhD students trying to establish a coherent research agenda when they are forced to work on multiple projects with diverse foci.

A fourth finding is the lack of support that ECRs receive when identifying sources and applying for funding. While some interviewees reported good experiences with their institution's research office, a clear majority of 57.9 % of those responding to the survey agreed or strongly agreed to the statement that a "lack of support identifying and applying for funding" had negatively impacted their careers. From a list of 21 factors, this was the third most important factor that respondents perceived to have a negative impact on their careers. Only two other factors were deemed more important: "lack of funding opportunities" and "lack of resources". In light of the findings reported by Laudel (2006) on different adaptive strategies in applying for funding, it is obvious that the knowledge required to successfully apply for scarce financial resources – including basic training in grant proposal writing, but also in assessing the "efficiency" of a funding source, negotiating gainful collaborations that improve the chances of acquiring international funding or adapting projects without leaving one's personal research agenda more than absolutely necessary – are competencies that require specialised institutional support structures and experienced mentorship.

The statistical data on expenditures in research and innovation in African countries and our findings not only confirm that the available resources need to be increased further, but we were able to provide new insights on the impact on how the work and careers of ECRs are affected and how they try to cope with the challenges they are facing. The general lack of funding, the high dependency on funding from international sources, an environment dominated by the need to apply for external funding driving researchers to adaptive strategies with unintended side-effects, and the lack of support in identifying sources and applying for funding characterise a setting that remains an impediment for the professional development of ECRs.

## 10.5 Recommendations

The recommendations have been formulated at four levels, as follows.

### African Governments

- Increase local and regional investment in HE and research systems to ensure that their focus aligns with the agendas set by local and national stakeholders.

### Government, Institutions, and industries

- Invest in emerging fields and interdisciplinary research to drive local innovation, and avoid being curtailed by funding limited to entrenched research fields. Early investment will provide African ECRs with the platform necessary to leapfrog innovation and to lead emerging fields, not being weighed down by pre-existing infrastructure.
- Policies and practices should stipulate the provisions for distinct mentors and supervisors during doctoral and post-doctoral research training. Enable supervisors to focus on research training and mentors to focus on career training.
- Increase salaries for ECRs to a level comparable to their peers in industry-based roles.
- Professionalise postdoctoral positions as a designated staff position to increase eligibility for funding.

### Funding bodies and HEIs

- Establish local and national funding schemes to non-resident scholars, recognising the high mobility of ECRs and the beneficial effect of foreign ECRs on local research output.
- Provide time-flexible funding schemes for female and parenting ECRs. Incorporate provisions for childcare and travel for children into international scholarships.
- Establish small pilot "idea" grants to give ECRs an opportunity to demonstrate capability. Assess these on the idea's potential rather than the researcher's publication record.
- Relax or remove age and time-since PhD restrictions for grant eligibility to reflect the diversity of research journeys. Evaluate the merit of the applicant based on the quality of their research, given their research life course.
- Open funding and grant applications that are intended for an international pool of applicants to submission and review in multiple languages.
- Facilitate and establish institutional research offices that support and manage grant applications and budgets.
- Provide training opportunities to write grant and fellowship applications.
- Provide an appeal process to respond to reviewers' comments. Ensure that grant reviews are constructive and that they offer a development opportunity for ECRs.

### Review panels

- Evaluate African ECRs by their research impact on solving problems relevant to their society.

Provide reviewers' comments and feedback with all grant and funding application outcomes.

These recommendations also appear as Table 10.7a in Appendix 10.7.

## 10.6 References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## 10.7 Appendix

*Table 10.7A – How to increase investments into R&D and configure funding schemes to ECR career stages*

| **Increase local, regional and private investments in R&D; configure contextualised funding schemes to life and career stages of ECRs; and institutionalise research grants management and application support** | |
|---|---|
| **Interlocutors** | **Suggested Policies and Measures** |
| **African Governments** | Increase local and regional investment in HE and research systems to ensure that their focus aligns with the agendas set by local and national stakeholders. |
| **Government, Institutions, and industries** | ▪ Invest in emerging fields and interdisciplinary research to drive local innovation, and avoid being curtailed by funding limited to entrenched research fields. Early investment will provide African ECRs with the platform necessary to leapfrog innovation and to lead emerging fields, not being weighed down by pre-existing infrastructure.<br>▪ Policies and practices should stipulate the provisions for distinct mentors and supervisors during doctoral and post-doctoral research training. Enable supervisors to focus on research training and mentors to focus on career training .<br>▪ Increase salaries for ECRs to a level comparable to their peers in industry-based roles .<br>▪ Professionalise postdoctoral positions as a designated staff position to increase eligibility for funding. |
| **Funding bodies and HEIs** | ▪ Establish local and national funding schemes to non-resident scholars, recognising the high mobility of ECRs and the beneficial effect of foreign ECRs on local research output.<br>▪ Provide time-flexible funding schemes for female and parenting ECRs. Incorporate provisions for childcare and travel for children into international scholarships.<br>▪ Establish small pilot "idea" grants to give ECRs an opportunity to demonstrate capability. Assess these on the idea's potential rather than the researcher's publication record.<br>▪ Relax or remove age and time-since PhD restrictions for grant eligibility to reflect the diversity of research journeys. Evaluate the merit of the applicant based on the quality of their research, given their research life course.<br>▪ Open funding and grant applications that are intended for an international pool of applicants to submission and review in multiple languages.<br>▪ Facilitate and establish institutional research offices that support and manage grant applications and budgets.<br>▪ Provide training opportunities to write grant and fellowship applications.<br>▪ Provide an appeal process to respond to reviewers' comments. Ensure that grant reviews are constructive and that they offer a development opportunity for ECRs. |
| **Review panels** | ▪ Evaluate African ECRs by their research impact on solving problems relevant to their society.<br>▪ Provide reviewers' comments and feedback with all grant and funding application outcomes. |

*Table 10.8A – Funding received in three years prior to survey*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| PhD | Master | Born | 0.800 | 0.0002 |
| Outside Africa | Western Region | Born | 1.847 | 0.0456 |
| Southern Region | Northern Region | Born | 1.312 | 0.0136 |
| Southern Region | Western Region | Born | 1.309 | <0.0001 |
| Eastern Region | Western Region | Born | 0.988 | 0.0017 |
| Southern Region | Western Region | Ms | 1.321 | <0.0001 |
| Eastern Region | Western Region | Ms | 1.087 | 0.0066 |
| Outside Africa | Western Region | Ms | 1.039 | 0.0022 |
| Research | Business Enterprise | Ms | 2.402 | 0.0001 |
| Higher Education | Business Enterprise | Ms | 2.034 | 0.0007 |
| Southern Region | Western Region | PhD | 1.653 | <0.0001 |
| Outside Africa | Western Region | PhD | 1.290 | 0.0002 |

Source: Authors.

*Table 10.9A – Funding from government organisations in home or host country*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Southern Region | Northern Region | Born | 1.743 | 0.0003 |
| Southern Region | Non-focal Africa | Born | 1.701 | <0.0001 |
| Outside Africa | Northern Region | Born | 1.619 | 0.0230 |
| Outside Africa | Non-focal Africa | Born | 1.578 | 0.0033 |
| Southern Region | Western Region | Born | 1.565 | <0.0001 |
| Outside Africa | Western Region | Born | 1.442 | 0.0033 |
| Southern Region | Eastern Region | Born | 1.303 | <0.0001 |
| Outside Africa | Eastern Region | Born | 1.179 | 0.0469 |
| Southern Region | Western Region | Ms | 1.720 | <0.0001 |
| Southern Region | Eastern Region | Ms | 1.413 | <0.0001 |
| Southern Region | Northern Region | Ms | 1.389 | 0.0048 |
| Southern Region | Non-focal Africa | Ms | 1.365 | 0.0003 |
| Southern Region | Outside Africa | Ms | 1.115 | 0.0001 |
| Southern Region | Northern Region | PhD | 2.078 | 0.0130 |
| Southern Region | Western Region | PhD | 1.627 | 0.0001 |

Source: Authors.

*Table 10.10A – Funding from international organisations outside of Africa*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| PhD | Master | Born | 0.705 | <0.0001 |
| Life and Health Sciences | Applied Sciences | Born | 0.943 | 0.0134 |
| Life and Health Sciences | Social and Humanities | Born | 0.656 | 0.0108 |
| Life and Health Sciences | Physical Sciences | Born | 0.573 | 0.0229 |
| Outside Africa | Southern Region | Born | 1.355 | 0.0077 |
| Outside Africa | Western Region | Born | 1.189 | 0.0208 |
| Eastern Region | Southern Region | Born | 0.874 | 0.0067 |
| Eastern Region | Western Region | Born | 0.709 | 0.0145 |
| Life and Health Sciences | Applied Sciences | Ms | 0.945 | 0.0139 |
| Life and Health Sciences | Social and Humanities | Ms | 0.714 | 0.0052 |
| Life and Health Sciences | Physical Sciences | Ms | 0.542 | 0.0412 |
| Eastern Region | Western Region | Ms | 0.976 | 0.0018 |
| Eastern Region | Southern Region | Ms | 0.924 | 0.0061 |
| Outside Africa | Western Region | Ms | 0.753 | 0.0184 |

Source: Authors.

*Table 10.11A – Desire for additional time to seek and write funding and grant applications*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Northern Region | Outside Africa | Born | 2.334 | 0.0003 |
| Eastern Region | Outside Africa | Born | 2.311 | <0.0001 |
| Western Region | Outside Africa | Born | 2.228 | <0.0001 |
| Non-focal Africa | Outside Africa | Born | 1.955 | 0.0003 |
| Northern Region | Southern Region | Born | 1.328 | 0.0199 |
| Eastern Region | Southern Region | Born | 1.304 | <0.0001 |
| Western Region | Southern Region | Born | 1.222 | <0.0001 |
| Non-focal Africa | Southern Region | Born | 0.949 | 0.0203 |

*Table 10.11A – Continued*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Northern Region | Southern Region | Live | 1.528 | 0.0063 |
| Eastern Region | Southern Region | Live | 1.374 | <0.0001 |
| Western Region | Southern Region | Live | 1.329 | <0.0001 |
| Non-focal Africa | Southern Region | Live | 1.149 | 0.0022 |
| Eastern Region | Southern Region | Ms | 1.393 | <0.0001 |
| Western Region | Southern Region | Ms | 1.151 | <0.0001 |
| Non-focal Africa | Southern Region | Ms | 1.143 | 0.0224 |
| Eastern Region | Outside Africa | Ms | 1.029 | 0.0099 |
| Western Region | Outside Africa | Ms | 0.788 | 0.0232 |
| Southern Region | Non-focal Africa | PhD | 1.496 | 0.0078 |
| Western Region | Southern Region | PhD | 1.092 | 0.0007 |
| Western Region | Outside Africa | PhD | 0.822 | 0.0218 |

Source: Authors.

*Table 10.12A – Soft-funded positions*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Research | Business Enterprise | Born | 2.250 | 0.0021 |
| Private non-profit/ NGO | Business Enterprise | Born | 2.050 | 0.0350 |
| Research | Higher Education | Born | 1.136 | 0.0001 |
| Research | Business Enterprise | Live | 2.127 | 0.0032 |
| Research | Higher Education | Live | 1.114 | 0.0001 |
| Research | Business Enterprise | Ms | 2.026 | 0.0055 |
| Research | Higher Education | PhD | 1.739 | <0.0001 |

Source: Authors.

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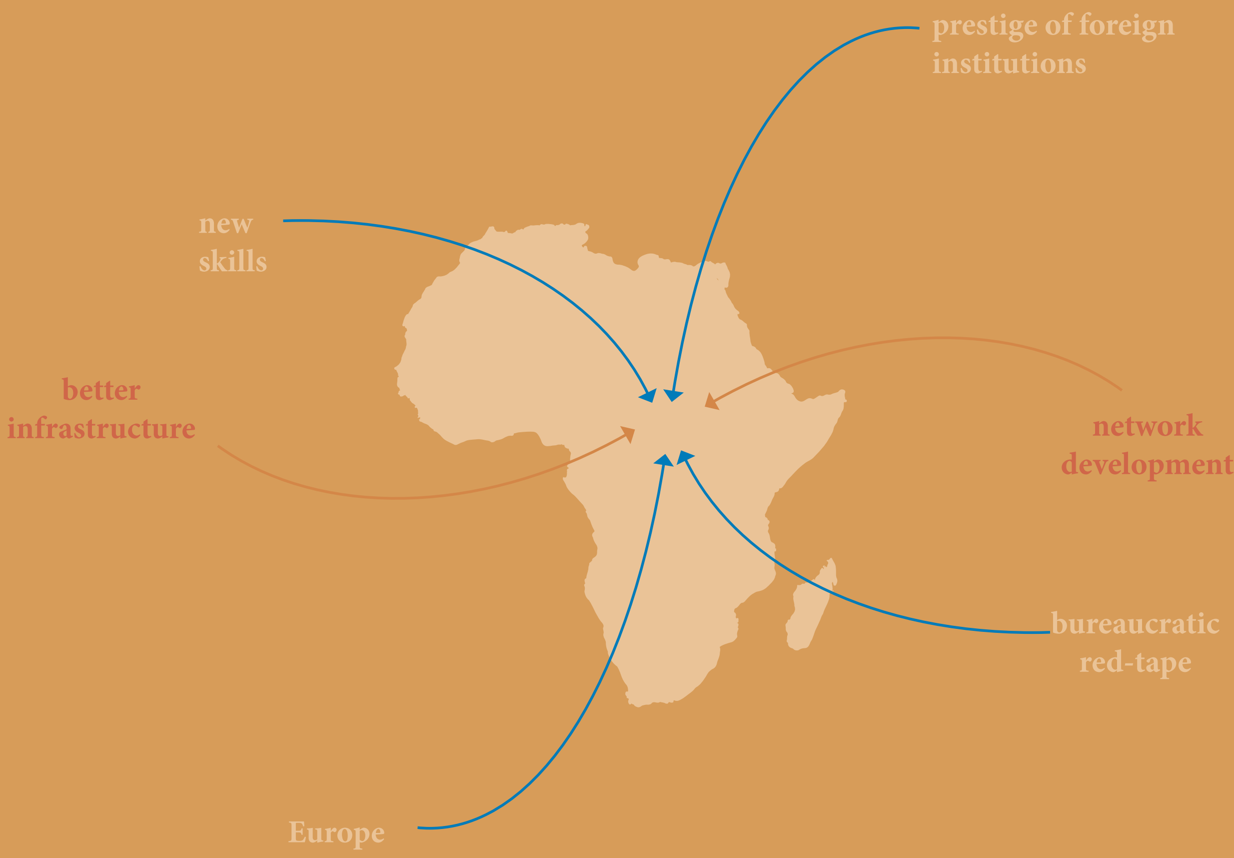

# 11 International mobility and collaborations

*"Science is not situated in one place…we need to make many sites of scientific collaboration."*
**Ethan, Male, 36, Egypt, Northern Region, Life Sciences, Public, PhD**

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| CAP | Changing Academic Profession |
| CDH | Careers of Doctorate Holders |
| ECR | Early-career researcher(s) |
| EU | European Union |
| HDI | Human Development Index |
| HE | Higher education |
| NGO | Non-government organisation |
| OECD | Organisation for Economic Co-operation and Development |
| PhD | Doctor of Philosophy |
| STEM | Science, technology, engineering and mathematics |
| UNESCO | United Nations Educational, Scientific and Cultural Organisation |
| USA | United States of America |

## 11.1 Introduction

In this chapter, we present an overview of the mobility patterns of our African early-career researcher (ECR) respondents during the different stages of their tertiary education and career. We discuss the benefits, challenges and barriers to international mobility they have experienced and provide an in-depth analysis of the relationship between mobility and the propensity for collaborative networks. In order to nuance the outcomes and recommendations, we distinguish mobility within Africa and mobility elsewhere in the world, as well as short and long-term mobility. We address the following questions directly:

*Mobility*

(1) Do ECRs leave their home countries for part of their training (at a Master's, PhD, postdoc level)? If so, why? What influences the destination (within or outside of Africa)? How long do they stay there?
(2) What are the benefits and challenges of ECRs regarding mobility outside their home country? And what factors entice ECRs to stay there?
(3) What factors entice ECRs to return to, or cause them to stay, in their home countries? What are the challenges faced by ECRs returning to their home country from elsewhere in Africa or outside of Africa?
(4) What are the barriers to short and long-term international mobility for ECRs?

*Collaboration*

(5) How often do ECRs form collaborations and with whom? What factors influence the types of collaborations ECRs form?

(6) What formal and personal networks do ECRs access and does this impact their collaborations and mobility?

Whilst these questions are our focus, we keep the discussion of the underlying questions of this study in view: (1) What are the opportunities and challenges that ECRs in Africa face in pursuing a career in research?

(2) Do these differ by region, discipline, employment sector, highest qualification, gender, or academy membership?

We conclude with recommendations for enabling the international mobility and collaboration efforts of ECRs.

## 11.2 Literature review

### 11.2.1 Introduction

International mobility and collaboration of researchers are key policy topics at the national level, highly relevant to research-oriented institutions and of no lesser importance for individual researchers (Huang 2014). International scholars may bring new skills and different research approaches to institutions (Cantwell 2011; Welch 1997) and increase the availability of highly skilled workers in a country (Regets, 2007; United Nations Educational, Scientific and Cultural Organisation (UNESCO) 2015). Both international mobility and research collaborations have become indicators in higher education (HE) rankings, providing universities with an incentive to hire internationally mobile staff and support international collaboration (Marginson and van der Wende 2009; Times Higher Education 2018). The imbalance of flows of scholars and other highly skilled labour between "peripheral regions" and "metropolitan" centres (often framed in terms of regional "brain drain", "brain gain" or "brain circulation") has usually focused on migration to the United States of America (USA) or Europe, but may see a shift of destinations in light of rising new centres of HE in South and East Asia (Gaillard and Gaillard 1997; Scott 2015; OECD 2018). For the African context, the notion of "brain drain" predominates the perceived flow of highly skilled scientists from the continent to other world regions (Network of African Science Academies 2009). Yet these mere perceptions are grounded in hearsay, with reliable figures on the number of graduates who immigrate long-term that are poorly curated or non-existent for most Africa countries. Recent developments indicate a need to investigate not only those who leave but the frequency with which African researchers return, either to their home country or another country within Africa (e.g. Blom, Lan and Adil 2016). Within the context of long-term investment in the capacity of the African R&D sector, understanding the motivations and patterns of mobility of African ECRs is crucially important.

