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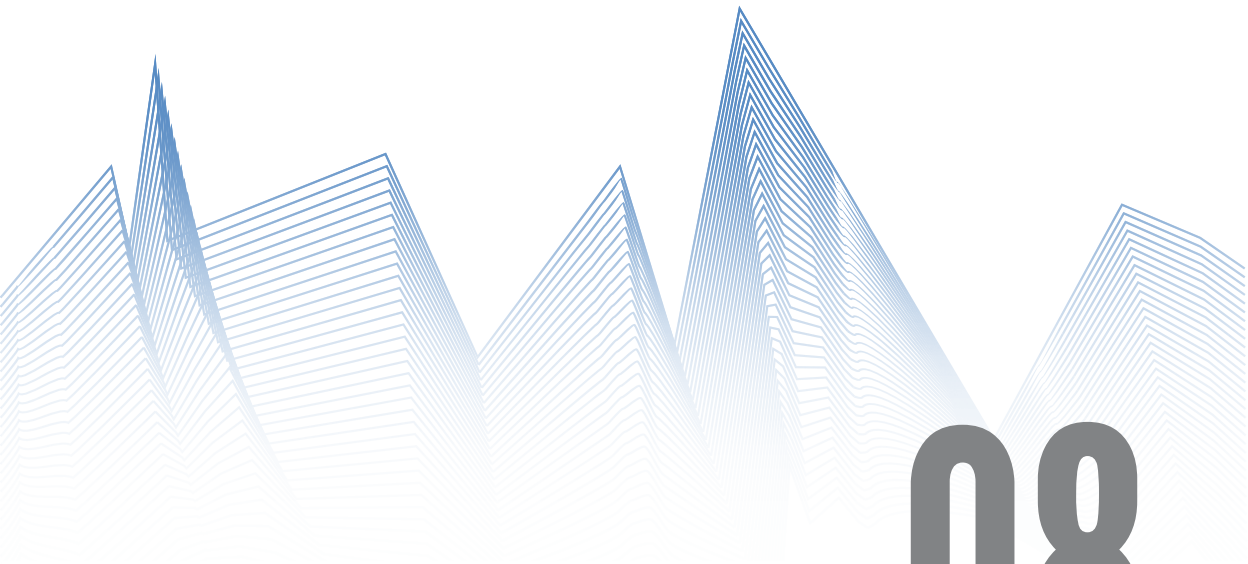

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RESEARCH CAPACITY IN THE NEW GLOBAL DEVELOPMENT AGENDA

Måns Fellesson

Research Capacity in the New Global Development Agenda

Mobility, Collaboration and Scientific Production among PhD Graduates Supported by Swedish Development Aid in Africa

Måns Fellesson

Rapport 2017:08
till
Expertgruppen för biståndsanalys (EBA)

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Preface

There is no doubt that it is fundamental to invest in Science, Technology and Innovation (STI) in building capacity for development. Knowledge and education are key components in fighting poverty and making societies more equal. Sweden has for more than 40 years supported research capacity building in many low-income countries by investing in institutional capacity, infrastructural capacity and individuals, the latter in the form of PhD training programs (the so called sandwich model; part time at a Swedish university and part time at a home university). Some 1000 individuals from partner countries have been enrolled in these PhD programs. The goal is to provide a good base for the researchers to contribute to the building of local research environments in which they can produce high-quality research.

In this report Måns Fellesson presents the results of a tracer study of PhD students from Mozambique, Tanzania and Ethiopia, who have been part of the Swedish PhD training program, to find out what happened to them after graduation. The analysis is based on primary data (survey and interviews) collected by the author in 2012-14, covering 243 PhD graduates. The study analyses the conditions and prerequisites for doing research in the three countries by focusing on three of the core areas within science production and academic careers, namely; mobility, international collaboration and scientific output. What are the premises for the PhDs to conduct high-quality research when returning to their home universities? Of course it varies, but in general it seems as if the mobility among the PhDs is weak, but most of them (who are still in academia) do participate in international collaboration. The great expansion of undergraduate teaching at universities in Africa has had the effect that many of the researchers have to teach almost full time and therefore have little time left to do research and apply for research grants. So although there are more people getting a higher education in the three countries, the researchers may get less time for research since most of their time is spent on teaching. An important dilemma to notice.

The author provides recommendations at two levels. At the overall policy level the author suggests, among other things, that Sweden should do more in terms of support to the research part of development cooperation. STI investments are indispensable in order to manage and reach the SDGs. This was made clear in the financing development agenda from Addis Ababa in 2015 and Agenda 2030.

Here Sweden can take a global lead! At a more operational level one suggestion is to acknowledge the post-doc situation, which is a critical phase in a researcher's career. Here, there should be financing for post-doc programs to make it possible for the researchers to focus on their research for a couple years more. The low level of mobility must also be recognized. The high ambitions in the Swedish research policy regarding internationalisation should also guide the strategy for research cooperation in development cooperation. This is not the case today, the author argues.