### 11.2.2 Prevalence of international mobility

In contrast to the inherent growth potential attributed to international mobility, data regarding the movement patterns of academics and researchers is rather scarce and fragmented (Scott 2015; Teichler 2017; Sehoole et al. 2019; Rostan and Ceravalo 2015). Scott (2015) as well as Teichler and Cavalli (2015) highlight some reasons for this lack of reliable data:

- The classifications of persons under consideration (e.g. scientists, scholars, academics or researchers) differ, or the terms may be used differently depending on the context. While researchers are usually monitored in statistics for research and development, different groups of academics are often listed in educational statistics. Further differences exist between the stages of formations considered (e.g. Master's degree, Doctor of Philosophy (PhD)), raising the question whether doctoral students should be classified as students or young academic staff. Additional difficulties for the classification may arise when persons only work part-time as scholars, or when researchers are only hired for individual projects.
- The timing, duration, frequency and patterns of mobility and migration account for a broad range of approaches and interpretations, limiting the possibilities for comparison.
- The roles or functions of mobility for individuals vary, e.g. short-term or long-term educational or different professional options such as conferences, short-term lab visits or teaching assignments, and long-term stays in other countries that may lead to a change of citizenship, blurring the boundary between mobility and migration.
- The relevance attributed to mobility and migration within the larger context of the internationalisation of HE and research in a globalised world varies in relation to other aspects such as (international) collaboration or the inclusion of international perspectives in research and teaching.

At an aggregate level, data from international surveys and statistics allow a description of the overall scale of internationally mobile academics and PhD holders. Based on data from the international comparative Changing Academic Profession (CAP) study, 42 % of academics surveyed from 18 countries had been mobile during their career, but only one African country was included.[47] Rostan and Ceravalo (2015) created a six-tier typology of academic international mobility to classify the purpose and prevalence of each pattern observed:

i. Sedentary: 58 % had never engaged in international mobility,
ii. International educational circulation: 16 % earned at least one HE degree abroad,
iii. International short-term professional circulation: 10 % had spent no more than two years abroad,
iv. International long-term professional circulation: 6 % had stayed abroad for more than two years,
v. Professional migration: 6 % are employed in a country different from their country of birth, and
vi. International early migrants: 5 % moved to a country to earn a degree and later found employment in HE.

The labour market doctorate holders encounter is more international than the one other tertiary graduates face (Auriol 2010). Based on data from the Careers of Doctorate Holders (CDH) study[48], which did not include any African country, 14 % of doctorate holders, on average across participating countries, had been internationally mobile during the 10 years preceding the survey (Auriol, Misu and Freeman 2013). However, this did not include doctoral holders who had not returned to their home country and thus the authors considered this average a low estimate (ibid.).

International mobility at the level of doctoral education has been increasing, with foreign students accounting for 26 % of enrolments across OECD countries (OECD 2018, p. 220). Though the USA may attract the largest absolute number of international doctoral students (UNESCO 2015), other OECD countries report higher shares of international students at the doctoral level, ranging from 85 % in Luxembourg,

47 The CAP study collected data in 18 countries (Argentina, Australia, Brazil, Canada, China, Finland, Germany, Italy, Japan, Korea, Malaysia, Mexico, Norway, Portugal, The Netherlands, South Africa, United Kingdom and United States of America (USA)) and the special administrative unit of Hong Kong (Teichler, Arimoto and Cummings 2013).

48 Countries participating in the 2010 CDH data collection: Belgium, Bulgaria, Croatia, Denmark, Finland, Germany, Hungary, Iceland, Israel, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Slovenia, Spain, Sweden, Switzerland, Chinese Taipei, Turkey, USA (Auriol, Misu and Freeman 2013, p. 14).

55 % in Switzerland, 43 % in the United Kingdom, 40 % in France and the USA to 3 % in Mexico and 2 % in Poland (OECD 2018, p. 228).

It is highly probable that a substantial part of these doctoral students are from non-OECD countries (van der Wende 2015, p. S74). In 2013, the outbound mobility ratio[49] of doctoral students for Sub-Saharan Africa was 4 %, second only to Central Asia with a ratio of 7.6 % and well above the world average of 1.8 % (UNESCO 2015).

For the African continent, reliable detailed information on the mobility of researchers is even more fragmented and scarce than for Europe or the USA. Blom, Lan and Adil (2016) use a bibliometric approach to assess researchers' mobility in Sub-Saharan Africa in Science, Technology, Engineering and Mathematics (STEM) fields, identifying distinct mobility patterns, based on different mobility classes (sedentary, brain outflow, transitory and brain inflow) for researchers from Eastern Africa, Western and Central Africa, and Southern Africa, with South Africa separated from other Southern countries. Western and Central Africa (41.8 %) and South Africa (34 %) report the highest percentages of sedentary researchers, Southern Africa (14,7 %) the lowest share (ibid., p. 67). Brain outflow is highest in Southern Africa (13.1 %) and Eastern Africa (9.7 %) while brain inflow is highest in Eastern Africa (9.1 %) and South Africa (8.9 %) (ibid., p. 67).

Regional hubs in Africa, South Africa in particular are becoming popular destinations for students, doctoral students and academic staff (Herman and Sehoole 2018; Sehoole 2011; Lee and Sehoole 2015; Sehoole et al. 2019). Other regional hubs for HE in Africa or countries with growing capacities for the training of PhDs in Africa are Egypt, Ethiopia, Ghana, Kenya, Mauritius, Nigeria and Senegal (British Council 2018; Akudolu and Adeyemo 2018; Barasa and Omulando 2018; Dimé 2018; Mohamudally-Boolaky and Padachi 2015; Nega and Kassaye 2018).

### 11.2.3 Drivers, barriers and impacts of international mobility

Drivers and barriers for international mobility can be identified at continental, national, institutional and individual levels. At the regional or continental level, the Academic Mobility Scheme in Africa (African Union 2018; European Commission 2019) aims at harmonising HE and promoting intra-African academic mobility. National policies targeted at attracting international students to doctoral programmes are commonly based on the belief that international talent will provide an edge in global scientific and economic competition (van der Wende 2015). At the national level, policy-related factors (e. g. travel visa restrictions) as well as economic and research conditions are reported as the main factors which impact international mobility of research scientists (Appeltet al. 2015). Even though regulations may be in place to facilitate mobility of academic staff, the actual experience of foreign academic staff trying to acquire a work permit may be difficult, as reported for South Africa (Sehoole et al. 2019). As already noted, a faculty composed of international staff is a scored indicator in some HE rankings (Marginson and van der Wende 2009; Times Higher Education 2018), rewarding universities for hiring international researchers. These incentives may drive organisations to "appear international" (Ackers 2008, p. 420), discriminating against nationals and scientists aiming to return to their home country in their hiring practices to raise the proportion of international researchers in the faculty. Oanda Ogachi (2016) analysed the state of national and institutional policies in African countries that aimed at facilitating members of the academic African diaspora to connect with African HE; Oanda Ogachi (2016) concludes that limitations at the institutional level (such as poor infrastructure and facilities), bureaucratic red tape, governance structures that do no facilitate connections with the diaspora and hierarchical structures all limit the engagement with the

49 Proportion (in %) of all tertiary students from the host country that move abroad for education.

academic African diaspora. A competitive research environment (including aspects such as the proximity to industry and the reputation of the hiring institution) and the availability of research funding are reported to be more important to top researchers than other factors such as salaries when considering opportunities for international mobility (Halme et al. 2012).

Based on data from the Global Science study, factors related to career prospects, the quality and prestige of the foreign institution and opportunities to extend the personal network were the most influential (Franzoni, Scellato and Stephan 2015). In contrast to those who highlight economic factors as the main drivers for international mobility, Baruffaldi and Landoni (2016) point to unsatisfied aspirational factors such as the personal need for independence, intellectual challenge and social status that stir intentions for international mobility. In the Global State of Young Scientists (GloSYS) Association of Southeast Asian Nations (ASEAN) regional study, respondents rated factors such as the acquisition of new skills, access to or development of the research network and better prospects for career advancement as the most relevant reasons for their intentions to leave their country (Geffers et al. 2017, p. 66). Lower rates of international mobility are reported for female compared to male researchers and for researchers with children, suggesting that family responsibility influences the decision and ability to move (Boring et al. 2015; Reale, Morettini and Zinilli 2019).

The impact of international mobility on the work and career of researchers is generally positive, but not unambiguous. Most studies report that internationally mobile scientists outperform non-mobile researchers. Veugelers and van Bouwel (2015) report positive effects of international mobility on research productivity and other career aspects like future job opportunities, career development and access to research infrastructure. Various studies report positive statistical associations between international mobility and scientific output and citation impact (Halevi, Moed, and Bar-Ilan 2016; Kwiek 2016; Aksnes et al. 2013; Franzoni, Scellato and Stephan 2012, 2015; Baruffaldi and Landoni 2012; Blom, Lan and Adil 2016; OECD 2017; De Filippo, Sanz Casado, and Gomez 2009). Though these associations of international mobility and increased output/impact are well documented, establishing a causal relation is more difficult (Guthrie et al. 2017). Mobility, the authors note, could be a marker and not necessarily a driver of academic excellence (ibid.). Mouton, Prozesky and Lutomiah (2018) report a positive relationship between international mobility and international collaboration by ECRs in Africa. An analysis of curricula vitae drawn from the Uganda National Council for HE from academics with a PhD and above confirms the findings from Beaudry et al., indicating that academics studying in countries high on the Human Development Index (HDI)[50] were 1.35 times more likely to collaborate internationally per year (Eduan 2019). Internationally mobile researchers, from or living in Europe, Australia, Brazil, Canada and India also report that their mobile experience had a positive impact on their research network (IDEA Consult, WIFO and Technopolis 2017; Scellato, Franzoni and Stephan 2015; Franzoni, Scellato and Stephan 2015; De Filippo, Sanz Casado and Gomez 2009) and access to funding (Canibano, Otamendi and Andujar 2008).

Challenges and potentially negative experiences of international mobility relate to the cultural "shock" experienced in the new environment (Groves, Montes and Carvalho 2018), including the necessary steps required to adjust the life-family-work-balance, to learn the language and to adjust at a cultural level (McAlpine 2012). International mobility may also be less of a choice, and better described as forced mobility between jobs when contracts expire, rather than a voluntary movement between institutions and countries (Ackers 2008).

50 The HDI has been developed as an alternative measure to economic growth alone, building on measures of health, knowledge, and standard of living. (Source: http://hdr.undp.org/en/content/human-development-index-hdi)

### 11.2.4 Collaboration

Research collaboration as a research subject in itself has a long tradition, but has recently received increased interest (Smith 1958; Price 1963; Katz and Martin 1997; Wagner 2005; Sonnenwald 2007; Wuchty, Jones and Uzzi 2007; Bozeman, Fay and Slade 2013). The diversity of research perspectives dedicated to the analysis of this phenomenon has resulted in a multitude of terminologies, methods and forums of publication, straining efforts to achieve a common understanding of research collaboration (Sonnenwald 2007). In a wide sense, definitions of the term *research collaboration* describe it as a temporary social process between scholars or scientists in which they share knowledge, skills and techniques, technical and financial resources, divide labour, become interdependent and provide bilateral stimulation usually with the aim of producing knowledge (Katz and Martin 1997; Laudel 2002; Bozeman, Fay and Slade 2013; Jeong, Choi and Kim 2014; Kosmützky 2018). Collaborations may occur at different organisational levels (e.g. individual, institutional, national or international), between different sectors (e.g. university/HE and industry), between disciplines, between different ranks of academics or between female and male researchers (Subramanyam 1983; Abramo, D'Angelo and Murgia 2014; Bozeman, Fay and Slade 2013; Bozeman and Gaughan 2011).

International collaboration in research is increasing (Pan, Kaski, and Fortunato 2012; Benavent-Pérez et al. 2012; Adams 2013; Wagner, Whetsell and Leydesdorff 2017). Based on an analysis of international co-authorship of research articles, we have entered a "fourth age of research", characterised by an increasing collaboration of international research groups, signalling a further shift away from previous modes of scientific knowledge production by individuals or collaborations at the institutional or national level (Adams 2013). There are different trends for established and emerging economies: Over the last three decades, papers with unexceptionally national authors flatlined in the United States and Western European countries. The total rise in output was due to international collaborations and resulted in a falling share of papers with unexceptionally national authors (ibid.). For countries representing emerging economies in this study (China, Brazil and South Korea), Adams (2013) reports a rapidly growing domestic output and an almost constant percentage of entirely national papers of about 75 % (ibid.).

A common method to measure and analyse research collaborations are bibliometric analyses of co-authorships, usually resulting in metrics or descriptions of networks (Katz and Martin 1997; Bukova 2010; Savanur and Srikanth 2010). Subramanyam (1983) highlights the benefits of using co-authorship of research papers as measure of collaboration: 1) the number of co-authors in a defined sample is invariant and other researchers with access to the same set of data should be able to reproduce the results; 2) the results are quantifiable; 3) the method is non-reactive, i.e. the process of research on collaboration is not affecting the process of collaboration itself. Katz and Martin (1997) note that the size of the sample that can be analysed can be substantial and the findings more statistically relevant than findings based on smaller samples from case studies.

Whether this operationalisation of research collaboration is adequate has been subject to debate. Laudel (2002) notes two assumptions central to this practice of studying research collaboration: First, that all people named as co-authors participated in the collaborative research process, and, second, that everyone who participated in the process will be named as a co-author. The first assumption has been questioned not least in light of unethical behaviour termed "honorary" or "ghost" authorships, a trend toward "hyper-authorship" or "author inflation" (Cronin 2001; Bozeman, Fay and Slade 2013; Bergen and Bressler 2017). The second assumption refers to the question whether or not some kind of collaborations or contributions are not being reflected in co-authorships. This limitation is further compromised by this methodology only capturing "successful" collaboration which results in publication. It does not reflect all instances of collaboration, particularly those which are less successful, or inherently do not result in referenceable publications. Melin and Persson (1996) report findings from a small scale study at a single university, where only about 5 % of the authors contacted for the study indicated situations where a research collaboration did not result in a paper co-authored by those involved. Laudel (2002) questions this low share of co-authorship or acknowledgment. In her research, she identifies six types of collaborations within research groups with specific patterns of reward, half of which are not reflected in formal channels (ibid). In their review of literature on research collaboration, Katz and Martin (1997) suggest that co-authorship is no more than a partial indicator of research collaboration. Alternative measures of the prevalence of different types of collaborations and related factors are based on survey data (e. g. Teichler, Arimoto and Cummings 2013; IDEA, WIFO and Technopolis 2017; Geffers et al. 2017).

Research on international collaboration patterns (Leydesdorff and Wagner 2008) has identified a global network with a core group of countries with strong research systems. Research on scientific collaborations with and within Africa has received increasing attention in the last few years. In general, research collaboration between African countries is reported to be low (Blom et al. 2016; Toivanen and Ponomariov 2011; Boshoff 2010) and international collaborations with non-African countries are more frequent than collaborations within the continent or region (Blom, Lan and Adil 2016; Onyancha and Maluleka 2011). In Africa, international collaborative research articles are growing faster than single-country articles: between 2007 and 2011, internationally collaborative papers increased by 66 % while the single-country papers increased by only 35 % (Pouris and Ho 2014). The authors interpret their findings as a sign of still subcritical research systems on the continent which depend on foreign funding sources and research priorities (ibid.). Further research on scientific collaboration within Africa has focused on the identification of regional collaboration patterns and drivers. Collaboration clusters where collaboration is driven by geographic proximity, culture and language have been described within Africa: a Northern group, sharing language and culture; a Western Africa group including Benin-Togo connected to Cameroon, with French as the connecting language; a group connected by English as a common language, including Kenya and geographical neighbours but also Nigeria, Ghana and Gambia; and a group linked to South Africa (Adams et al. 2014). This grouping mostly corresponds with the findings of Toivanen and Ponomariov (2011) who identify three distinct research regions in Africa: Southeastern, Western, and Northern. Examining the structure and dynamics of scientific collaboration between Northern Africa countries (Algeria, Egypt, Morocco and Tunisia), Egypt has been identified as a regional research hub impacted by its strong link to Saudi Arabia (Landini, Malerba and Mavilia 2015).

Tables 11.1 and 11.2 give an account of findings on different types of national and international collaboration reported by researchers in two major surveys, the CAP study (for which South Africa was the only African country included, see Teichler, Arimoto and Cummings 2013) and the MORE3 study which only included European countries (IDEA Consult, WIFO and Technopolis 2017) reflecting data collected in 2007–2008 and 2016. The results point to some differences between groups and their engagement in international research collaboration: 1) The propensity for international research collaboration is higher for researchers from economically advanced countries and countries with mature HE systems than for researchers from emerging countries; 2) seniority and advanced career stages are associated with higher engagement in international research collaboration; and, 3) male researchers indicate experience with international research collaboration more frequently than female researchers. Similar findings have been reported by Bozeman and Gaughan (2011), Abramo, D'Angelo and Murgia (2013, 2014), Shin, Lee and Kim (2013) and Kwiek (2018). Engaging in experimental research in the natural sciences, mathematics or engineering has also been related to higher rates of involvement in international research collaboration than research in the social sciences or humanities (IDEA Consult, WIFO and Technopolis 2017; Kwiek 2018).