To stimulate constructive debates on various issues of relevance to the Swedish international development cooperation is part of EBA's remit. This report shows that the support to PhD training has contributed to the building of essential institutional capacity in partner countries, but it also points to the challenges. The author provides suggestions about how this form of development cooperation can be developed further. It is my hope that this study will stimulate the debate on the role of development cooperation in relation to research, which may become even more important going forward. The authors' work has been conducted in dialogue with a reference group chaired by Arne Bigsten. The analysis, views and recommendations presented in the report are the sole responsibility of the author.

Stockholm, May 2017

Gun-Britt Andersson

Sammanfattning

I ljuset av en alltmer konkurrensutsatt global kunskapsekonomi och de globala utmaningar som lyfts fram i Agenda 2030 och i de hållbara utvecklingsmålen finns det mycket som talar för att tillgången till nationella forskningsresurser kommer att bli allt viktigare. Detta faktum är lika viktigt för låginkomstländerna som för OECD-länderna. Låginkomstländerna behöver faktiskt ännu mer resursinvesteringar inom vetenskap, teknik och innovation för att inte riskera att halka efter ytterligare och för att ha en chans att hantera de utmaningar som är förenade med de hållbara utvecklingsmålen. Många av utmaningarna slår som hårdast mot dessa länder.

Utgångspunkten för den här studien är att den främsta orsaken till fattigdomen i många låginkomstländer idag inte är brist på naturtillgångar eller geografisk marginalisering utan brist på utbildad och specialiserad arbetskraft som kan generera kontextspecifik kunskap, utveckla lösningar på samhällsutmaningar och bidra till en gynnsam och hållbar utveckling. Institutioner med koppling till vetenskap, teknik och innovation och högre utbildning spelar i det hänseendet en central roll som forsknings- och utbildningsaktörer. De viktigaste institutionerna däribland är universiteten.

Betydelsen av institutionell kapacitet inom vetenskap, teknik och innovation i låginkomstländer har sedan början av 1970-talet fungerat som en vägledande princip för det svenska forskningsbiståndet. Det har skett en övergång från övergripande bistånd till bistånd för uppbyggnad av forskningskapacitet, där doktorandutbildning varit ett huvudinslag i arbetet med att skapa konkurrenskraftiga och hållbara forskningsmiljöer vid nationella universitet i samarbetsländer i Afrika, Asien och Latinamerika. Länder som Moçambique, Tanzania och Etiopien har erhållit bistånd från Sverige i mer än 35 års tid och ett betydande antal personer som doktorerat har utbildats inom ramen för olika institutionssamarbeten med huvudsakligen svenska samarbetspartner. Under årens lopp förefaller den starka tilltron till doktorandutbildningsformatet (sandwich-modellen) ha överskuggat behovet av en systematisk analys av de långsiktiga resultaten i förhållande till de förändrade villkoren för forskningsproduktionen. Efter mer än 40 års bistånd till uppbyggnad av forskningskapacitet behöver vi ställa oss följande frågor: *Vart tog alla dessa forskare vägen efter att de tagit sin examen och på vilket sätt bidrar de till det*

övergripande svenska biståndsmålet om att bygga upp lokal forskningskapacitet i låginkomstländerna?

Studien syftar till att med hjälp av primärdata besvara denna fråga genom att utifrån parametrarna rörlighet, samarbete och vetenskaplig produktion studera karriärutvecklingen bland personer från Moçambique, Tanzania och Etiopien som fått biståndsstöd från Sverige då de doktorerade. Skälet till att dessa tre parametrar studeras är att de idag utgör vedertagna delar i den vetenskapliga produktionen och således ett värdefullt instrument för att få kunskap om kunskapsproduktionens villkor och om utvecklingen vid låginkomstländernas forskningsinstitutioner samt för att bevaka den politik som bedrivs till stöd för uppbyggnad av forskningskapacitet.

Studien baseras på primärdata som inhämtats mellan 2012 och 2014 och som inbegriper personer i de tre länderna som doktorerade mellan 1990 och 2014. Studien baseras på en blandad metod och uppgifterna har inhämtats med hjälp av enkäter och djupintervjuer. Datauppsättningen omfattar 243 personer (82 i Moçambique, 87 i Tanzania och 74 i Etiopien) från fyra universitet: Eduardo Mondlane-universitetet (UEM), universitetet i Dar es Salaam (UDSM), universitetet i Addis Abeba (AAU) och universitetet i Alemaya (AU). De två huvudparametrarna i jämförelsen har varit land och vetenskaplig disciplin.

I syfte att på ett kritiskt sätt placera uppgifterna om de utvalda områdena rörlighet, samarbete och vetenskaplig produktion i sitt sammanhang beskriver studien tre faktorer som antas vara avgörande för karriärutvecklingen bland dem som doktorerat. Dessa faktorer är: i) den nuvarande situationen för och utvecklingen inom vetenskapen och den högre utbildningen i världen, i Afrika och i de berörda länderna, ii) den politiska motiveringen till och förutsättningarna för det svenska utvecklingsbiståndet till förmån för uppbyggnad av forskningskapacitet samt iii) internationaliseringen och Sveriges politiska utveckling i frågan.