*Table 11.1 – Average percent of HE researchers engaging in varying types of collaborative research, stratified by country descriptors and researchers' level of experience*

| | Advanced countries a) | Emerging countries b) | South Africa |
|---|---|---|---|
| **All respondents** | | | |
| **Working individually** | 52 | 47 | 64 |
| **Project collaboration** | 78 | 75 | 63 |
| **National collaboration** | 62 | 53 | 53 |
| **International collaboration** | 50 | 32 | 41 |
| **Seniors* at universities** | | | |
| **Working individually** | 50 | 44 | 62 |
| **Project collaboration** | 84 | 80 | 62 |
| **National collaboration** | 73 | 61 | 51 |
| **International collaboration** | 67 | 41 | 37 |
| **Juniors* at universities** | | | |
| **Working individually** | 51 | 45 | 61 |
| **Project collaboration** | 79 | 76 | 63 |
| **National collaboration** | 61 | 52 | 56 |
| **International collaboration** | 50 | 31 | 45 |

Source: Teichler, Arimoto and Cummings (2013); selected data from table 6.7; a) "advanced" countries include: Australia, Canada, Finland, Germany, Italy, Japan, Norway, Portugal, The Netherlands, South Korea, United Kingdom, United States of America and Hong Kong Special Administrative Region; b) emerging countries include: Argentina, Brazil, China, Malaysia, Mexico and South Africa.
The CAP study identifies respondents as seniors when employed in staff categories equivalent to full or associate professors in the USA, whereas all others were classified as junior academics (ibid., p. 28).

*Table 11.2 – National and international collaboration*

| | European Union (EU) total | Per (current) career stage a) | Per Gender |
|---|---|---|---|
| **Researchers in your country** | 62,9 % | R1: 51.2 %<br>R2: 54.5 %<br>R3: 63.1 %<br>R4: 73.7 % | F: 62.2 %<br>M: 63.4 % |
| **Researchers in EU countries** | 63,2 % | R1: 39.5 %<br>R2: 48.3 %<br>R3: 67.7 %<br>R4: 78.2 % | F: 60.1 %<br>M: 65.2 % |
| **Researchers in non-EU countries** | 45,9 % | R1: 22.9 %<br>R2: 31.0 %<br>R3: 47.1 %<br>R4: 64.8 % | F: 40.5 %<br>M: 49.3 % |

Source: IDEA Consult, WIFO and Technopolis (2017), selected data from table Section 10.1.3, International Collaboration (IDEA Consult et al., 2017, p. 133); a) R1: first stage researcher (up to the point of PhD), R2: recognised researcher (doctorate holders or equivalent level of experience), R3: established researcher, R4: leading researcher (see IDEA Consult, WIFO and Technopolis, pp. 195–196).

Research collaboration of academics and scientists in Africa is highest at intra-institutional level (62.9 %), followed by international collaboration (36.9 %), inter-institutional collaboration at the national level (35,7 %) and collaboration with partners in other African countries as the lowest share of 1.3 % (Mouton, Prozesy and Lutomiah 2018, p. 152). Most of the findings of Mouton et al. (2018) confirm the differences between groups (age, gender and academic rank) presented above.

Interdisciplinary research is commonly understood as pursuing research beyond the boundaries of traditional disciplines. Those in favour of this type of research collaboration considered it best-suited or even required to address complex societal challenges, to stimulate disruptive innovation and facilitate the transfer of research findings to economic and societal application (Allmendinger 2015). Interdisciplinary research careers may offer particular opportunities in terms of interdisciplinary learning experiences, but the often unclear or non-existent professional pathways may prove a source of frustration (Holley 2018). Findings from the MORE3 survey indicate a generally positive perception of interdisciplinary research collaboration. 73.5 % of the responding researchers report to have collaborated with other fields (IDEA Consult, WIFO and Technopolis 2017). Experience in interdisciplinary research collaboration increases according to the career stage, starting with 66.2 % for first stage researchers (R1) to 77.5 % for leading researchers (R4). Besides, it varies between fields of research from 67.7 % in the social sciences to 84.7 % in the agricultural sciences (ibid., p. 140). The results from the MORE3 survey do not indicate gender differences in interdisciplinary research, but previous research found women to be more often involved in interdisciplinary research collaboration (van Rijnsoever and Hessels 2011).

Intersectoral collaboration and mobility of researchers between universities and industrial or other non-academic sectors is considered essential to maintain and improve the economic competitiveness of countries and regions (EURAXIND 2017). Motives for researchers to engage in collaborative research with industry may include the desire to pursue research that is more applicable with "real life" problems and improve employment options in non-academic sectors (Borrel-Damian, Morais and Smith 2015). Collaboration with non-academic sectors is reported overall by 35.5 % of researchers working in HE in Europe (IDEA Consult, WIFO and Technopolis 2017), but this average is lower for early stage researchers (24.6 %), female researchers (30.5 %) and humanities (26.4 %) and the social sciences (29.2 %) (ibid.). Such data within the African context is lacking.

Whether or not female and male researchers collaborate differently or experience different opportunities to collaborate is a question that has received some attention in light of the importance of scientific collaboration for a research career as well as a possible explanation for the underrepresentation of women in various STEM fields, particularly at the more senior levels. An earlier study reported that women in science experienced more collaboration during their early career but faced difficulties in establishing egalitarian, collegial collaborations later in their career (Sonnert and Holton 1996). Bozeman and Corley (2004) reported female researchers to have a somewhat lower number of collaborators and identified different collaboration patterns between scientists of both genders, showing that female scientists have a higher percentage (36 %) of collaborating with other female researchers than their male peers (24 %). Striking differences between different ranks of female researchers exist, with non-tenured female faculty having other female researchers as collaborators in the majority of their collaborations (84 %) while tenured females collaborate much less (34 %) with other females (ibid.). But this may be inherently linked to the paucity of female researchers at the senior level for them to collaborate with. In a more recent study, Bozeman and Gaughan (2011) have found evidence contradicting earlier findings, whereas women tend to have more collaborators and little differences in collaboration in comparison to men. A more recent study on gender differences in scientific collaborations identified female researchers to have a higher propensity for egalitarian compositions of gender in research collaborations while men are more likely to collaborate with other men (Araújo et al. 2017). Summarising the findings from previous studies, some might be considered contradictory or an expression of an ongoing change (Bozeman and Corley 2004; Bozeman and Gaughan 2011). Generally, female researchers seem to pursue interdisciplinary research collaborations more than their male peers, but tend to have fewer international and intersectoral research collaborations (van Rijnsoever and Hessels 2011; Abramo, D'Angelo and Murgia 2013; IDEA Consult, WIFO and Technopolis 2017; Kwiek 2018).

The increase of different forms of research collaborations is driven by a wide range of factors. Advancements in fundamental science require more complex, often large scale research instruments culminating in escalating costs that need to be shared at the national, regional or even international level (Katz and Martin 1997; Beaver 2001). The growth of knowledge requires more knowledge and specialisation to make significant advances at the frontier of knowledge, but specialised researchers increasingly require other researchers and professions to provide those contributions they cannot provide due to lack of specialised skill or time (Jeong, Choi and Kim 2011, 2014; Laudel 2002; Beaver 2001; Katz and Martin 1997). Some specialised skills and tacit knowledge in particular may need to be learned "on the job", requiring sufficient time and collaboration to be conferred between the partners (Laudel 2002; Katz and Martin 1997).

Academic excellence is a factor in attracting international collaboration as are opportunities for informal, face-to-face communication and prospects to access external funds (Jeong et al. 2014). Policy measures such as the introduction of incentive systems conducive to scientific publishing (Kyvik and Aksnes 2015) may orient researchers towards international collaboration and publishing. Research collaborations between (Central) African countries and non-African partners have been found to include different roles, with African partners largely involved in the collection of data and fieldwork and partners from outside of Africa being instrumental in providing resources (facilities, instruments, equipment) and securing research funds (Boshoff 2009; Owuso-Nimo and Boshoff 2017). Beaver (2001) shares a list of purposes that may motivate researchers to engage in scientific collaborations: obtain prestige or visibility; improve access to funds; enhance productivity; create or participate in a network; learn new skills or techniques; satisfy curiosity and share the excitement of an area with other people; keep focused, because others are relying on your contribution; reduce isolation; educate.

Research collaborations do not only promise opportunities, but also incur costs and face barriers to their realisation. Kosmützky (2018) provides an overview of previous research on dimensions of complexity and diversity in international comparative research that at least in part may hold true for collaborative research in general (e.g. different geographic, cultural contexts, languages, career stages, standards of research integrity and ethics, governance and quality assurance). In consequence, diverse teams may not share a common frame of reference, and input from different team members may not be understood (ibid.). Katz and Martin (1997) also point to the increased complexity of research collaborations throughout different stages of the collaboration that require additional time for the joint development of the research problems and methodology, the acquisition of research grants, keeping all collaborators informed, and increased administration. How ECR acquire these skills early in their careers and the impact of early attainment in order to enhance collaborative potential may have a significant impact on their career success.

Research collaboration may have very different functions and (un)intended outcomes, but the question whether or not research collaborations have an effect on scientific productivity and impact is probably among the most interesting topics for policy makers designing funding schemes, researchers considering where to invest their resources, or the management of research organisations. In broad strokes, the effect of international research collaborations on scientific productivity is not straightforward but the effect on citation impact is clearly positive (Narin et al. 1991; Glänzel and Schubert 2001; Adams 2013; Guerrero Bote, Olmeda-Gómez and Moya-Anegón 2013; Blom, Lan and Adil 2016; Leydesdorff, Bornmann and Wagner 2017). For interdisciplinary research collaborations, a lower output but higher citation impact has been reported (Larivière, Haustein and Börner 2015; Leahey, Beckmann and Stanko 2017). Conversely, a positive association between international collaboration and scientific productivity remains contentious with contradictory evidence questioning the positive correlation (Shin and Cummings 2010); Abramo, D'Angelo and Di Costa 2009; Shin, Lee and Kim 2013).

## 11.3 Results – International mobility

We first present an overview of the rate of respondents moving internationally (whether within Africa or outside), for how long and why they go (section 11.3.1). Therein, we discuss respondents' intentions to move countries in the future and reflect on their motivation in the context of their prior mobility. We also discuss the challenges experienced when returning to one's home country or elsewhere in Africa after a period of time abroad (section 11.3.4). We then discuss the intentions of respondents to move internationally into the future (section 11.3.6) and possible benefits of international mobility (section 11.3.7). Finally, we explore a deeper context to the barriers and difficulties faced by interview respondents with the need to be internationally mobile (section 11.3.8) during early career stages.

### 11.3.1 Internationally mobile African ECRs: Who, where, why and for how long?

In order to build a profile of respondents' geographical movements through time, they were asked to specify all locations they have lived for at least 3 months in the last 10 years, their reason for moving to and leaving each location and the length of time spent there. They were also asked where they were born and if they spent a significant amount of their childhood in another location. As a background to this discussion, we first note that 3.4 % (n=39) of all respondents were born outside of Africa. In regards to mobility during childhood, 4.5 % (n=51) of all respondents spent significant parts of their childhood in a country in Africa outside their birth country. A further 2.8 % (n=32) of all respondents spent significant parts of their childhood living outside their country of birth, somewhere outside of Africa.

From this starting point of 7.3 % mobility from childhood, the proportion of respondents that have experienced international mobility increases considerably. Most (64.5 %) African born respondents had moved at least once in their life (see Figure 11.1). For our study we were particularly interested in their movements in the last 10 years and the relationship to their education, training and career. We begin by discussing where the respondents did their Master's and/or PhD degrees, moving then to mobility among the respondents' for any education or research-related purpose and their future intentions.

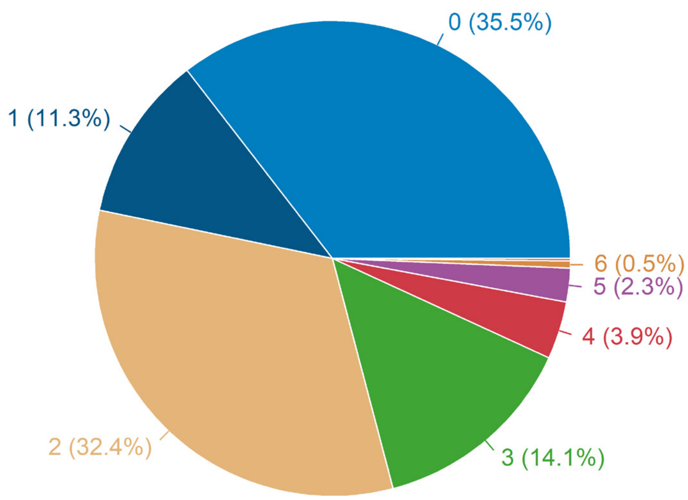


*Figure 11.1 – Number of international moves, by proportion of African born respondents*
*Source: Authors.*

### Mobility for HE

Amongst respondents with a Master's degree, 29.3 % (n=322) obtained their degree outside the country they were born in; 17 % (n=187) outside of Africa and 12.3 % (n=135) inside Africa but outside their home country. At the level of PhD mobility was more common, with 45.9 % (n=274) of respondents moving internationally to obtain their PhD (Figure 11.2); made up of one-quarter (27.3 %, n=163) of those who moved outside of Africa. Nearly a fifth (18.6 %, n=111) moved to another Africa country.

Just over half of all respondents that moved internationally to do either a Master's or PhD chose a country outside of Africa (58.1 % for Master's and 59.5 % for PhD). However, the mobility of researchers increased further when considering not just extended periods of study for qualification attainment but shorter training trips. As Kenneth, who completed his PhD in Morocco, described during his interview, short international travel for training increased the access to research equipment and network development as highly valuable experiences for ECRs. Short research visits of less than three months were not captured in our survey as we asked about mobility greater than three months only. As such we cannot quantify the frequency of such trips amongst our respondents, though we can reflect on their importance through the interviewees:

> *"At the beginning of my PhD thesis I went to France for three months. That was the first time that I went abroad… so I went to Paris because we had a project between [an institute there] and Morocco at the time. This had a positive impact on my career because during these three months I started to study [in my field of research]. And from that time I'm still working in [the same] kind of field."*
> **Kenneth, Male, Morocco, Northern Region, Health Sciences or Medicine, Public Institution, PhD holder**

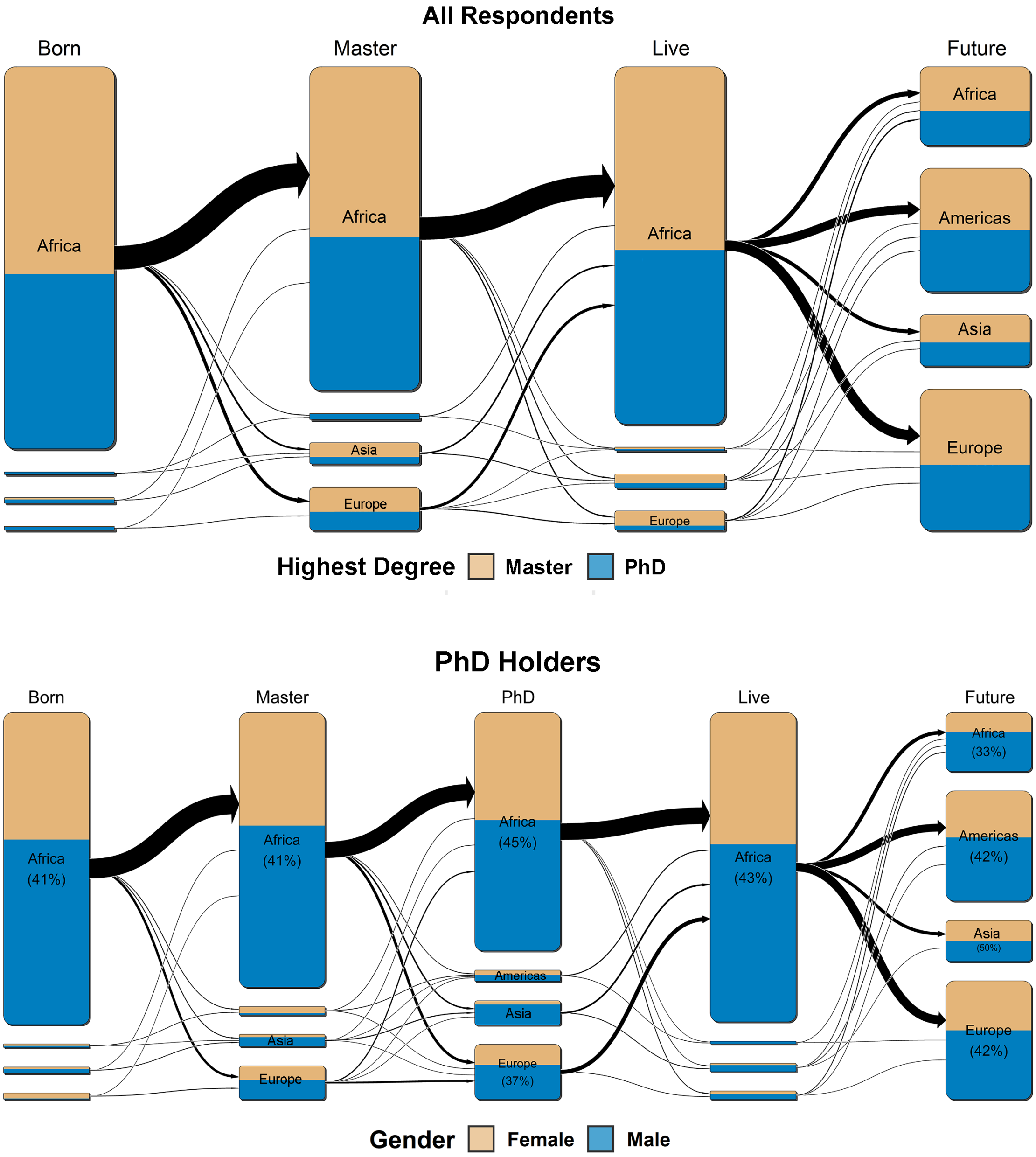


*Figure 11.2 – Transition plot of all respondents' movement (top) and those with a PhD (bottom) for their HE training, from where they were born, to where they were living at the time of the survey and their future intended location*

***Note:*** *Movement of all respondents (top) coloured by Master's (yellow) and PhD (blue) as the highest degree attained. The bottom plot is restricted to those who have completed a PhD according with the percentage of female respondents indicated and displayed in yellow, while males are presented in blue. The thickness of the connecting lines is proportional to the percentage of respondents.*

*Source: Authors.*

### Destinations in the last 10 years

Amongst the total survey respondents, 59.2 % (n=651) had lived, worked, or studied for three months or more in a country other than their country of origin in the last 10 years. PhD holders were significantly more likely than Master's holders to have spent more than three months overseas in the last 10 years, irrespective of where they were born or currently live; 70.1 % vs 47.3 %, respectively. Around a quarter of all respondents (22.5 %, n=248) had lived in two countries outside their home country, whilst a small proportion (6.6 %, n=73) were highly mobile, having lived in at least three different countries in the last 10 years.