Avsikten är att länka resultaten i fråga om rörlighet, samarbete och vetenskaplig produktion till dessa viktiga faktorer och lägga grunden för en diskussion kring följande övergripande frågor:

- Ligger det svenska biståndet till uppbyggnad av forskningskapacitet i låginkomstländer i linje med förutsättningarna för internationell vetenskaplig produktion och utvecklingen inom den högre utbildningen på nationell nivå?

- Hur ser villkoren för forskning ut i de berörda länderna och vilka förutsättningar har de som doktorerat att delta i internationell forskning?
- Vilken roll spelar de svenska universiteten när det gäller biståndet till uppbyggnad av forskningskapacitet i låginkomstländer och hur överensstämmer dessa samarbetsformer med Sveriges politiska hållning när det gäller internationaliseringen?

Resultat

Genomgången av förutsättningarna i förhållande till begreppet internationalisering (globalt och i politiskt beslutsfattande i Sverige), som har en nära koppling till det svenska biståndet till doktorandutbildning, visar att vissa inslag i urvalet främst styrs av ekonomiska motiv. Dessa förutsättningar, som allesammans har bäring på rörligheten, samarbetet och publikationerna, har koppling till *vem som inbegrips (representation) och på vilka villkor det sker (funktion)?* Till stor del på grund av låginkomstländernas svaga institutionella kapacitet tenderar deras representanter att inte involveras som potentiella samarbetspartner när det gäller det politiska beslutsfattandet i frågor som rör internationaliseringen i höginkomstländer. Sveriges beslutsfattande kring högre utbildning och forskning är inget undantag.

Genomgången av läget och förutsättningarna för vetenskaplig produktion i världen, i Afrika och i de berörda länderna visar på en ojämn fördelning av forskningsresurser och forskningskapacitet och på att Afrika saknar de flesta av de nödvändiga förutsättningarna för forskning. Det mest kritiska resultatet rör den begränsade tillgången till kvalificerade forskare. Situationen och utvecklingen inom den högre utbildningen och forskningen i Moçambique, Tanzania och Etiopien visar att högre utbildning, liksom vetenskap, teknik och innovation, prioriteras alltmer i politiken. Trots att den första prioriteringen har medfört en betydande ökning av antalet lärosäten och studenter så förefaller den politiska prioriteringen när det gäller vetenskap, teknik och innovation inte har resulterat i några särskilt viktiga insatser i fråga om ytterligare resurser.

I det empiriska underlaget visar resultaten för den grupp som doktorerat överlag på en låg grad av internationell, sektorsspecifik och vertikal rörlighet. Den övervägande delen av de som doktorerat i de tre länderna arbetar fortfarande inom den akademiska världen.

Majoriteten har även stannat vid samma universitet. För många har doktorsexamen lett till en högre akademisk tjänst. Ur ett forskningsperspektiv är det en nackdel att många högre tjänster i den akademiska världen har administrativ inriktning, vilket begränsar utrymmet för forskning. Den internationella rörligheten var allmänt låg i alla tre länderna och – med några få undantag – mellan de vetenskapliga disciplinerna. De som utnyttjat rörligheten förefaller främst ha åkt till Europa och andra afrikanska länder.

Om man ser till formerna och förutsättningarna för internationellt samarbete så verkar merparten delta i något slags internationellt samarbete. I alla tre länderna är akademiker inom vetenskap, medicin och jordbruksvetenskap generellt mer involverade i internationellt samarbete än sina kollegor inom samhällsvetenskap och humaniora. Vi ser att mycket av samarbetet sker i Afrika och Europa. Deltagandet i gemensamma forskningsprojekt verkar vara den vanligaste samarbetsformen bland de personer från de tre länderna som doktorerat och detta gäller alla discipliner. När det gäller villkoren för det internationella samarbetet visar resultaten att många av de som doktorerat upplever sig ha en relativt underordnad ställning. De rapporterar att de ofta har mindre resurser i fråga om finansiering, tid och akademiska meriter (publikationer) då de inleder internationella samarbeten och att detta påverkar deras inflytande, roll och följaktligen samarbetets omfattning.

Det långsiktiga givarbiståndet för att ge anställda vid nationella universitet bättre forskningskvalifikationer förefaller inte ha lett till någon avsevärd ökning eller intensifiering av deras forskningsverksamhet, mätt i tid och tillgänglig forskningsfinansiering, efter att de doktorerat. Bristande forskningsresurser efter avlagd examen och den pågående utökningen av antalet intagna på grundutbildningsnivå är de två faktorer som främst hindrar framväxten av en forskningskultur vid de berörda universiteten. Detta inverkar utan tvivel negativt på den vetenskapliga produktionen.