In terms of destinations, a higher proportion of respondents had been to countries outside of Africa (65.7 %, n=428) compared to those that went elsewhere within Africa (34.3 %, n=223). Surprisingly, the most recent previous destinations of the study's African ECR comprised 70 different countries, including 28 countries in Africa and 42 elsewhere, indicating that the locations attracting African ECR are highly diverse.

Looking individually at the destination countries, 39.2 % (n=168) of those that travelled outside of Africa went to one of three destinations: 14.7 % (n=63) went to Germany, 12.6 % (n=54) to the USA, and 11.9 % (n=51) to England. Of those that went elsewhere in Africa or moved from outside of Africa, 56.1 % (n=124) travelled to South Africa, which was by far the most common African destination, with Kenya the next most common (8.6 %, n=19). When restricting this finding to respondents who were born outside of Africa, South Africa was again the favoured African destination for ECR (69.2 %, n=27). There was no significant difference in the experience of moving between gender, discipline or employment sectors. However, those living in the Eastern region were more likely to have moved than those born in the Western region, as were respondents who are members of Young Academies, compared to those who are not (see table 11.3 below). Interactive online maps allow to explore the individual movement of respondents by discipline and gender.

*Table 11.3 – Lived, worked or studied for three months or more outside their home country in the 10 years preceding survey*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| PhD | Master | Live | 1.350 | <0.0001 |
| Eastern Region | West Region | Live | 0.803 | 0.0219 |
| Academy Member | Not an Academy Member | PhD | 1.579 | <0.0001 |

Note: See also Table 11.16A in Appendix 11.9.
Source: Authors.

## 11.3.2 Why do African ECRs move?

When documenting the movements of African ECR, it is crucial to understand the intentions underling these movements. In a multi-response question, respondents most commonly indicated that completion of a PhD and academic factors (including institutional facilities and possibilities for publishing) were key reasons for international movement. Job or economic factors ranked third (see table 11.4). These three reasons accounted for 78.8 % (n=649) of the most recent movements. Personal and family reasons and a statutory obligation to return influenced only 10 % of respondents. However, PhD holders where more likely to return due to family reasons, such as starting a family, or caring for children or a family member (β=1.139, P=0.0001). A similar ranking of reasons was also observed for the second most recent location respondents had moved to (table 11.4).

*Table 11.4 – Reasons for moving internationally for the most recent and second most recent movement*

| Reason | Most recent move (sorted) Frequency (n) | Most recent move (sorted) Proportion (%) | Second recent move (unsorted) Frequeny (n) | Second recent move (unsorted) Proportion (%) |
|---|---|---|---|---|
| Completion of PhD or doctoral degree | 312 | 37.9 | 80 | 27.1 |
| Academic factors (facilities, publishing etc.) | 225 | 27.3 | 85 | 28.8 |
| Other job-related or economic factors | 112 | 13.6 | 55 | 18.6 |
| Other personal reasons | 39 | 4.7 | 10 | 3.4 |
| Obligation to return to home country | 27 | 3.3 | 12 | 4.1 |
| Family reasons | 23 | 2.8 | 8 | 2.7 |
| End of postdoc appointment | 8 | 1 | 1 | 0.3 |
| Political reasons | 7 | 0.8 | 1 | 0.3 |
| End of residence permit or visa | 5 | 0.6 | 3 | 1 |
| End of job contract | 4 | 0.5 | 2 | 0.7 |
| Other | 62 | 7.5 | 38 | 12.9 |
| Total | 824 | 100 | 295 | 100 |

Source: Authors.

The importance of moving internationally to obtain a PhD, and to improve academic, job and economic factors were also part of the reasons interviewees regularly cited as influencing their mobility. This is demonstrated here by Jacob, who did his PhD in Europe:

> *"I moved to [Europe] because of three things. The first one is that I wanted to do my PhD and there was no PhD programme in my country that fitted my research area… The second one was the lack of funding and infrastructure. Then the third one was the fact that [the country] is known for world class research especially in [my field]."*
> **Jacob, Male, 37, Ghana, Western Region, Health Sciences or Medicine, Academia, PhD**

Jacob illuminates how moving from one's home country in order to obtain a PhD is related also to academic factors regarding facilities and even prestige. The criticality of the lack of infrastructure is illuminated further by Faith, who did her PhD in Uganda but went to Europe to complete parts of the research for the PhD:

> *"I moved there because the nature of my research required…[equipment] that could not be accessed anywhere in my department or even in the country, even in Eastern Africa. So as the institute had a collaboration then with the [European] institute, they had this equipment at their disposal, I moved there in order to do the analysis that I could not do when I'm here in my department."*
> **Faith, Female, 38, Uganda, Eastern Region, Physical Sciences, Academia, PhD**

The motivation to move internationally to access research equipment was consistently referenced by interviewees from across the African continent and applies to moves outside of Africa but also to South Africa. However, this is far from being the only reason why respondents moved internationally. Investigating the reasons different groups moved within or outside of Africa, those in the applied sciences were more likely ($P \leq 0.0014$) than those in social and humanities ($\beta = 1.721$) and the life and health sciences ($\beta = 1.373$) to move internationally in order to obtain a PhD degree. Access to equipment may explain some of these differences because the applied sciences are reliant on highly-technical research equipment, but it is not definitively the cause. First, research in the life and health sciences also relies on such equipment, as the interview with Jacob highlighted, and even those in the humanities and social sciences can benefit from access to basic infrastructure.

Significant differences were found among the reasons respondents gave for moving to a second-prior country, if they had, in the last 10 years (see table 11.5). Those with a PhD were more likely than those with only a Master's degree to have moved for job or economic factors, such as searching for a job, taking up a job offer, or secondment ($\beta = 1.252$, $P = 0.0003$). On a regional basis, those born outside Africa were more likely than respondents born in any region in Africa (with exception of the Northern) to have moved to a second country for job or economic factors ($\beta = 1.503–2.570$, $P \leq 0.0284$).

*Table 11.5 – Job-related or economic factors being the reason for second most recent movement*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| PhD | Master | Live | 1.252 | 0.0003 |
| Outside Africa | Western Region | Born | 2.570 | <0.0001 |
| Outside Africa | Non-focal Africa | Born | 2.440 | 0.0004 |
| Outside Africa | Southern Region | Born | 1.789 | 0.0059 |
| Outside Africa | Eastern Region | Born | 1.503 | 0.0284 |

Source: Authors.

Finally, PhD holders were more likely than those with a Master's as their highest degree to have moved to a second country for academic reasons, such as better access to research facilities and publishing opportunities ($\beta = 0.952$, $P = 0.0002$). This is possibly related to promotional criteria for PhD holders, which often require a certain number of publications, while for Master's holders the hurdle to promotion can often be obtaining the PhD itself. Refer to Chapter 7 for further discussion of respondents' experiences with promotion, including the requirements to be met at each stage of the academic pipeline.

### 11.3.3 How long do African ECRs move for?

We already caught a glimpse of Kenneth's response earlier that international mobility for just a matter of months can have a significant impact on the career. However, given longer periods spent away from home are governed by a desire for enhanced academic potential, there may be associated personal and family life consequences for being away for long-periods. Hence, it is important to investigate how long respondents are away from their home countries (see table 11.6). Amongst our respondents, short trips up to one year were the most common length for their most recent (32.3 %, n=210) and second most recent movements (50 %, n=121). Conversely, about 10 % of the most recent and second most recent trips had been for more than 5 years, and 23–25 % had been for 2–5 years. PhD holders were also more likely to spend 2–5 years or more than five years (P≤0.0280) away than shorter periods of time, or to currently be away, compared to those who hold only a Master's degree (see table 11.7). The shorter trips represent those researchers who did part of their Master's or PhD degree – or some other brief research related activity – outside their home country, whilst the longer periods represent those who moved to attain their qualifications. We have heard during Kenneth and Jacob's interviews that even these shorter periods of time abroad can be critical to an ECR's career development, providing an opportunity to access to equipment and training while increasing the publishing potential. Our respondent population also included a substantial number of ECR who had not yet returned to their home country (17.1 %, n=111). Their future intention to move from where they are currently living is discussed in Section 11.3.6.

*Table 11.6 – Length of time in host country for most recent and previous instance of international mobility*

| Duration | Most Recent Move | | Second most recent move | |
|---|---|---|---|---|
| | Frequency (n) | Proportion (%) | Frequency (n) | Proportion (%) |
| I am currently still in this new home country | 111 | 17.1 | na | na |
| More than five years | 62 | 9.5 | 22 | 9.1 |
| 2–5 years | 163 | 25.1 | 56 | 23.1 |
| 1–2 years | 104 | 16 | 43 | 17.8 |
| 6 months to 1 year | 85 | 13.1 | 33 | 13.6 |
| 3–6 months | 125 | 19.2 | 88 | 36.4 |
| Total | 650 | 100 | 242 | 100 |

Source: Authors.

*Table 11.7 – Length of time away for PhD holders compared to Master's holders*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| 2–5 years | Still living away | Live | 1.266 | 0.0014 |
| 2–5 years | 1–2 years | Live | 1.188 | 0.0017 |
| 2–5 years | 3–6 months | Live | 0.933 | 0.0280 |
| More than 5 years | 1–2 years | Live | 1.379 | 0.0170 |
| More than 5 years | Still living away | Live | 1.456 | 0.0132 |

Note: See also Table 11.17A in appendices.
Source: Authors.

In general, our surveyed African ECR had a tendency to be in their international host country for a discrete (rather than indefinite) amount of time. It is likely that PhD holders that have moved internationally and stayed abroad are underrepresented in our survey sample. Nevertheless, an attitude that perhaps underpins our results is that those surveyed have left their home country to develop skills to enhance their careers and they return within five years to either their home country or elsewhere in Africa. This is demonstrated here by Stanford, who did his PhD in Oceania and remained there in a post-doctorate position at the time of the interview:

> *"We try to learn as much as we can so that when the time is right [we can] possibly go back to Africa and implement some of the things that help, and nurture the next generation of people who could do things that benefit our communities."*
> **Stanford, Male, 33, Oceania (from Uganda), Outside Africa, Life Sciences, Academia, PhD**

Stanford exemplifies an attitude widely upheld by the interviewees that had lived or were living outside their home country, but also those that had always been in their home country. Yet, despite returning home or having a desire to do so, once they have attained the skills they desire to make an impact in their communities, we found that the current conditions African ECR experience force them to once again leave in the future.

### 11.3.4 Returning home after international mobility

Respondents most frequently noted completion of their PhD degree (24.2 %, n=183) or an obligation to return to home (21.7 %, n=164) as the reason they had left their host country (table 11.8). This supports the fact that conducting a PhD is a primary influence on international mobility. Many perceive, in spite of the benefits of international mobility experienced, the need to return home:

> *"The people in Egypt need help, [so I] return to them to try [to] help them as much as possible, they're your family by the way."*
> **Emily, Female, 37, Europe (from Egypt), Outside Africa, Physical Sciences, PhD**

> *"I can go and come back… my challenge is to help my people… if you want to change the face of our continent, it is not possible to do it without the researchers, or without the universities."*
> **Gerald, Male, 41, Cameroon, Western Region, Applied Sciences, PhD**

Family reasons were the third most common factor (9.8 %, n=74, see table 11.8 below) influencing the decision of many respondents to leave their most recent host country. Though it is clear that family decisions influence the decision to return home, the interviews revealed that many respondents felt their prospects back in Africa would be better than overseas:

> *"Okay, so the reason I came back to South Africa after my PhD was just that [I am] too close to my family. So they live about two hours drive from where I am. So that's one of the motivations why I'm here."*
> **Shane, Male, 31, South Africa, Southern Region, Life Sciences, Academia, PhD**

*Table 11.8 – Reasons for leaving host country (inside and outside of Africa) for first and second time*

| Reason | First Move (Sorted) Frequency (n) | First Move (Sorted) Proportion (%) | Second Move (Unsorted) Frequency (n) | Second Move (Unsorted) Proportion (%) |
|---|---|---|---|---|
| Completion of PhD or doctoral degree | 183 | 24.2 | 51 | 16.7 |
| Obligation to return to home country | 164 | 21.7 | 54 | 17.6 |
| Family reasons | 74 | 9.8 | 21 | 6.9 |
| Other job-related or economic factors | 70 | 9.3 | 39 | 12.7 |
| End of residence permit or visa | 60 | 7.9 | 20 | 6.5 |
| Academic factors | 49 | 6.5 | 22 | 7.2 |
| Other personal reasons | 47 | 6.2 | 20 | 6.5 |
| End of job contract | 35 | 4.6 | 18 | 5.9 |
| End of postdoc appointment | 25 | 3.3 | 20 | 6.5 |
| Political reasons | 2 | 0.3 | 2 | 0.7 |
| Other | 46 | 6.1 | 39 | 12.7 |
| Total | 755 | 100 | | |

Source: Authors.

Comparing differences in the reasoning between respondents from different regions within Africa, we found those born in the Eastern and non-focal regions were more likely ($P \leq 0.0311$) than those born in Southern and Western regions to have left their host country because they had completed their PhD. Furthermore, when controlling for where respondents were born, PhD holders were more likely than those with a Master's as their highest degree to move from their host country for job-related or economic factors ($\beta=1.091$, $P=0.0002$) and for family reasons ($\beta=1.139$, $P=0.0001$).

From the interviews, it was quite clear that family ties, job security and access to research facilities are key factors that influence respondents' decision about whether to return to their home country or not. For a group of respondents that had moved within Africa – often from Zimbabwe to South Africa but not exclusively – social and political factors had a tangible influence. The extent of the social problem is illuminated here by Monica who moved from Zambia to South Africa:

> *"So far things are not working well for me here [as I am unemployed] and… I tried to apply back home but there is… this thing about going to diaspora, it's like you're betraying the people at home by leaving the country. They always ask these questions [like], "What have you done for the country?"*
> **Monica, Female, 35, South Africa (from Zambia), Southern Region, Applied Sciences, Unemployed, PhD**

The problem Monica describes was also evident in responses from interviewees that had left Zimbabwe for South Africa (see Ian in section 11.3.6, for example); they regularly faced difficulties with securing work in South Africa, but the prospect of moving home meant overcoming a sometimes hostile reception to people who leave the country, even temporarily.

We saw above how family reasons shaped Shane's decision to leave Europe after completing his PhD, but during the interviews, job security emerged as key influence factor for the decision to return to and remain within Africa. As we see here, Shane feels there are other factors that are keeping him there:

> *"I'm staying in South Africa, other than the family situation, I think because… I could actually establish my career faster than if I stayed in Europe… The [people] who graduated with me are struggling to get a second postdoc grant, whereas I basically walked into a fulltime position at a small university. I have match better job security… but the price I pay is that I'm outside of that intense academic environment."*
> **Shane, Male, 31, South Africa, Southern Region, Life Sciences, Academia, PhD**

Shane's desire to combine a closeness to family and job security is a factor that other interviewees also spoke of, including the difficulty of securing a permanent contract in countries outside of Africa:

> *"The main reason really I'd probably go back to Mauritius one day is because of our families are there. I think this will be reason number one… Otherwise, in terms of the work environment, I think Mauritius is going to provide job security, which we probably do not have here, although we have a good job and I like [it], I don't have a full contract here."*
> **Simon, Male, 35, Europe (from Mauritius), Outside Africa, Physical Sciences, Academia, PhD**

Optimism for job security within Africa was not shared by all respondents, and particularly those who had returned home after completing their degrees internationally:

> *"But the thing is, there are no job openings in the science field in Mauritius… There are no new openings… I'm not really getting a job which matches my skills, so I'm having to do things that I feel do not match my competences… After returning from my PhD I feel like I have not moved anywhere, I have not travelled [and] not made any progress."*
> **Clara, Female, 29, Mauritius, Southern Region, Life Sciences, Academia, PhD**

> *"We thought it was going to be automatic to get good jobs… but it's not that easy. [In] my own case, I did almost two years without a job after coming back."*
> **Moses, Male, 45, Nigeria, Western Region, Health Sciences or Medicine, Para-Public, Master**

> *"After my PhD I came back home and I didn't get a job. I tried at the university but I didn't [get anything]. So, will I just sit and be unemployed? I thought, I'm not bound, so I went and did my post doctorate in [Northern America], then I went to [Europe] and then I came back."*
> **Jason, Male, 44, Kenya, Eastern Region, Life Sciences, Private, PhD**

Jason and Moses indicate how strong the inclination to leave Africa may be for those respondents who had already lived outside of Africa once before. However, we found no statistical difference in a desire to leave Africa between respondents who had lived outside of Africa at least once compared to those who had never left. Both groups had a strong desire to leave; 78.1 % (n=433) of those who had previously left and 80.9 % (n=356) of those who hadn't. The desire for and perceived benefits of international mobility are discussed in sections 11.3.6 and 11.3.7.