Rekommendationer

Studiens resultat visar att det finns anledning att titta närmare på följande allmänna rekommendationer:

Betydelsen av att ha kapacitet i låginkomstländerna inom områdena vetenskap, teknik och innovation för genomförandet av Agenda 2030 och

de hållbara utvecklingsmålen behöver erkännas. När det gäller de hållbara utvecklingsmålen framhålls lösningar baserade på vetenskap, teknik och innovation tydligt i Agenda 2030. De ges även ett särskilt erkännande i åtgärdsavsnittet om vetenskap, teknik och innovation och kapacitetsuppbyggnad i Addis Ababa-handlingsplanen om utvecklingsfinansiering (FfD). Dessa internationella agendor baseras på principerna om universell giltighet och samarbete. Det handlar därför om att i det internationella samarbetet finna vetenskapligt baserade lösningar på de globala utmaningarna som gör det möjligt att sammanföra kontextspecifika insatser till större enklaver av vetenskapligt kunnande. Sverige har goda förutsättningar att ta en ledande roll i arbetet med att främja och mobilisera resurser till vetenskap, teknik och innovation i låginkomstländer.

Bistånd till forskningsutveckling måste finnas med i Sveriges internationaliseringsarbete inom högre utbildning och forskning. I de aktuella planerna för global utveckling framhålls behovet av att betona den till synes ganska svaga och otydliga kopplingen mellan svenskt bistånd till forskningsutveckling och Sveriges politiska målsättningar för den högre utbildningen och forskningen, särskilt inom ramen för internationaliseringspolitiken.

Skapa politiska incitament för mer samarbete mellan områdena bistånd till forskningsutveckling och nationell högre utbildning och forskning. Eftersom forskningsbiståndet, och särskilt det bilaterala biståndet till kapacitetsuppbyggnad, som form är helt förenlig med det allmänpolitiska begreppet internationalisering skulle det kunna bana väg för ett samspel mellan de två politikområdena i enlighet med politiken för global utveckling (PGU).

Följande rekommendationer bör övervägas på det operativa planet:

Situationen för postdoktorer samt villkoren för forskningen efter doktorsexamen behöver ses över. Det krävs åtgärder för att bemöta det faktum att det sett till forskningsmöjligheterna inte lönar sig särskilt mycket att doktorera. En flaskhals är avsaknaden av möjligheter för att få göra en post-doc tjänst, något som skulle kunna resultera i både rörlighet och undervisningsuppehåll i forskningssyfte.

Öka stödet till doktorandutbildning som stomme i det bilaterala forskningssamarbetet. Under årens lopp har Sveriges stöd till doktorandutbildningar i hög grad bidragit till att skapa en kritisk

massa av kvalificerade forskare vid de tre universiteten. På grund av den massiva ökningen av antalet institutioner och studenter är dock läget tufft när det gäller möjligheterna för dem som doktorerat att öka den institutionella kapaciteten. Detta hotar att underminera deras utveckling som forskare. Proportionellt sett har de flesta låginkomstländerna dessutom en mycket liten forskarpool, ett starkt incitament för fortsatt och utökat stöd.

Rikta och förtydliga biståndets roll när det gäller uppbyggnaden av forskningskapacitet i förhållande till den utveckling som sker inom den högre utbildningen. Den nuvarande trenden att från politiskt håll prioritera universitetens utbildningsuppdrag, särskilt på grundnivå, och resultaten vad gäller forskningsverksamhetens omfattning bland de som doktorerat aktualiserar frågan om det svenska biståndets plats och mål.

Bibehåll ett koncentrerat stöd till doktorandutbildning vid de nationella universiteten. Läget för forskningskapaciteten vid de tre universiteten är ansträngt. Om dessa institutioner ska ha en chans att utvecklas till spetsforskningsenheter och få ett erkännande på internationell nivå så måste de i högre grad få del av de resurser som anslås till forskning.

Ta upp frågan om samarbetsförhållanden för deltagare i internationellt samarbete. Ett förfarande för kritisk bedömning är nödvändigt för att komma tillrätta med faktorer som är avgörande för samarbetet mellan personer som doktorerat och för strukturen vid internationellt samarbete. En möjlig åtgärd skulle kunna vara att inom ramen för Vetenskapsrådets ”utvecklingsforskningsprogram” inrätta ett särskilt program som endast är öppet för forskare från låginkomstländer som huvudsökande och projektledare, i samarbete med svenska institutioner.

Hantera frågan om den låga internationella rörligheten. Problemet med den låga rörligheten bland dem som doktorerat behöver erkännas om man vill förhindra att de tre universiteten isoleras i den internationella forskningen. Stöd till postdoktorprogram kan utgöra ett sätt att öka rörligheten.

Den vetenskapliga produktionen bland dem som doktorerat behöver studeras ytterligare. En fullständig bibliometri- och citatanalys är därför påkallad för att komplettera studiens resultat.

Summary

In an increasingly competitive global knowledge economy and in view of the global challenges put forward in the 2030 Agenda and the Sustainable Development Goals (SDGs), there is much to suggest that access to national capacity for research will grow in importance. This is a reality that is as relevant for low-income countries as for any OECD country. In fact, low-income countries are in greater need of investments in Science, Technology and Innovation (STI) capacity to eliminate the risk of being left further behind and to stand a chance of tackling the challenges related to the SDGs, many of which affect these countries the most.

This study starts out from the fact that the main determinant of poverty in many low-income countries today is not a lack of natural resources or geographical marginality, but a lack of trained, specialised individuals who could generate context-specific knowledge and solutions to challenges in society and contribute to prosperous, sustainable development. In this connection, institutions linked to Science, Technology and Innovation (STI) and higher education are central as providers of training and research. Universities are the most important institutions in this regard.

Since the early 1970s, the importance of institutional capacity for STI in low-income countries has been a guiding principle of Swedish development aid for research. The support has shifted from a comprehensive approach to research capacity building in which PhD training has been a prime component in achieving competitive, sustainable research environments at national universities in collaborating countries in Africa, Asia and Latin America. Countries like Mozambique, Tanzania and Ethiopia have received Swedish support for over 35 years and a considerable number of PhD graduates have been trained within the framework of different institutional collaborations with mostly Swedish partners. Over the years, the great confidence in the modality of PhD training (the Sandwich model) seems to have overshadowed the need for systematic examination of the long-term outcome in relation to changing conditions for research production. After more than 40 years of support for research capacity building we need to ask ourselves – *What happened to all these researchers after graduation and in what ways are they contributing to the overall objective of the Swedish aid intervention to build local research capacity in low-income countries?*

Drawing on primary data, the present study aims to help answer this question by examining career development with regard to mobility, collaboration and scientific output among Swedish development aid-funded PhD graduates from Mozambique, Tanzania and Ethiopia. The three variables are examined because they constitute recognised elements in current science production, and are therefore valuable for understanding conditions for knowledge production and institutional research development in low-income countries and for monitoring policy on the support for research capacity building.

The study is based on primary data collected 2012 – 2014, covering PhD graduates in the three countries that took their exams from 1990 to 2014. The study is based on a mixed methods approach, and data is collected using surveys and in-depth interviews. The dataset comprises 243 individuals (82 in Mozambique, 87 in Tanzania and 74 in Ethiopia) from four universities: University Eduardo Mondlane (UEM), University of Dar es Salaam (UDSM), Addis Ababa University (AAU) and Alemaya University (AU). The two prime comparative variables were country and scientific discipline.

To critically contextualise the focus areas of mobility, collaboration and scientific output, the study outlines three factors believed to be conditional for the PhD graduates' career development. These are: i) the current status of and developments in science and higher education at global level, in Africa and in the countries of concern, ii) the policy rationales and premises of the Swedish development support for research capacity building and iii) the issue of internationalisation and Swedish policy development on the matter.

The intention is to relate the results for mobility, collaboration and scientific output to these influential factors to form the basis of the following overall questions for discussion:

- Is the Swedish aid for research capacity building in low-income countries in tune with the premises for international science production and developments in higher education at national level?
- What are the conditions for research in the countries of concern and what are the premises for the PhD graduates' participation in international research?
- What is the role of Swedish universities in the aid for research capacity building in low-income countries and how do these types of collaboration fit in to Swedish policies on internationalisation?

Results

The review of premises related to internationalisation as a concept (globally and in Swedish policy-making), which have close links to those of the Swedish aid for PhD training, reveals elements of selection governed primarily by economic rationales. These premises, which all have an impact on mobility, collaboration and publication, are linked to representation and function – *who is included and on which terms?* Largely due to weak institutional capacity, representations from low-income countries tend to be left out as potential collaborating partners in the context of policy-making on internationalisation in high-income countries. In this regard, Swedish policy-making in higher education and research is no exception.

The overview of the status of and premises for science production globally, in Africa and in the countries of concern shows that resources and capacities for science are unevenly distributed and that Africa falls short on most of the indispensable elements for science. In particular, limited access to qualified researchers is the most critical issue. The status of and developments in higher education and research in Mozambique, Tanzania and Ethiopia demonstrate increasing policy priority to higher education and also to STI. However, while the first priority has led to a significant increase in institutions and students, the policy priority of STI seems not to have resulted in any noteworthy measures in terms of additional resources.

Turning to the empirical material, the results for the international, sectoral and vertical mobility of the PhD graduates generally indicated low levels. The large majority of PhD graduates in all three countries are still in academia. A majority has also remained at the same university. For many, the doctorate resulted in higher-level academic positions. The down side, seen from a research perspective, is that many senior positions in academia are of an administrative nature, which limits the scope for research activities. International mobility was generally low in all three countries and, with a few exceptions, across scientific disciplines. Europe and other African countries seem to be the prime destinations among those with mobility experience.

Looking at modes and premises of international collaboration, a majority seems to be involved in some type of international collaboration. Across all three countries, graduates in science, medicine and agricultural science generally have a higher frequency of international collaboration compared to their colleagues in the social

sciences and the humanities. We see that Africa and Europe are very much at the centre of collaborations. Participation in joint research projects seems to be the dominant type of collaboration among the graduates in all three countries and across disciplines. With respect to the conditions of international collaboration, the results reveal a feeling of relative subordination among many PhD graduates, reporting that they often embarked on international collaboration with fewer resources – funding, time and academic merits (publications), which determined their position with regard to influence, role and consequently range in collaboration.