### 11.3.5 What influences African ECR's future desire to leave Africa?

The likelihood of respondents to leave their home country for three months or more was higher for PhD holders compared to Master's ($\beta=1.350$, $P<0.0001$). The implication of this pattern for respondents' home countries (predominantly in Africa) cuts to the "brain drain" issue, and particularly "brain outflow" as discussed in section 11.2.2 In this context we now consider respondents' intentions to leave the country of current residence, be it their home or host country.

20 % of respondents indicated that they have no intention to move abroad in the future (see table 11.9). Respondents most frequently noted that they are "considering" moving from the country of residence at the time of survey (36.8 %, n=410). 29.9 % (n=333) sought to move temporarily, and another 13 % (n=147) to move permanently. We explore the perceived benefits respondents expect to gain by international mobility in the future in the section 11.3.7.

*Table 11.9 – Respondents' intention to move countries*

| | All Respondents | | Only Respondents in Home Country (African) | |
|---|---|---|---|---|
| **Response** | (n) | (%) | (n) | (%) |
| **Yes, permanently** | 147 | 13.2 | 84 | 9.7 |
| **Yes, temporarily** | 333 | 29.9 | 305 | 35.1 |
| **Maybe – I'm considering it** | 410 | 36.8 | 291 | 33.4 |
| **No** | 223 | 20 | 190 | 21.8 |
| **Total** | 1,113 | 100 | 870 | 100 |

Source: Authors.

Restricting the results to only those respondents that live in their home country in Africa, we found the results to be relatively consistent with those from the whole respondent population. 78.2 % (n=680) of these respondents planned to move in the future (see table 11.9). In total, 834 respondents with an intention to move named 71 countries as target destinations; 26 of those in Africa and 45 outside of Africa. 18.9 % (n=158) of respondents named other African countries and 81.1 % (n=676) named countries outside of Africa. This desire to move outside of Africa in the future and particularly into the Americas (Canada and USA) is striking given that the respondents have not done their training period there (see Figure 11.3).

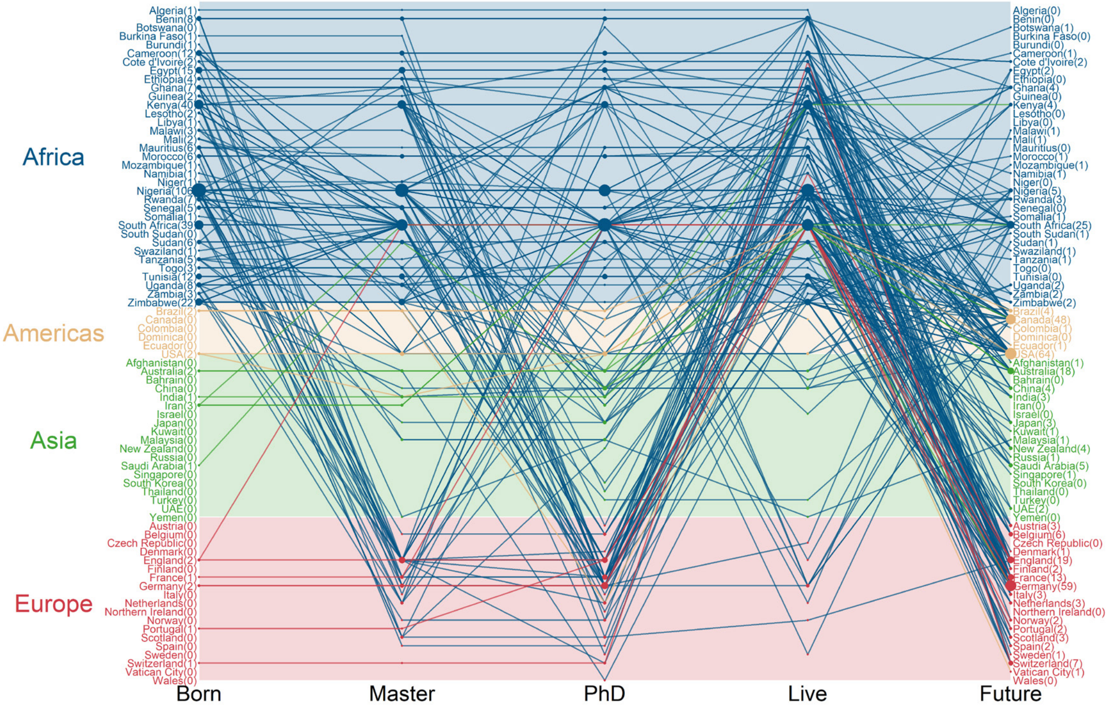


*Figure 11.3 – International mobility of PhD holders during their tertiary education, current location and future intentions*
*Source: Authors.*

Those respondents who considered countries outside of Africa as desired future destinations most frequently named the USA (22 %, n=149), Germany (18.6 %, n=126), and Canada (15.7 %, n=106; see table 11.10). The other 42 countries shared the remaining 43.7 % (n=295) of responses. Those considering countries in Africa most frequently named South Africa (27.8 %, n=44), with an additional 12 % (n=19) naming Nigeria and 10.1 % (n=16) Kenya (see table 11.10). The inclusion of Nigeria here is interesting as it did not emerge as a location of previous mobility (section 11.3.1). Indeed, all those except one (94.7 %, n=18) who expressed an intention to move to Nigeria in the future were Nigerian citizens. Only 4.5 % (n=2) of the respondents who named South Africa as a future destination were born there. This reinforces the earlier result suggesting African ECRs have a preference for South Africa when moving within Africa for research and education purposes.

*Table 11.10 – Countries respondents intend to move to in the future*

| Inside Africa | | | Outside Africa | | |
|---|---|---|---|---|---|
| Country | (n) | (%) | Country | (n) | (%) |
| South Africa | 44 | 27.8 | United States | 149 | 22 |
| Nigeria | 19 | 12 | Germany | 126 | 18.6 |
| Kenya | 16 | 10.1 | Canada | 106 | 15.7 |
| Ghana | 8 | 5.1 | England | 62 | 9.2 |
| Rwanda | 7 | 4.4 | Australia | 49 | 7.2 |
| Tanzania | 7 | 4.4 | France | 25 | 3.7 |
| All Others | 57 | 36.1 | All Others | 159 | 23.5 |
| | 158 | 100 | Total | 676 | 100 |

Source: Authors.

Respondents living in the Western region were more likely (P≤0.0140) than those living outside of Africa and in Southern or Eastern region to plan a temporary move rather than considering or excluding it (see Figure 11.4 and Table 11.11). This result perhaps provides some context to the greater focus interviewees from the Western region had on seeking frequent opportunities for international mobility, which is also indicated by the number of interviewees living in or from Western region that are quoted in the latter sections of this chapter.

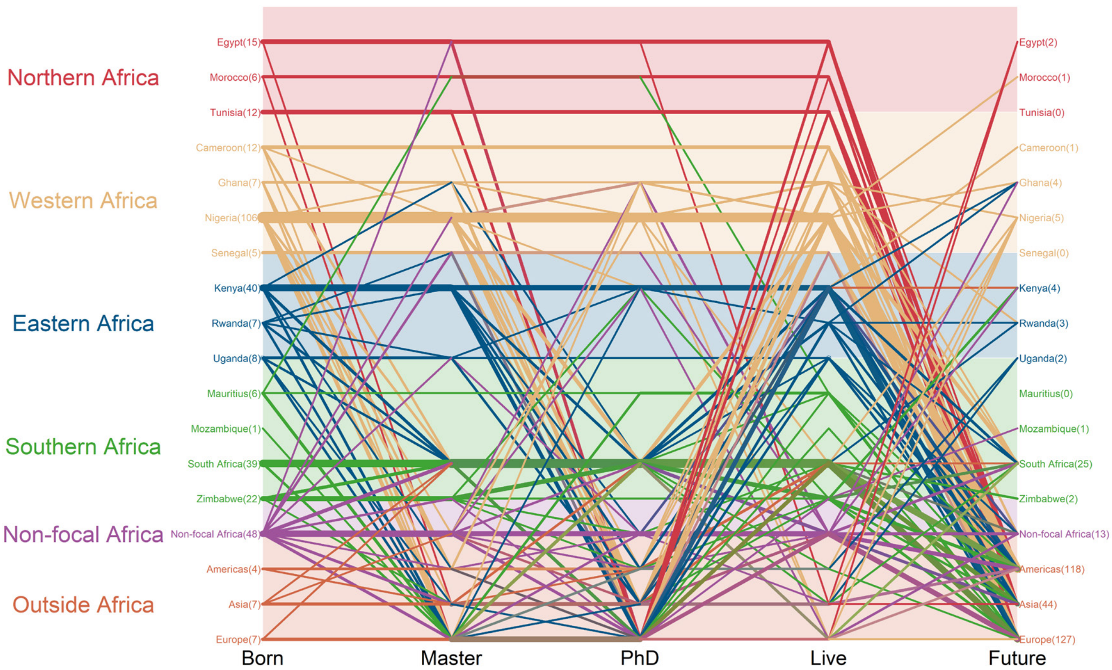


*Figure 11.4 – International mobility of PhD holders born in the focal regions during their tertiary education, current location and future intentions*

*Table 11.11 – Respondents living in Western region compared to other regions for intention to move countries*

| Basis Variable | Reference Variable | Reference Region | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Yes, temporarily | No | Outside Africa | 1.664 | 0.0140 |
| Yes, temporarily | No | Southern Region | 1.590 | <0.0001 |
| Yes, temporarily | No | Non-focal Africa | 1.574 | <0.0001 |
| Yes, temporarily | No | Eastern Region | 1.275 | 0.0006 |
| Yes, temporarily | Maybe – I'm considering it | Outside Africa | 1.731 | 0.0001 |
| Yes, temporarily | Maybe – I'm considering it | Southern Region | 1.296 | <0.0001 |
| Yes, temporarily | Maybe – I'm considering it | Eastern Region | 0.902 | 0.0064 |

Source: Authors.

Compared to respondents who considered to more short- or long-term, the share of those aspiring permanent mobility is relatively low (9.7 %, n=84). This suggests that our African-based respondents desire to be in Africa and their home countries over the long-term, although this may be complemented by an additional stay abroad. This attitude was reflected in the interviews, as conveyed by Edna, who is from Nigeria and has done part of her research in Europe:

> *"We've had people that undertake such visits and never returned back to their institutions. So, that's very sad because that's the brain drain that we expected. I wouldn't mind going for two or three years to do the bit that I can, but no matter the length of time that I stay there I would always go back home and give back to my primary institution where I belong to."*
> **Edna, Female, 42, Nigeria, Western Region, Physical Sciences, Public, PhD**

Enda captures here for us the tension for many of our respondents between their aspirations to pursue a research career and their deep commitment towards their home countries, societies and even institutions.

When selecting from a range of reasons that represented their motivations to move in the future, the most common responses from ECRs living in Africa related to career development opportunities; 34.7 % (n=451) noted research-related reasons, such as better access to collaboration networks, the opportunity to create their own research team or new research area, or acquisition of new skills (see Figure 11.5). An additional 28.4 % (n=369) of responses identified career-development in the specific sense of moving to a more prestigious institution and/or having better prospects for career advancement. A further 15.2 % (n=197) of responses indicated that job-related factors such as better salary or employment benefits in the host country were reasons for intending to leave. Other reasons, including the end of contract (4.9 %), personal (5.5 %), familial (4.4 %) or political (2.4 %) reasons, and an obligation to return home (2.3 %) were less common from ECRs living in Africa.

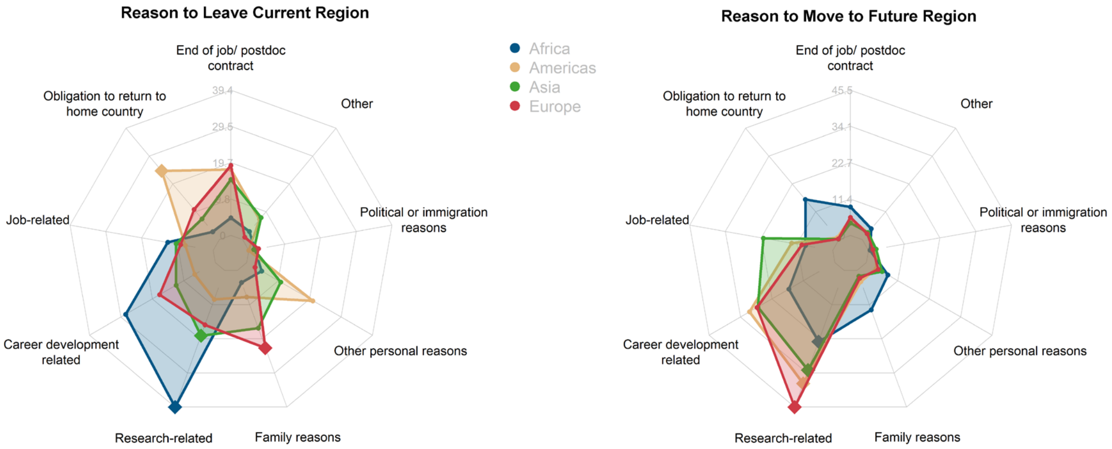


*Figure 11.5 – Reasons for African ECR intending to leave where they are (left) and move to where they intend to go (right)*
*Note: Coloured by the regions where respondents were (left) or intend to go to (right). Accompanying data is in appendix Table 11.18A.*
*Source: Authors.*

Conversely, considering the reasons African ECRs living outside of Africa mentioned for leaving their place of residence reveals considerable shifts (Figure 11.5). Significantly more African ECRs living outside of Africa intend to move due to family reasons (18 %, n=57, see table 11.12 for statistics) or an end of the job contract (14.7 %, n=22, see table 11.13 for statistics). Less frequently, they indicated research (16.7 %, n=25), or career development (16 %, n=24) as a reason to move., 8.7 % (n=13) mentioned obligations to move back to one's home country (8.7 %, n=13), but these findings were non-significant due to smaller numbers of respondents.

*Table 11.12 – Family reasons as an impact on the future intention to leave current country of residence*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Outside Africa | Eastern Region | Live | 2.532 | <0.0001 |
| Outside Africa | Non-focal Africa | Live | 1.961 | 0.0002 |
| Outside Africa | Northern Region | Live | 1.801 | 0.0283 |
| Outside Africa | Southern Region | Live | 1.618 | 0.0001 |
| Outside Africa | Western Region | Live | 1.501 | 0.0001 |

Source: Authors.

*Table 11.13 – End of contract as an impact on the future intention to leave current country of residence*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| Outside Africa | Eastern Region | Live | 2.003 | 0.0001 |
| Outside Africa | Non-focal Africa | Live | 1.825 | 0.0013 |
| Outside Africa | Southern Region | Live | 1.396 | 0.0018 |
| Outside Africa | Western Region | Live | 1.360 | 0.0011 |

Source: Authors.

In line with the survey results, interviewees also highlighted family reasons, the end of job contracts or insecure prospects for ongoing work as reasons for having left a country outside of Africa, or for their intentions to do so. For many interviewees, this was a significant stress factor, particularly due to future uncertainty. Victor has lived in five different countries in his life, inside and outside of Africa, and demonstrates for us here how employment contracts that end have contributed to his high degree of mobility:

> *"I have my personal strategy which consist of leaving as soon as your contract ends. Because when you leave to go to a different place you can apply for other positions and you promote yourself within a different organisation."*
> **Victor, Male, 46, Kenya (from Cameroon), Eastern Region, Life Sciences, Para-public, PhD**

Victor has undoubtedly had some success with this strategy and is clearly willing to perceive the uncertainty in his employment status as a positive situation. This is a testament of the general attitude of the interviewees facing hardship. However, what is not clear here is that Victor has experienced issues with obtaining visas for his international mobility, discrimination in his career, and that he has a wife and children to support whilst he travels so often. We explicitly discuss different barriers to international mobility that respondents experience in section 11.3.8, and at different points in the chapter we discuss the challenge of balancing family responsibilities. For more on how family responsibilities shape respondents' careers see Chapter 7, and for further discussion of how discrimination or unfair treatment affect respondents' careers refer to Chapter 8. Finally, for more on Victor's story and others like him, refer to our publication: "Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective" (McAlpine et al. 2020).

## 11.3.6 Benefits and challenges of international mobility

Many of the benefits of international mobility emerge through the chapter and relate directly to respondents' concerns about the research environment and employment conditions that they have in their home countries. A recurrent theme is access to funding, which Jacob highlighted earlier as a reason for him to move to Europe to do his PhD. We found a significant association between respondents that were mobile in the previous 10 years and securing funding in the previous three years ($P \leq 0.0001$). This can mean one of three things: (1) that international mobility makes it more likely for a respondent to secure funding, (2) that securing funding makes it more likely for a respondent to be internationally mobile, or (3) the association works in both directions. In the interviews, respondents provided examples of both.