The long-term donor support to raise research qualifications among university staff members at the national universities seems not to have resulted in any notable expansion or intensification of research activities, measured in time and available funding for research, after they completed their PhDs. Lack of resources for research after graduation and the current expansion of undergraduate enrolment are the two main impediments to the emergence of a research culture at the universities of concern, which undoubtedly have a negative effect on scientific output.

Recommendations

From the results of the study there are reasons to consider the following overall recommendations:

The significance of capacity for science, technology and innovation in low-income countries for the implementation of the 2030 Agenda and the SDGs needs to be acknowledged. The call for STI based solutions to the SDGs is clearly presented in the 2030 Agenda and specifically acknowledged in the Addis Ababa Action Agenda on Financing for Development (FfD), which contains an action area on science, technology, innovation and capacity building. These global agendas are based on the idea of universality and collaboration. Finding science-based solutions to the global challenges is therefore a matter of international collaboration in which context-specific contributions could be brought together to form larger entities of science-based knowledge. Sweden is well positioned to take an international lead in the work of raising the level of attention and mobilising resources for STI in low-income countries.

Development aid for research needs to be part of Swedish internationalisation in higher education and research. The current global development agendas raise the need to highlight the seemingly weak and unclear relationship between Swedish development aid for research and Swedish policy aspirations in science and higher education, specifically as part of policies on internationalisation.

Create policy incentives for increased collaboration between development aid for research and national higher education and research. As a modality that sits perfectly with the general policy notion of internationalisation, development aid for research and specifically the bilateral support for capacity building could potentially pave the way for collaboration between the two policy areas in accordance with the Policy for Global Development (PGD).

On an operational level the following recommendations should be considered:

The post-doc situation and the conditions for research after graduation need to be addressed. Measures are needed to counter the current low pay-off for having a PhD degree in terms of ability to conduct research. One bottleneck is the absence of post-doctoral opportunities, which could provide both mobility and research leave from lecturing.

Increase the support for PhD training as the backbone of bilateral research collaboration. Over the years, Swedish support for PhD training has contributed substantially to the building of a critical mass of qualified researchers at the three universities, but the potential of the PhD graduates to raise institutional capacity is under severe strain from the current massive expansion of institutions and students. This threatens to undermine the development of their capacity as researchers. In addition, the pool of researchers in most low-income countries is proportionally very small, which entails a strong incentive for continued and increased support.

Address and clarify the role of the support for research capacity building in relation to the current development in higher education. The current trend of policy priority to the universities' educational mission, especially at undergraduate level, along with the results for the degree of research activities among PhD graduates, raises the question of the Swedish support's position and objective.

Maintain the concentration of support for PhD training on the national universities. The research capacity at the three universities is under pressure. If these institutions are to have a chance to develop into centres of excellence and reach international levels of recognition, they must benefit from the larger share of resources allocated to research.

Address the premises of the relational orders in international collaboration. There must be a process of critical assessment to overcome the determinants of relational order and structure in the PhD graduates' international collaborations. One possible action could be to create a specific programme within the Swedish Research Council's 'Development programme' open only to researchers from low-income countries as the main applicant and project leaders in partnership with Swedish institutions.

Address the situation of low international mobility. To prevent the three universities from being isolated from the international sphere of research, there is a need to acknowledge the problem of low mobility among the PhD graduates. Support for post-doc programmes could be a possible way to increase mobility.

The scientific output of the PhD graduates needs to be further examined. This calls for the need to conduct a full bibliometric and citation analysis to complement the findings in this study.

1 Introduction

'We aspire that by 2063, Africa shall be a prosperous continent, with the means and resources to drive its own development… well educated and skilled citizens, underpinned by science, technology and innovation for a knowledge society [are] the norm....' (African Union Commission, 2015)

Capacity to generate and exploit knowledge is nowadays a well-established premise for positioning in the competitive knowledge economy. In this regard, Science, Technology and Innovation (STI) have a prominent position, which is mirrored in the policy priority given to the area by many governments. Reinforced by conceptual frameworks of the relationship between STI and economic growth and how this is to be institutionalised in nexuses between different actors in society (Mode 2, Triple Helix, the entrepreneurial university, innovation systems, academic capitalism), STI, higher education and ICT are highlighted as core components in the building of a knowledge-based economy in most OECD countries' policy-making (OECD 2014).

The rationale for the Swedish national policy on STI over the past ten years (Sweden being among the countries in the world that allocates most money to research per capita) has persistently been based on the idea of an intimate relationship between high-quality research (institutions and individuals), innovation, industrial competitiveness and societal development. Similar to most OECD countries, the government's goal is that Sweden should be a world-leading research and innovation country. However, the recognition of STI as a competitive tool is not restricted to high-income countries. Over the past twenty years, the issue has gradually climbed up the political agenda in an increasing number of low-income countries.