In section 11.3.2 of this chapter Faith and Jacob highlighted that securing access to research equipment was a critical reason why they moved outside of Africa for the whole or part of their PhD. This is a benefit that comes up throughout this chapter, and interviewees often relate it directly to their productivity (see

Kimberley below). Mobility in the 10 years preceding the survey was significantly associated with the number of articles respondents published in the three years preceding the survey ($P \leq 0.0001$). This may indicate that the ability to get funding for mobility, or the mobility itself, increases the publishing capabilities of ECR. Moving internationally can open opportunities to improve output through, for example, an improved access to equipment but also by temporarily relieving their teaching load. It also enables respondents to form new collaborations, which improve their productivity as well, as Sylvia describes while reflecting on her research stay in Europe:

> *"It helped to open my mind more… you do meet a lot of people and make collaboration with them…[and] co-author."*
> **Sylvia, Female, South Africa (born in Middle Eastern), Southern Region, Life Sciences, Academia, PhD**

> *"It was a conducive environment to carry out research… The fact that I had access to a conducive environment [with] good access to internet [and] power. They both helped me to be productive and of course some equipment in the lab for my research."*
> **Kimberley, Female, 39, Nigeria, Western Region, Life Sciences, Academia, PhD**

These interviewees support the association that mobility improves productivity. The benefits of collaboration are discussed further in section 11.4. In addition to commonly referenced benefits of equipment access, funding, and collaboration, interviewees also identified additional benefits and challenges associated with international mobility. The improvement in power supply by moving internationally that Kimberley (above) refers to was more frequently described by those from the Western region. However, interviewees from across Africa frequently reported that their access to basic resources and opportunities were an important benefit of international mobility; this applies to those that moved outside of Africa but also to those that moved to South Africa. It also applies to respondents in the humanities and social sciences, whom may have limited needs for complex laboratory equipment but nevertheless require resources to do their research. Both of these are demonstrated by Dorothy, who is from Zimbabwe and did her PhD in the Humanities in South Africa:

> *"So many resources, unlike in my country, you get here as a PhD student. You are given a desktop, your own office, and you are considered [as a] member of staff, and so that is a very positive thing for me. It is also the ability to travel as a PhD student; I presented at conferences, which I never did in Zimbabwe, [and] that was eye opening."*
> **Dorothy, Female, 53, South Africa (from Zimbabwe), Southern Region, Humanities, PhD**

In section 11.3.1 we highlighted that respondents in the social sciences and humanities were less likely than those in applied sciences to report that they moved abroad to do their PhD ($\beta=1.721$, $P=0.0002$). It is clear from Dorothy's response that, irrespective of respondents' discipline, there is benefit to be gained for education and/or research purposes. Indeed, it may cause us to consider whether respondents in these disciplines consciously abstain from international mobility or whether other factors inhibit their ability. We are unable to address this with our acquired data.

When respondents that had returned to their home countries reflected on their experiences abroad, they spoke positively of the improvements they have been able to make in terms of mentoring, as demonstrated here by Jeremiah who did his PhD in Asia:

> *"I'm now mentoring researchers due to the knowledge I acquired in [Asia]… On the other hand there were not many opportunities to network."*
> **Jeremiah, Male, 42, Uganda, Eastern Region, Health Sciences or Medicine, PhD**

Although Jeremiah did not expand on the lack of opportunities he had expected for networking and collaboration in his Asian host country, interviewees residing in countries where the main language is different to their own regularly mentioned language as a barrier that impacted their ability to apply and be successful in securing funding. This is demonstrated by Fiona, who has also spent time in Asia for research purposes:

> *"I found it too challenging to be able to settle in [Asia] and attract grants. And of course mostly because of the language barrier."*
> **Fiona, Female, 41, Kenya, Eastern Region, Life Sciences, Academia, PhD**

The intersection of funding and language that Fiona brings to the fore here is also a challenge for some respondents in their home countries. Barriers of language are discussed in further detail in Chapter 10.

For other interviewees, difficulties abroad stemmed from more personal reasons. Numerous interviewees referred to experiences of unfair treatment and discrimination in a host country, both within Africa and outside. For those that had such experiences outside of Africa it was common to refer to it as something related to being African:

> *"International scientists do not actually see African scientists as we do [ourselves]. They see us [as not] really knowing much because we do not have the facilities that are required for research. So, when you come they want you try to take you through from the fundamental things that you already know, and they will not allow you to handle some of the equipment yourself."*
> **Nelisiwe, Female, 39, Europe (from Nigeria), Outside Africa, Applied Sciences, PhD**

Nelisiwe points out this experience in relation to being in Europe and was joined by others who had been in different continents. However, interviewees who mentioned similarly difficult experiences when they moved within Africa described the prejudice differently; they felt it was less focused on their perceived lack of skills and more so on them being foreign:

> *"I'm a national of Zimbabwe and I'm in a foreign country… the locals around you feel as if you're coming to take over. So there's this natural resistance towards certain people from certain countries. There's a xenophobic spirit… just because I am of Zimbabwean origin I cannot easily get a position."*
> **Ian, Male, 43, South Africa (from Zimbabwe), Southern Region, Physical Sciences, PhD**

The difficult treatment that Ian describes here is discussed further in Chapter 8 because it overlaps with the experiences of others, including nationals of South Africa, who have challenges with securing positions because of perceived hiring practices in the country.

It is clear from the discussion throughout this chapter that the benefits of international mobility are broad, as are the challenges. The difficulty of leaving family behind, including partners, parents, children and friends, becomes one of balancing family and work aspirations:

> *"One has to adjust to being away from family… So, the issue is that it's not always easy just getting up and going somewhere else… But the good thing is that I met more established scientists in my field. Yes, I'm able to develop more collaborations by going on such trips. So this is why I keep going on such trips."*
> **Fredrick, Male, Nigeria, Western Region, Physical Sciences, PhD**

Fredrick, like other respondents, manages the balance between the benefits and challenges of international mobility by using short but frequent stays abroad. A consistent reason for international movement was to overcome the "price" they pay for having job security in Africa whilst being "outside that intense academic environment" found elsewhere:

> *"[Abroad], I give half effort [and] I get four or five times the result, so what I did [there] in three months [takes] more than three years to do [here]."*
> **Caroline, Female, 44, Tunisia, Northern Region, Applied Sciences, Public, PhD**

Caroline demonstrates that even for those respondents who have been abroad once and have had the opportunities this enables them, the motivation to go abroad again is present insofar as the challenges affecting their productivity (such as access to equipment or overbearing teaching workloads) go unabated in their home countries.

As an alternative to those who utilise short trips to enhance their research potential, as noted earlier, 35 % of respondents had previously moved away for more than 2 years, including 10 % who moved away for more than 5 years, before moving again (table 11.14).

*Table 11.14 – Length of time in host country for most recent and previous instance of international mobility*

| Duration of stay | Most Recent Move | | Second Most Recent Move | |
|---|---|---|---|---|
| | Fred. (n) | Proportion (%) | Fred. (n) | Proportion (%) |
| **I am currently in this new home** | 111 | 17.1 | - | - |
| **More than five years** | 62 | 9.5 | 22 | 9.1 |
| **2–5 years** | 163 | 25.1 | 56 | 23.1 |
| **1–2 years** | 104 | 16 | 43 | 17.8 |
| **6 months to 1 year** | 85 | 13.1 | 33 | 13.6 |
| **3–6 months** | 125 | 19.2 | 88 | 36.4 |
| **Total** | 650 | 100 | 242 | 100 |

Source: Authors.

Considering these extended periods of time, it is clear that the temptation to remain in one's host country is strong even in spite of the challenges many face there. For some, these periods align with the length of their PhD, but it was clear from the interviewees that people stayed for periods beyond this too. Additional factors that may entice respondents to stay included level of salary, job security, and fatigue of moving. The low salaries for research and lecturing positions in Africa, particularly when compared to other sectors in their home countries, such as in industry, was commonly cited by respondents (see Chapter 7 for further detail):

> *"My PhD scholarship [in Oceania] was much more than my salary as a lecturer [in Nigeria]… So if I'm able to [secure a] research grant and get a lot of money to do the kind of research I want to do, I will go back."*
> **Sam, Male, 37, Oceania (from Nigeria), Outside Africa, Applied Science, Academia, PhD**

> *"I'm very tired of moving around from different country to different country… and I have an ongoing position, so I don't see myself leaving [Oceania]."*
> **Valentina, Female, 42, Oceania (from South Africa), Outside Africa, Physical Sciences, Academia, PhD**

The fatigue related to moving countries that Valentina refers to is seldom raised by other interviewees, though that may be because other factors meaningfully limit their mobility (refer to section 11.3.5) to such a degree that this fatigue seldom has an opportunity to manifest. The job security that Valentina has in a host country outside of Africa also contrasts with other interviewees who had moved internationally, as they frequently reported to have trouble securing an ongoing position – both in their host country and their home country upon return (refer to section 11.3.5). In that context, it is immediately clear why Valentina and others who end up in a similar position may be reluctant to return to their home countries.

### 11.3.7 Barriers to international mobility

Whilst the majority of respondents 59.2 % (n=651) had been outside of their home country at least once in the 10 years preceding the survey, there remains a large proportion of African ECR respondents (40.8 %, n=449) who had not been mobile. This may be out of a lack of interest, or because other factors limited their access to mobility. We posit some possibilities as to why this might be, given a greater number of respondents intend to leave in the future (80 %, n=890, see table 11.11 above). We also note that the barriers discussed may also apply to those who have been internationally mobile, particularly if they have a change in employment circumstances, family situation or similar.

Family and social circumstances of the interviewees arose as a common theme associated with a lack of mobility. In particular, responsibilities towards children were noted, although there were examples of both men and women who travelled in spite of having children. Family responsibilities were not limited to children but included other family members and spouses:

> *"I see some woman moving away but to me as an individual I feel [that] my family comes first, my children come first. I know sometimes I forego some opportunities for the sake of my children."*
> **Sheila, Female, 50, Kenya, Eastern Region, Life Sciences, Academia, PhD**

> *"I didn't want to stay away again from my relatives and also I wanted to get married… Going without getting married, it wasn't good. So, I declined the offer."*
> **Stephen, Male, 36, Rwanda, Eastern Region, Life Sciences, Academia, PhD**

> *"[M]y parents did not believe me when I wanted to go out of Nigeria for my PhD. You know like normal African parents they told me it's time to get married."*
> **Grace, Female, 35, Nigeria, Western Region, Physical Sciences, Unemployed, PhD**

In both Stephen and Grace's responses we develop our perspective of how the familial and social dimensions of interviewees' lives can influence respondents' career paths, which had begun forming in the previous sections of this chapter. What is not clear here is how Grace was able to get the approval of her family to complete her PhD in India, which she credits to her supervisor at the time, and how she got married and had a child since she returned to Africa. Though Grace is fortunate to have overcome this barrier, her story serves as a good example of the inhibiting influence of family and social factors. For more on Grace and Stephen's stories and others like them, refer to our publication: "Voices of Early Career Researchers in and out of the Academy: A Pan-African Perspective" (McAlpine et al. 2020).

The sacrifices made by the respondents regarding family choices in order to achieve their PhD internationally and to access equipment and funding resonated through the interviews. The weight of these sacrifices provides an important context as to why others may choose differently – to stay in their home countries, for example, in order to have children, and to be married.

> *"And I have decided to delay having children so that I can move. So, that is when the choice between my family and career crushes [and] that can be a big challenge."*
> **Jacob, Male, 37, Ghana, Western Region, Health Sciences or Medicine, Academia, PhD**

Mobility of many researchers was also limited by their current working conditions, a similar issue raised in Chapter 6, where we discuss how these same responsibilities limit respondents' time to do research in their home country:

> *"I will not move as freely as I could do before I was a teacher, because I am compelled to be in my teaching position, and [fulfil] my administrative duties."*
> **Hunter, Male, 38, Cameroon, Western Region, Humanities, Academia, PhD**

Finally, for some respondents the cost for travelling large distances to conferences in other parts of the world were prohibitive to career advancement. Whilst for some, funds for even travelling within Africa were prohibitive:

> *"So the fact that I was based in [North America] and the meeting was [also there], moving around and attending conference[s] was much easier. Whereas now…it is very exorbitant to travel to these same conferences, which I could easily do when I was doing my PhD."*
> **Eveline, Female, 33, Mauritius, Southern Region, Other (Food Sciences), Academia, PhD**

> *"We can't interact with other people… I'm supposed to be [at another Nigerian university] for a symposium. But the truth is it's about 40,000 Naira, which is about $110 [and] I can't afford it, I just cannot afford it. I've contributed to the book [and] if I had gone to the symposium… I would interact with new people… but the challenge is I cannot pay for [it]."*
> **Judy, Female, 33, Nigeria, Western Region, Social Sciences, Academia, PhD**

The practice of self-funding research and travel emerged with some regularity in the interviews, and particularly for researchers in the Western region. It relates directly to discussions of low salaries in academia discussed in Chapter 7, and also funding, discussed in Chapter 10.

## 11.4 National and international collaboration

### 11.4.1 Partners of Collaboration

We asked respondents how often they collaborate with other researchers in different locations, institutions and industries and investigated co-variate factors associated with relatively high rates of collaboration. Respondents most frequently ($P<0.0001$) reported *often* or *very often* to collaborate with researchers within their own institution or company (54.1 %, n=511,) and with researchers in other institutions within the country of residence (38.8 %, n=367; see Figure 11.6).

In contrast, respondents were least likely (P<0.0001) to report collaborating with researchers in private companies (9.5 %, n=85), compared to governmental agencies or non-governmental organisations (NGOs) (15.1 %, n=135), researchers in other countries within the same continent (25.6 %, n=236), other disciplines (28.1 %, n=264), and other continents (31.9 %, n=291).

The limited rates of collaboration between respondents and these final groups of researchers is also reflected by the 70.2 % (n=632) of respondents whom *never* or *seldom* collaborate with researchers from private companies, and the 59.3 % (n=528) of respondents who reported the same about collaboration with NGOs and governmental agencies. Strikingly, almost half of all respondents (46 %, n=424) indicated they *never or seldom* collaborate with researchers on the same continent (see Figure 11.6).

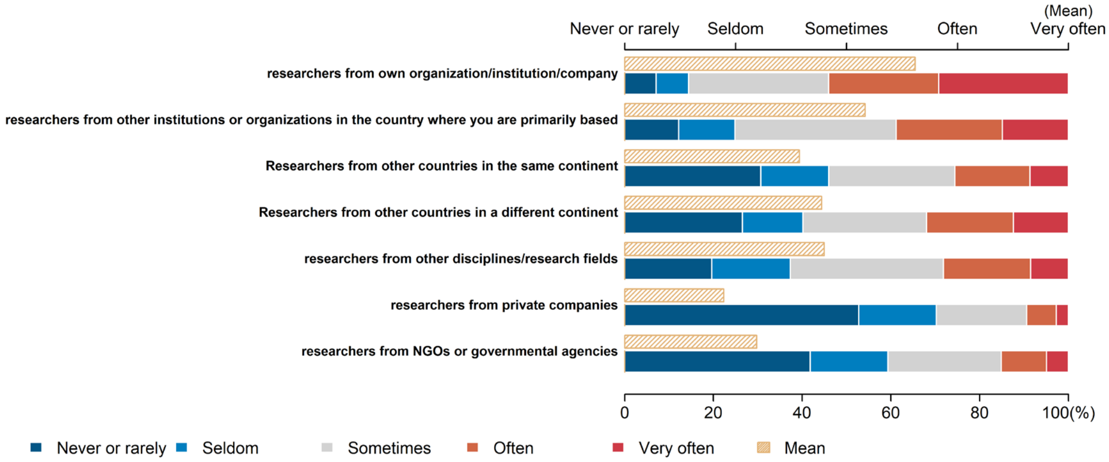


*Figure 11.6 – Frequency of collaboration on joint research projects with researchers in different sectors, institutes and regions*
*Source: Authors.*

There are practical reasons why respondents may more often collaborate with other researchers in their own organisation, however, our interviewees also revealed some other possible influences:

> *"Each and every institution wants to protect their niche. You have one institution that has this equipment and another institution has that equipment. So what we may need is a collaboration whereby institution A allows me to use what they have [and] we also allow them to use what we have. But then… they'll just say, "We do our own things at university A. You do your things at university B." [So] it's more like we are competition."*
> **Timothy, Male, 32, Zimbabwe, South Region, Other (Food Science and Nutrition), Academia, PhD**

The difficulty that different institutions within the same country in Africa cause each other emerged also in the interviews with those who had been abroad, wherein the ease of using equipment that another institute has was something that both surprised and pleased interviewees:

> *"Here there's a lot of paperwork to be done before you can use some resource, facility or equipment from another laboratory. It makes the process very heavy. Whereas [in North America] it was very agile. If you needed to use something, [then] my supervisor would just write an email to the other*

*guy and he would allow me to use it the same day. So I found that… there was almost like an open door policy. We were welcome to use other facilities from other labs."*
**Eveline, Female, 33, Mauritius, Southern Region, Other (Food Sciences), Academia, PhD**

Eveline and Timothy together give us an insight not only into the issues respondents have with forming collaborations with others in Africa, but also possibly why survey respondents living in Africa reported collaborating often or very often with researchers and groups outside of Africa (31.6 %, n=265) compared to others in Africa (24.9 %, n=208).

Researchers working in life and health sciences and applied sciences were more likely ($P \leq 0.0091$) than those in the social sciences and humanities to collaborate with researchers from their own institution (see table 11.19A in Appendix 11.9), as were those working in public or private research institutes, HE and NGOs ($P \leq 0.0045$) compared to those in business enterprise (see table 11.20A in Appendix 11.9). Conversely, those working in NGOs/private non-profits were most likely to work with other NGOs or governmental agencies than all other sectors, as were those in research institutes compared to those in HE (see table 11.21A in Appendix 11.9; Figure 11.7).

Investigating the location of collaborators, respondents working in private non-profit/NGOs and public or private research institutions were more likely ($P \leq 0.0017$) than those in business enterprises to collaborate with researchers from outside of the continent in which they live (see table 11.22A in appendices, and Figure 11.7 below). PhD holders were also more likely to collaborate with researchers in other continents and countries compared to those with a Master's ($P<0.0001$; see table 11.15, figure 11.7). Finally, respondents that received their PhD outside of Africa were more likely than those that received theirs in the Western or Southern regions to collaborate with other researchers from outside of Africa ($P \leq 0.0009$), thus giving an indication of how a PhD from outside of Africa enables researchers to more readily form international collaborations.