A country's progress and position in the global hierarchy of knowledge-based economies are usually measured using internationally recognised indicators of the number of publications in highly ranked international journals, citations, patents, international fund-raising and international mobility and collaboration. The outcome of these indicators usually correlates with the availability of qualified researchers and research institutions in a country. Even though these indicators have certain limitations, the results from them

give an insight into the occurrence of inequalities between countries as regards *capacity* for STI.

Since the start, awareness of the great inequalities between countries as regards the conditions for pursuing and making use of STI, particularly science, has formed the basic rationale for Swedish development aid to support research capacity building in low-income countries.

Sweden has supported research capacity building in low-income countries for more than 40 years. Over the years the modality of the support has remained relatively unchanged, based on the principle that each country should be able to identify its own areas of research and have the capacity to carry out research relevant to its own development. A prime goal of the support has been that each country in receipt of support should have at least one university capable of carrying out high-quality research by international standards. For this to materialise, the Swedish support has been based on a comprehensive approach to capacity building, meaning that individual research projects are seen as an integral part of a national research system consisting of a functional and supportive institutional environment of research councils, research policies, administrative resources, ICT connectivity, libraries and laboratories.

In keeping with this approach, the training of PhD graduates has been a core component from the very beginning. The importance of support for PhD training is clearly stated in the current government's strategy for research 2015–2021 (Swedish Government 2015). Operationally, the support is to large extent provided within the framework of sandwich programmes between Swedish institutions and institutions in the receiving country. This modality is designed to sustain links with the home institution in order to promote capacity-building efforts more holistically, beyond the individual researcher, by gradually transferring capacities and responsibilities from the Swedish counterpart to the collaborating partner. Hence, one important milestone is the establishment of local PhD programmes in the partner countries.

Accordingly, a significant part of the aid budget for research cooperation, which is a specific budget item, has been allocated to PhD training over the years. In 2017, the total aid budget for research collaboration was SEK 765 million. According to Sida's division for research cooperation, about SEK 300 million was allocated to bilateral

research collaboration and SEK 70 million to regional collaboration. Over the years, support for PhD training programmes has consumed a major part of allocated funds in most of the bilateral collaborations. No statistics have been kept, but a considerable number of individuals have graduated from these PhD programmes over the years. A rough estimate suggests that more than 800 individuals in African, Asian and Latin American countries have been enrolled in Sida-funded PhD training programmes since the early 1990s (Fellesson and Mählck 2013).

The confidence in the PhD training modality as the foundation for research capacity building seems to have been so great that it has overshadowed the need to systematically examine its long-term outcomes The relative absence of information is particularly notable considering the fact that the support for PhD training is both resource-intensive and sensitive. No single contribution from Swedish development aid allocates as much funding to one single individual as the support for PhD training. Sida's division for research cooperation estimates that the total cost for one PhD graduate ranges from SEK 1.5 to 2 million, depending on the scientific discipline.

Against this background, this study will present an empirically based contribution to the discussion on the overall question: What happened to all these researchers after graduation and in what ways are they contributing to the overall objective of the Swedish aid intervention to build local research capacity in low-income countries? More specifically, by presenting and analysing primary data on mobility, collaboration and science production from aid-supported collaborations with three African countries, the study aims to form the basis of the following question areas for discussion:

- We know that Africa remains at the bottom of the globalscience, technology and innovation league tables and lags behind on indicators of gross domestic expenditure on R&D[1], number of researchers[2] and share of scientific publications and patents.

[1] Sub-Saharan Africa's share of the world's gross domestic expenditure on R&D (GERD) is just 0.8%. (UNESCO 2015)

[2] Africa as a whole hosted 2.4% of the world's researchers in 2013 and Sub-Saharan Africa only 1.1%. (UNESCO 2015)

Against this background, is Swedish aid for research capacity building in low-income countries in tune with the changing premises for international science production? How can we understand the outcome of the long-term Swedish aid contribution in this context?

- How do African researchers navigate in the international research landscape, increasingly governed by economic incentives for science production characterised by excellence, competition, accountability and audit? What are the premises for participation?
- In times of a significant increase in the number of institutions and students (massification), privatisation and commodification (marketisation) in African higher education, what are the conditions for research? If the aim is to improve conditions for the conductance of research, is there a risk that the long-term Swedish aid for research capacity building could be eroded by these factors?
- How should we look at the value of PhD training in this context? Should it be seen as an explicit resource for building research capacity at the universities or from a broader societal perspective?
- What is the role of Swedish universities in the aid for research? How does collaboration with developing countries and development aid fit in to strategies of internationalisation at Swedish universities? What are the premises for participation and collaboration?