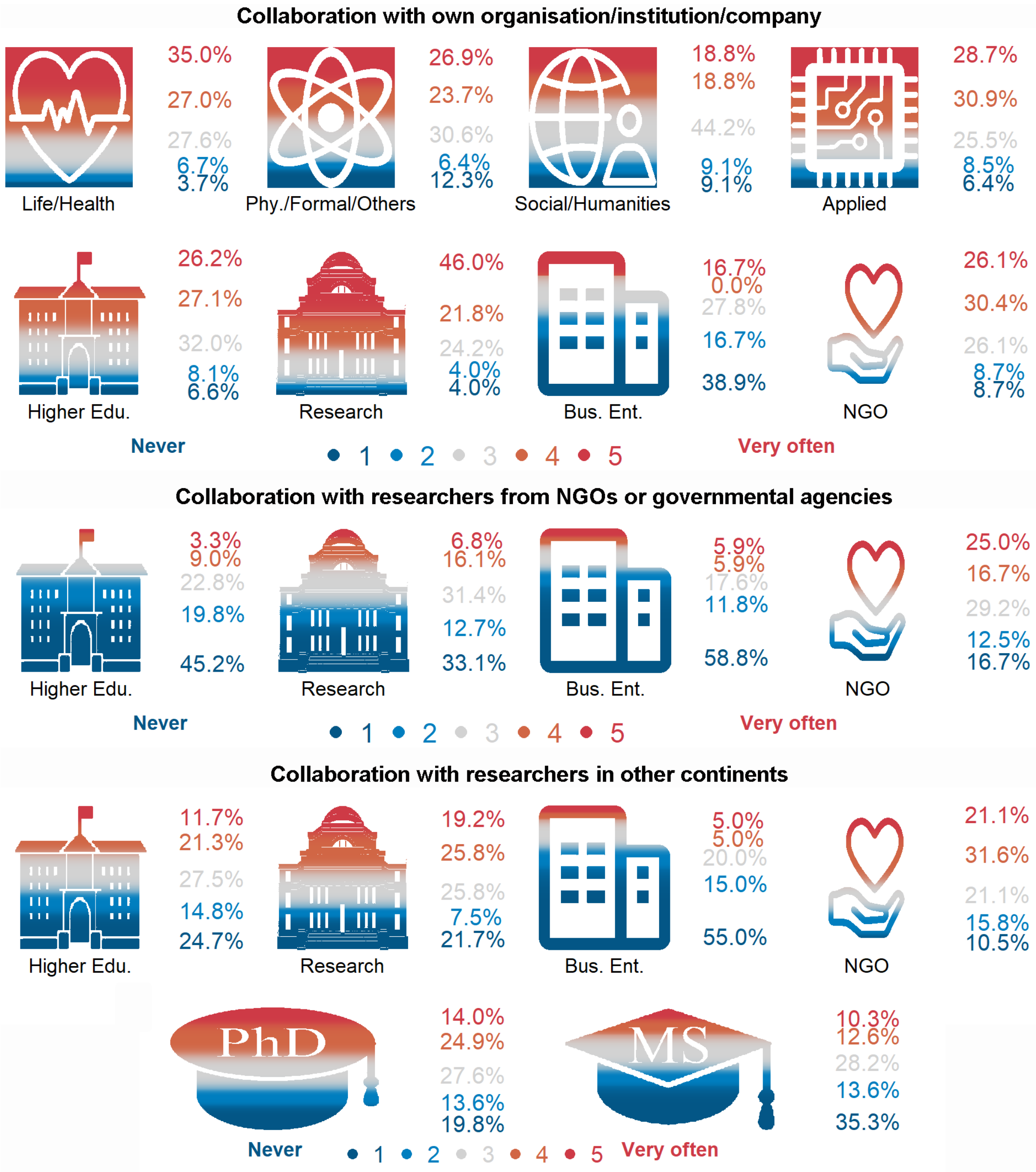


*Figure 11.7 – Significant difference in collaboration partners based on respondents' discipline, employment sector, and highest degree*
*Source: Authors.*

As may be expected, researchers born outside of Africa but residing in Africa were more likely than those born anywhere in Africa to collaborate with researchers outside the continent of residence (P≤0.0265, see table 11.15). Respondents living in the Western region were less likely than those in the three other focal regions in Africa to collaborate with researchers outside of Africa (0.655≤β≤0.995, P≤0.0343).

*Table 11.15 – Frequency of collaboration with researchers in countries outside the continent where they were living*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P)* |
|---|---|---|---|---|
| Outside Africa | Western Region | Born | 2.248 | <0.0001 |
| Outside Africa | Non-focal Africa | Born | 1.883 | 0.0001 |
| Outside Africa | Eastern Region | Born | 1.649 | 0.0005 |
| Outside Africa | Southern Region | Born | 1.507 | 0.0016 |
| Outside Africa | Northern Region | Born | 1.415 | 0.0265 |
| PhD | Master | Live | 0.764 | <0.0001 |
| Private non-profit/NGO | Business Enterprise | Live | 2.265 | 0.0015 |
| Research Institutions | Business Enterprise | Live | 1.754 | 0.0017 |
| Research Institutions | HE | Live | 0.548 | 0.0290 |
| Outside Africa | Western Region | Live | 1.253 | 0.0064 |
| Northern Region | Western Region | Live | 0.995 | 0.0343 |
| Southern Region | Western Region | Live | 0.845 | 0.0003 |
| Eastern Region | Western Region | Live | 0.655 | 0.0291 |

Note: See also Table 11.22A in appendices.
Source: Authors.

### 11.4.2 Factors which Influence ECRs' Patterns of Collaboration

It is clear in the interviews discussed in the preceding sections that respondents felt that they benefitted from the enhanced opportunity to collaborate, which they experienced through international mobility. Amongst survey respondents, those who had been mobile in the 10 years preceding the survey were more likely to form collaborations with researchers elsewhere in the continent ($P<0.0001$), and also outside the continent ($P<0.0001$). This demonstrates that international mobility – whether within Africa or outside – increases the likelihood of respondents to form collaborative relationships. Though collaboration is often considered a career benefit in and of itself, it is important to illuminate the practical reasons why respondents seek collaborative partnerships, or may wish to if they were more readily facilitated; this includes access to equipment and enhanced opportunity to secure funding:

> *"If we're talking with respect to my country, we are all incapacitated with no equipment. So the collaboration must be outside the country."*
> **Christine, Female, 40, Nigeria, Western Region, Physical Sciences, Academia, PhD**

> *"If a grant is not in my research background, I usually look for others [to collaborate with]. For example, if its funding related to agriculture, I usually look for someone from agriculture to combine and work together with."*
> **Charles, Male, 35, Kenya (from Ethiopia), Eastern Region, Health Sciences or Medicine, Para-Public, PhD**

Charles demonstrates here that some respondents create interdisciplinary collaborations in order to secure funding. However, other interviewees indicated that collaboration was necessary for them to secure funding due to their current employment status that makes them ineligible unless they partner with others with secure positions. This applied most to interviewees who were: (1) employed on fixed-term contracts, or (2) without an official affiliation to an applicable university or research organisation. In these circumstances, interviewees sought a collaborative partner that satisfied one or both of these conditions. Though, even for those that were successful, these kinds of partnerships were noted by interviewees to structurally limit their academic independence. In many cases they may initiate and lead a proposal but the collaborator is named as the principal investigator:

> *"In 2017 and 2018, I made [around] 50 applications to secure funding… Out of those I was successful with one, and [then] second one came in February this year. [That one is] actually more so collaborative funding with an institution in South Africa. So, the funding actually goes to them, because I'm just like a collaborator. I remember I was the one who initiated the idea of trying to make an application. I was looking to get a willing collaborator. I drafted a proposal [and] from there [it] came as a success."*
> **Trevor, Male, 33, Nigeria, Western Region, Life Sciences, PhD**

To provide some context to the potential impact of such requirements on building career success for African ECR, 43.7 % (n=288) of our respondents were employed on fixed-term contracts and thus in a situation where they may need to seek collaborative partnerships to secure funding, and concurrently obfuscate the lead position in the application in order to access the funding opportunity. Chapter 10 provides a detailed discussion on funding in the context of Africa ECR careers.

## 11.5 Factors which facilitate international mobility and collaboration

Given the synergistic benefits of international mobility and collaboration on ECR career trajectories, which includes increased publication, funding potential, equipment access and scope of interdisciplinary research, understanding the factor that facilitate these two crucial components of a research career is fundamental for building a thriving research community. Personal and professional support networks play an important role in this regard. Refer to Chapter 9 for our main discussion on African ECR support structures.

The sheer persistence of interviewees shone through while discussing numerous elements of their careers, as we have seen above in Trevor's push to make around 50 funding applications in two years. This was also a feature of other interviewees' success with securing opportunities for international mobility and collaboration:

> *"What I did then was to look for researchers all over the world. Basically, researchers that work in my area of research. Because [there was] one type of equipment that I needed [so] I Googled and I found email addresses. So, I sent 100's of emails, to anyone who I found who works in this field and who may have this kind of equipment… I got few replies… [but] I was fortunate to mail the chairman of the department [who referred me to his colleague]. Fortunately, he was willing to take me for a short time there, for six months to one year, just to use the equipment that I needed. Then afterwards I applied and did an interview on Skype and that's how I got a full time offer for a scholarship [with them too]. So, I didn't know much about funding opportunities before [that] but*

*after that time… I've been able to [encourage] other younger people to also look for these funding opportunities. But before I left I didn't have any idea."*
**Grace, Female, 35, Nigeria, Western Region, Physical Sciences, Unemployed, PhD**

Grace's experience characterises the commitment and persistence of many interviewees. However, her last comment also reveals the lack of exposure and training she had received as an ECR seeking funding, international mobility and other opportunities to that point. Interviewees who had the opportunity to be mobile commonly noted that they actively encourage other ECRs to seek opportunities like they had, or assist others to gain placements to institutions where they had themselves been hosted:

*"I had a scholarship for my PhD which enabled me to post to [Europe] to do part of my research. And I was able to get hooked up to people that have facilities and… at times I go to such laboratories to do work and collaborate with people in my field outside the country… So, I get motivated to do such work when I get collaborations outside my country, and more so when I have students that I'm able to get places [so they can] do their research. Currently I have two students doing parts of their PhD's there."*
**Edna, Female, 42, Nigeria, Western Region, Physical Sciences, Public, PhD**

The importance of ECRs' willingness to share information and open opportunities with their students and colleagues is reinforced by other interviewee's experience with older supervisors and colleagues who are much less forthcoming:

*"We have some difficulties, those of us who are early career researchers, because when we have superiors in the same area of research like us [but] most of them hardly introduce us into forums, or in their research groups. So, if they have been to Germany or to the United States for some programmes there, they don't openly help you with how to [go] about it [too]."*
**Hunter, Male, 38, Cameroon, Western Region, Humanities, Academia, PhD**

Whilst not everyone experienced this dichotomy in whom had provided key support and opportunities for mobility and collaboration, the necessity for it to shape a successful career resonanted amongst respondents. A number of our interviewees noted that the establishment of a network of African diaspora researchers may provide support for those aspiring mobility experience, whilst away and on returning to Africa:

*"Is there any network for young African scientist in the diaspora? Like a forum for young African scientists because we need to connect. I have colleagues from Kenya that are in the diaspora, [and] also young African scientists from Tanzania, Zimbabwe, Malawi, Ghana, Egypt, Morocco, Tunisia and all that, young African scientists from all these countries in the diaspora. [I mean] a network that can bring us all together. We're all Africans and some day we will return back home."*
**Dominique, Male, 36, Asia (from Nigeria), Outside Africa, Humanities, Public, PhD**

## 11.6 Conclusions

Our research findings help to inform a better understanding of two highly sensitive topics, that is, the international mobility and international collaborations of ECRs in Africa. Subsequently, we will focus on the general patterns and main findings, being conscious and aware of the regional differences in Africa we have outlined above.

Our findings on the *international mobility* of ECRs in Africa will subsequently be presented in three clusters: prevalence and preferred destinations; barriers and drivers; and impact of international mobility. Our first cluster of findings provides evidence showing that ECRs in Africa are highly mobile, with short-term trips being the most common form of mobility, and a preference for countries highlighting the importance of North America and regional hubs in Africa.

1. Moving outside of Africa to obtain a Master's or PhD is common amongst African ECRs. Most (64.5 %) African-born respondents had moved to a new country at least once in their life. One-third of Master's holders (29.3 %) obtained their degrees outside the country they were born in, and nearly half (45.9 %) moved internationally to obtain their PhDs. The majority of respondents that moved internationally to do either a Master's or PhD chose a country outside of Africa (58.1 % and 59.5 %, respectively). African ECRs living in Eastern Africa were more likely than those in western Africa to have completed a PhD outside their home country, as were respondents who are members of a Young Academy. In comparison to other studies focused on other regions of the world, these findings portray a very mobile academic workforce. Findings from the CAP study (Teichler, Arimoto and Cummings 2013), with data collected in 18 countries (including South Africa as the only African country), report a share of 42 % of academics who had been mobile during their career. Based on the same data, Rostan and Ceravalo (2015) reported a share of 16 % of academics that earned at least one HE degree abroad. Findings from the CDH project of the OECD (Auriol, Misu and Freeman 2013) indicate that about 14 % of the doctorate holders, on average, surveyed were mobile during the 10 years prior to the survey. Though the data from both studies was collected several years ago, and our findings may reflect a general increase in international mobility (OECD 2018), the scale of the difference leads us to assume that African ECRs are comparatively more mobile than their international peers.

2. Short trips up to one year long are the most common form of recent international mobility. Respondents indicated that experiencing even a few months in another research facility can have a significant impact on career enhancement, enabling them to complete, in a short period of time, research that would have taken considerably longer to complete in their home country. This finding aligns with the general trend reported by the CDH project, with most countries reporting that international mobility is most commonly a one-off and short-term one, with stays abroad of a duration of less than one year being the most frequent (Auriol, Misu and Freeman 2013).

3. PhD holders were more likely to spend two to five years, or more than five years away compared to Master's degree holders. Completion of their PhD degree (24.2 %), an obligation to return home (21.7 %) and family reasons (9.8 %) were the most common factors cited by African ECRs to leave their international host country.

4. North America is the most desired future location African ECRs are considering moving to, despite having no previous experience of training or working there. South Africa and Kenya were the most desired international destinations within Africa. Respondents living in Western Africa were more likely than those living outside of Africa and in the Southern or Eastern regions to be intending to move. Our findings on the preferences of early-career mobility for specific countries support the role of regional hubs as destinations for talented ECRs (Herman and Sehoole 2018; Lee and Sehoole 2015; Sehoole 2011).

Our second group of findings relates to the drivers and barriers of international mobility. These findings are generally in alignment with previous research (e. g., Auriol, Misu and Freeman 2013) pointing to the relevance of academic, job-related or economic factors as well the importance of family both as a barrier to mobility as well as motivation to return home. Additionally, we were able to capture evidence of unfair treatment and discrimination towards mobile scientists and scholars in their host countries.

5. Access to equipment, facilities, topical expertise, enhanced publishing potential and economic factors influence African ECR to move internationally. This is related to both those who moved to do a PhD and after having obtained one. African ECR respondents in the applied sciences were more likely than those in social and humanities and life and health sciences to move internationally to obtain a PhD degree, which related specifically to increased research facility access.

6. Language differences, unfair treatment and discrimination in host countries hinder integration and limit the collaborative potential ECRs had envisaged from their mobility. These experiences of discrimination were felt by respondents who have travelled both outside and within Africa, with no one location associated with such challenges. These findings add a somber tone to the positive associations commonly used to describe the importance of attracting international talent to a country for the benefit to the receiving institution, the research system, and the economy of the receiving country (Cantwell 2011; Marginson and van der Wende 2009; Times Higher Education 2018). Recent studies by Lee (2017) and Sehoole et al. (2019) on the experiences of foreign academic staff in South Africa have reported similar findings, relating negative experiences to neo-nationalism, racism and xenophobia.

7. Family obligations and social circumstances are barriers to international mobility. Many respondents cited self-sacrifice in terms of the impact on their family choices in order to achieve their PhD internationally, but they were able to do so through the support of others.

8. The cost involved in travelling to conferences in other parts of the world are prohibitive to career advancement. For some, funds for even travelling within Africa are prohibitive, given that self-funding travel is common practice.

9. A sense of duty, family ties, job security and access to research facilities are key factors that influence respondents' decisions to return to their home countries. Respondents felt their prospects back in Africa would be better than that overseas and that in spite of the benefits of international mobility they experienced, they felt duty bound to return home and contribute to their community. The high importance of family reasons among the cluster of key factors influencing the decision to return home mirrors the findings from the GloSYS ASEAN study (Geffers et al. 2017) where family-related factors were most important, followed by job-related or economic and academic factors.

10. Despite returning to Africa with the intention of impacting their communities with the skills they acquired internationally, the current conditions ECRs are experiencing in Africa are forcing them to once again look to leave temporarily, or even permanently. Fully 80 % of respondents indicated they were considering leaving Africa, irrespective of whether they had previously left or not.

11. Better access to collaborative networks, an opportunity to create their own research team or new research area, and the acquisition of new skills primarily influence the future desire to leave Africa. Moving to a more prestigious institution and/or having better prospects for career advancement and job-related factors such as better salary or employment benefits also influenced the consideration to leave.
Finally, our research provides further support for the positive impact of international mobility on the advancement of a research-oriented career reported in previous studies.

12. An increased ability to publish, secure funding and an increased number of international collaborations were associated with the experience of international mobility.

Summarising our findings on international mobility, our research delineates ECRs in Africa as highly mobile, even more mobile than their international peers. We found academic, job-related and economic factors as the primary factors leading ECRs to become mobile, with the majority aiming for destinations outside of Africa such as the USA, Germany or the United Kingdom, or within Africa where South Africa or other regional hubs such as Kenya were sought after. We identified family obligations, travel costs and visa regulations as the main barriers to mobility. Similar to the findings from previous research, we found the experience of being internationally mobile to be positively associated with access to funding, the ability to publish and to engage in international collaborations. As much as our results seem to mirror the findings from studies from other parts of the world reported on in our literature review – with most findings based on research from Europe or North America – we note a substantial difference. Whereas international mobility may be a valuable experience and enhance one's career in most countries with mature and well-funded research systems, and may even be necessary to stay ahead in the highly competitive field of excellent researchers, international mobility in Africa may be better understood as a precondition to enter some fields of research and the international arena of excellent researchers.

Our findings on *collaboration* patterns of ECRs in Africa underline the importance of international research collaborations, particularly with countries outside of Africa. This collaboration pattern is strongly driven by the intent to improve one's chances of getting funded by international donors, which are of pivotal importance for African researchers in light of the scarce national sources for research funding in the vast majority of African countries (see Chapter 10). Our findings present indications that this particular setting may further prove a hindrance to collaborations between different research institutions within the same country, or with other African countries. Our analysis of the data reveals:

13. African ECRs are more likely to collaborate with researchers outside of Africa than they are in other countries within Africa. A lower rate of international research collaborations between African countries than between African and non-African countries has been reported before (Blom, Lan and Adil 2016; Onyancha and Maluleka 2011). In their analysis of African regional innovation systems, Toivanen and Ponomariov (2011) state an "absence of regional integration of collaborative research networks" (Toivanen and Ponomariov 2011, p. 491) and point out that the European and North American research communities were identified as "the only research hubs with strong or moderate links to all African research regions, suggesting that they have important African networking functions, too," (ibid.). Our findings suggest that the structural weaknesses of continental and regional collaborative research networks reported by these earlier studies persist, and research collaborations between different African countries may yet rely on the inclusion of a North American or European partner. Studies on research collaborations in Central Africa with partners from abroad reported that collaborators from outside of Africa were often found to be instrumental in securing research funds (55 %) or providing other resources (49 %), whereas data collection or field work seemed to be the most frequent role of the African partners involved in these projects (Boshoff 2009; Owuso-Nimo and Boshoff 2017).

14. PhD holders were also more likely than Master's holders to collaborate internationally, as were respondents who have experienced mobility. The finding that PhD holders were more likely to collaborate internationally than Master's holders mirrors the results of the MORE3 study (e. g., IDEA Consult, WIFO and Technopolis 2017) reporting higher levels of international collaboration at later career stages, and other studies indicating positive associations of international mobility and international collaboration (Mouton et al. 2018).

15. Collaboration is seen as a necessary means to enable African ECRs to submit funding applications, given that their current employment conditions prohibit their ability to be lead applicants. The reliance on senior and international collaborators to secure funding structurally limits their academic independence.

16. African ECRs most commonly collaborate with researchers within their own institutions and they infrequently collaborate with private enterprise, NGOs and governmental agencies.

In sum, our findings on international research collaborations strongly revolve around the dependency of African ECRs on access to international sources of funding and senior African researchers who have access to those international collaborative research networks required to form partnerships that are able to secure funding. While those research collaborations have proven beneficial in improving research productivity and international visibility of African research Blom, Lan and Adil 2016) the focus of the research may not be in the primary interest of the country and monitoring the participation of African researchers in key project activities may be warranted.

## 11.7 Recommendations

The recommendations have been formulated at two levels, as follows.

**Government, Institutions, Academies, and funding bodies**

- Turn brain drain into brain gain by providing reintegration, seed and catalyst grants for returning African ECRs to support the establishment of their research in Africa.
- Both governments and HE institutions need to invest efforts and logistics to upgrade modern research facilities and create linked research positions which are designed to provide a platform for returning ECRs to implement the scare skills they have acquired abroad.
- Develop dual-institution PhD and postdoc exchange programmes.
- Establish an African scholars visa to enable movement and collaboration within Africa and abroad.
- Invest in research infrastructure and capacity which will incentivise researchers living abroad to migrate and contribute to Africa‘s research endeavour.
- Support and facilitate the establishment of research networks and academies, including a diaspora network of African ECRs. Also support the inclusion of ECRs in those networks and academies that do already exist.

**Funding bodies and international institutions**

- Designated bodies should increase the availability of funding for national/African collaborative research projects as well as the number of smaller travel grants for 1–6 months to increase ECRs access to research infrastructure abroad and future collaboration potential.
- Provide time-flexible funding schemes for female and parenting ECRs. Incorporate provisions for childcare and travel for children into international scholarships.

These recommendations also appear as Table 11.16a in Appendix 11.9.

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## 11.9 Appendix

*Table 11.16A – How to foster mobility and collaboration*

| Foster bilateral and regional international mobility and collaboration | |
|---|---|
| **Interlocutors** | **Suggested Policies and Measures** |
| **Government, Institutions, Academies, and funding bodies** | ▪ Turn brain drain into brain gain by providing reintegration, seed and catalyst grants for returning African ECRs to support the establishment of their research in Africa.<br>▪ Both governments and HE institutions need to invest efforts and logistics to upgrade modern research facilities and create linked research positions which are designed to provide a platform for returning ECRs to implement the scare skills they have acquired abroad.<br>▪ Develop dual-institution PhD and postdoc exchange programmes.<br>▪ Establish an African scholars visa to enable movement and collaboration within Africa and abroad.<br>▪ Invest in research infrastructure and capacity which will incentivise researchers living abroad to migrate and contribute to Africa's research endeavour.<br>▪ Support and facilitate the establishment of research networks and academies, including a diaspora network of African ECRs. Also support the inclusion of ECRs in those networks and academies that do already exist. |
| **Funding bodies and international institutions** | ▪ Designated bodies should increase the availability of funding for national/African collaborative research projects as well as the number of smaller travel grants for 1–6 months to increase ECRs access to research infrastructure abroad and future collaboration potential.<br>▪ Provide time-flexible funding schemes for female and parenting ECRs. Incorporate provisions for childcare and travel for children into international scholarships. |

Source: Authors.

*Table 11.17A – Lived, worked or studied for three (3) months or more outside home country in the 10 years preceding survey*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| PhD | Master | Born | 1.258 | <0.0001 |
| Outside Africa | Western Region | Ms | 2.849 | <0.0001 |
| Outside Africa | Non-focal Africa | Ms | 2.789 | <0.0001 |
| Outside Africa | Eastern Region | Ms | 2.491 | <0.0001 |
| Outside Africa | Southern Region | Ms | 2.325 | <0.0001 |
| Academy Member | Not an Academy Member | PhD | 1.579 | <0.0001 |

Source: Authors.

*Table 11.18A – Length of time away for PhD holders compared to Master's holders*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P) |
|---|---|---|---|---|
| 2–5 years | Still living away | Born | 1.731 | <0.0001 |
| 2–5 years | 1–2 years | Born | 1.349 | 0.0013 |
| 2–5 years | 3–6 months | Born | 1.051 | 0.0248 |
| More than 5 years | Still living away | Born | 1.577 | 0.0162 |

Source: Authors.

*Table 11.19A – Reasons for intention to move countries into the future*

| | Respondents Living in Africa | | Respondents Living Outside Africa | |
|---|---|---|---|---|
| **Reason** | (n) | (%) | (n) | (%) |
| **Research-related** | 451 | 34.7 | 25 | 16.7 |
| **Career development related** | 369 | 28.4 | 24 | 16 |
| **Job-related** | 197 | 15.2 | 17 | 11.3 |
| **Other personal reasons** | 72 | 5.5 | 14 | 9.3 |
| **End of job / postdoc contract** | 64 | 4.9 | 22 | 14.7 |
| **Family reasons** | 57 | 4.4 | 27 | 18 |
| **Political or immigration reasons** | 31 | 2.4 | 3 | 2 |
| **Obligation to return to home country** | 30 | 2.3 | 13 | 8.7 |
| **Other** | 28 | 2.2 | 5 | 3.3 |
| Total | 1,299 | 100 | 150 | 100 |

Source: Authors.

*Table 11.20A – Frequency of collaboration with researchers from own organisation/institution, stratified by discipline*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P)* |
|---|---|---|---|---|
| Applied Sciences | Social and Humanities | Live | 0.917 | 0.0091 |
| Life and Health Sciences | Social and Humanities | Live | 0.868 | <0.0001 |
| Life and Health Sciences | Physical Sciences | Live | 0.584 | 0.0087 |
| Applied Sciences | Social and Humanities | Born | 0.936 | 0.0071 |
| Life and Health Sciences | Social and Humanities | Born | 0.869 | <0.0001 |
| Life and Health Sciences | Physical Sciences | Born | 0.580 | 0.0093 |
| Life and Health Sciences | Social and Humanities | Ms | 0.851 | 0.0001 |
| Applied Sciences | Social and Humanities | Ms | 0.802 | 0.0388 |
| Life and Health Sciences | Physical Sciences | Ms | 0.649 | 0.0037 |
| Life and Health Sciences | Social and Humanities | PhD | 0.961 | 0.0001 |
| Applied Sciences | Social and Humanities | PhD | 0.899 | 0.0454 |
| Life and Health Sciences | Physical Sciences | PhD | 0.746 | 0.0043 |

Source: Authors.

*Table 11.21A – Frequency of collaboration with researchers from own organisation/institution, stratified by sector*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P)* |
|---|---|---|---|---|
| Research Institutions | Business Enterprise | Live | 2.793 | <0.0001 |
| Higher Education | Business Enterprise | Live | 2.055 | 0.0001 |
| Private non-profit/ NGO | Business Enterprise | Live | 1.978 | 0.0045 |
| Research Institutions | Higher Education | Live | 0.738 | 0.0012 |
| Research Institutions | Business Enterprise | Born | 2.826 | <0.0001 |
| Higher Education | Business Enterprise | Born | 2.082 | <0.0001 |
| Private non-profit/ NGO | Business Enterprise | Born | 1.968 | 0.0049 |
| Research Institutions | Higher Education | Born | 0.744 | 0.0011 |
| Research Institutions | Business Enterprise | Ms | 2.639 | <0.0001 |
| Higher Education | Business Enterprise | Ms | 2.069 | <0.0001 |
| Private non-profit/ NGO | Business Enterprise | Ms | 1.988 | 0.0049 |
| Research Institutions | Higher Education | Ms | 0.570 | 0.0284 |

Source: Authors.

*Table 11.22A – Frequency of collaboration with researchers from NGOs or governmental agencies, stratified by sector*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P)* |
|---|---|---|---|---|
| Private non-profit/ NGO | Business Enterprise | Born | 2.122 | 0.0030 |
| Private non-profit/ NGO | Higher Education | Born | 1.428 | 0.0019 |
| Research Institutions | Higher Education | Born | 0.617 | 0.0124 |
| Private non-profit/ NGO | Business Enterprise | Ms | 1.995 | 0.0068 |
| Private non-profit/ NGO | Higher Education | Ms | 1.425 | 0.0019 |
| Research Institutions | Higher Education | Ms | 0.630 | 0.0128 |

Source: Authors.

*Table 11.23A – Frequency of collaboration with researchers from other countries outside of the continent, stratified by degree, sector, region*

| Basis Variable | Reference Variable | Basis | Correlation (β) | Significance (P)* |
|---|---|---|---|---|
| PhD | Master | Born | 0.752 | <0.0001 |
| Private non-profit/ NGO | Business Enterprise | Born | 2.221 | 0.0021 |
| Research Institutions | Business Enterprise | Born | 1.807 | 0.0012 |
| Higher Education | Business Enterprise | Born | 1.230 | 0.0475 |
| Research Institutions | Higher Education | Born | 0.577 | 0.0187 |
| Southern Region | Western Region | Born | 0.741 | 0.0042 |
| Private non-profit/ NGO | Business Enterprise | Ms | 2.352 | 0.0012 |
| Research Institutions | Business Enterprise | Ms | 2.075 | 0.0001 |
| Higher Education | Business Enterprise | Ms | 1.721 | 0.0011 |
| Outside Africa | Western Region | Ms | 1.335 | <0.0001 |
| Northern Region | Western Region | Ms | 1.335 | 0.0005 |
| Outside Africa | Non-focal Africa | Ms | 0.908 | 0.0500 |
| Southern Region | Western Region | Ms | 0.697 | 0.0147 |
| Outside Africa | Western Region | PhD | 1.615 | <0.0001 |
| Northern Region | Western Region | PhD | 1.264 | 0.0123 |
| Outside Africa | Southern Region | PhD | 0.881 | 0.0009 |
| Southern Region | Western Region | PhD | 0.733 | 0.0454 |

Source: Authors.

# 12 Conclusion

**List of Acronyms and Abbreviations**

| | |
|---|---|
| ECR(s) | Early-career researchers |
| GloSYS | Global State of Young Scientists |
| HE | Higher education |

Africa is a continent in transition to a new era, and young scientists and scholars are set for a special role in this process – to generate new knowledge that drives innovation, creates new jobs, addresses exigent societal challenges such as health and climate change, and to educate the next generation of highly qualified human resources needed for the knowledge-based societies envisaged for the future. Yet, early-career researchers (ECRs) in Africa are facing serious impediments to their professional development and careers, which often lead them to pursue their careers abroad or abandon a research-oriented career altogether.

Looking back to the final decades of the twentieth century, in broad strokes, most higher education (HE) and research systems in Africa, Sub-Saharan Africa in particular, were in a state of deterioration. Failing African economies limited the options for African governments to properly fund HE systems, international funding was not available as The World Bank deemed investments in HE misguided – based on findings that later proved to be false. Since the turn of the century, with international funding returning to African HE systems, a phase of regeneration and growth has begun. Furthermore, African organisations at the continental and regional levels, as well as national governments, have increasingly recognised the need to develop HE and science to achieve the goals for the development of African societies.

Against this backdrop, the Global State of Young Scientists (GloSYS) Africa project set out to investigate the state of young scientists and scholars in Africa, with the aim of providing evidence-based recommendations for their support to policy and interested stakeholders, and to contribute to ongoing discussions in the fields of HE research and science studies. How do the major international trends in HE and science – the massification and marketisation of HE; the internationalisation, globalisation and regionalisation of HE and science; the changing role of women in these fields – impact the academic profession and ECRs in particular? Specifically, what are the opportunities and challenges that ECRs in Africa face in pursuing a career and research? Do these opportunities and challenges differ by region, discipline, employment sector, highest qualification, gender, and/or academy membership?

In consideration of our international comparative approach, we want to highlight only those findings and observations that seem to us particularly relevant because they either differ from or converge with previous studies on junior academics or ECRs in other parts of the world:

- African ECRs are more often internationally mobile compared to many of their international peers, at least with regard to the acquisition of HE degrees. While international mobility may be considered an important addition to any research career, the insufficient resources (e. g., funding, infrastructure) available in many African countries often make international mobility a necessity rather than a mere enhancement.

- The high teaching loads of young scientists and scholars as well as related administrative burdens do not receive the recognition they deserve, and these time-consuming tasks directly impact the time available for meaningful research and funding applications. Our finding on high teaching loads converges with previous findings on time allocations for junior academic staff in other emerging countries compared with their peers from countries with stronger economies. This puts African ECRs at a disadvantage when applying for international funding or positions abroad (and possibly at home).
- The predominant focus on quantifiable research metrics for promotions is considered adverse to the pursuit of excellent, novel research or to improve the quality of teaching. This finding is similar to our results from the GloSYS Association of Southeast Asian Nations project, where ECRs criticised the focus on quantifiable research output and the extent to which different indicators needed to be documented across a range of reporting systems.
- Inequities in research and science related to gender and race/ethnicity are common. Female researchers report significantly more often than their male peers to have experienced sexual or power harassment. African ECRs are not only discriminated against or treated unfairly abroad – with a persistent theme of “having to prove themselves because of their race/ethnicity”. Indeed, unfair treatment based on ethnicity, race or nationality is also experienced when one is internationally mobile within Africa.
- Funding for research is particularly low in Africa. Only about two in five of our respondents were able to acquire funding within the three years prior to our survey, and of those who acquired funding, slightly more than one in five considered the amount sufficient to cover their expenses (research, travel and salary). Further, the dependency on international funds for research is very high. This may result in research agendas and forms of collaboration that have been described as “neo-colonial” in previous research.

African societies are in transition and so are their HE and research systems. Though recent years have offered some reason for hope that the state of science in Africa is improving, the effects of decades of neglect still linger. Many ECRs in Africa are still bound to pursue their careers in institutions that cannot provide up-to-date technological infrastructures, have shortages of competent senior academic staff to supervise and mentor them, and lack sufficiently qualified administrative staff to help alleviate bureaucratic burdens, among other things. Our study was able to produce more than a snapshot of the state of young scientists and scholars in Africa, their challenges and opportunities. We were able to relate many of our findings to previous research from other regions of the world, offering opportunities for scholarly discussion and bringing Africa into the picture from which it has been missing.

During our research, we noted a lack of consistent administrative/statistical data not only on ECRs, but on the HE and science systems in many if not most African countries. Similarly, with the exception of a few countries, research on and monitoring of ECRs is still scarce or absent, and detrimental to the focused support of young scientists and scholars based on national priorities and resources.

Based on our findings, we have developed suggestions for policies and other measures for different stakeholders to improve the situation of young scientists and scholars. Our findings offer an opportunity to include additional evidence in debates within institutions of HE and research, funding agencies, granting councils, ministries and the general public.

GLOBAL
YOUNG
ACADEMY