As the modality of support for PhD training involves institutional collaboration with a Swedish partner in most cases, this study aims to contribute to policy discussions not only within Swedish development cooperation but also among actors in Swedish higher education and research. Consequently, it emphasises the need for coherence and collaboration between the policy area of development aid (Ministry for Foreign Affairs) and the policy areas of research, higher education and innovation (Ministry of Education and Research and Ministry of Enterprise and Innovation) in accordance with Swedish Policy for Global Development (PGD) and to accelerate the work to achieve the Agenda 2030 and the sustainable development goals (SDGs). In the context of the latter, science could be seen as a global public good, both in generating transformative change for sustainable development and as a political, cultural and social cross-border activity.

The study is structured in the following way. Following this short introduction intended to frame the question area in focus of the study, chapter two will present the specific objective and methodology. Chapter three seeks to contextualise the question areas of mobility, collaboration and scientific production in relation to the current status of and premises in international and national scientific work and production. In chapter four the principles and implementation of Swedish bilateral development aid for research capacity building are presented together with an outline of Swedish policy aspirations in internationalisation. This is done to display the policy framework against which the results of the study can be critically discussed. Chapter six presents an empirical account of conditions and outcomes for mobility, collaboration and scientific outcome that are potentially influenced and shaped by the different contexts outlined in the previous chapters. The results are presented in three mutually connected parts. The first part deals with the magnitude, features and premises of international, sectoral and vertical mobility. The second part displays results for the magnitude, features and premises of international research collaboration, while the last part looks at the premises and magnitude of scientific production in terms of publication output. Conclusions, policy implications and recommendations are presented in the last chapter.

2 Objective and methodology

2.1 Objective and principal questions

With reference to developments in the international science regime and premises of internationalisation in higher education and research, the overall objective of the study is to comparatively examine individual outcomes of PhD training in three African countries (Mozambique, Tanzania and Ethiopia), all of which are recipients of long-term Swedish aid aimed to build research capacity in low-income countries. This will be done by analysing data in three areas:

- *Mobility* (*vertical* - within academia, *sectoral* – interaction with other sectors in society and *international* – stays and positions abroad)
- *International collaboration* (magnitude and modes of international collaboration as well as prerequisites and roles in international collaboration)
- *Scientific production* (magnitude and modes of publication as well as international outreach)

These areas have been selected because they constitute recognised elements of current science production and are therefore valuable for understanding conditions for knowledge production and institutional research development in low-income countries and for monitoring policy on the support for research capacity building.

The following principal questions will be examined:

1. Mobility

- In which positions and areas are the PhD graduates at present?
- What are the patterns of individual development in terms of mobility (international, sectoral and vertical) from the date of graduation to the present?
- Could specific patterns of mobility (international, sectoral and vertical) be revealed in terms of country and scientific discipline?

2. *International collaboration*

- What are the patterns of individual development in terms of international collaboration from the date of graduation to the present?
- Could specific patterns of international collaboration (geographical areas and type of collaboration) be revealed with regard to country and scientific discipline?
- What are the individual conditions for international collaboration (roles and premises)

3. *Scientific production*

- What are the patterns of scientific output on an individual basis since graduation (magnitude, type and international coverage)?
- Could specific patterns of publication (geographical areas, type of collaboration) be revealed with regard to country and scientific discipline?

Country and scientific discipline have been selected as the principal comparative variables in the study. In short, these three variables have been selected on the following premises:

- Country: Ethiopia, Tanzania and Mozambique (being long-term collaborating countries in receipt of Swedish aid) all share the similarity of acknowledging higher education and research as important tools for development and invest heavily in institutions and student intake (massification), but they are also quite divergent politically, linguistically and not least in terms of colonial heritage, which hypothetically may generate variations in relation to the questions of the study.
- Scientific discipline: Conditions for mobility, collaboration and scientific production may vary within and between the selected countries.

2.2 Method and data

The study is based on primary data collected 2012 – 2014, covering PhD graduates that have trained within the framework of Sida's support for research capacity building in Mozambique, Tanzania and Ethiopia from 1990 to 2014. The period of investigation was chosen on technical grounds and also constitutes a sufficient timespan to measure possible variations in the three selected areas of examination. In addition, 1990 was chosen as a starting point because it is generally seen as marking the beginning of major shifts in African higher education and research systems, associated with massification, privatisation and commodification (Global University Network for Innovation, GUNI 2008).

The study is based on a mixed methods approach (Allwood 2004), containing both quantitative and qualitative data collected using surveys (to cover general quantifiable patterns and tendencies) and in-depth interviews (to cover individual nuances in more subtle question areas – for example in relation to power-related premises for mobility and collaboration). The methodological design is based on a retro-perspective approach, meaning that respondents have been asked to answer questions on their individual mobility, collaboration and publication stories from the date of PhD graduation to the present.

The dataset comprises 243 individuals (82 in Mozambique, 87 in Tanzania and 74 in Ethiopia) from four universities in receipt of support for PhD training from Sida. The universities are University Eduardo Mondlane (UEM), University of Dar es Salaam (UDSM), Addis Ababa University (AAU) and Alemaya University (AU).

The PhD graduates were primarily traced using alumni lists, registers and supervisors at collaborating institutions in Sweden and South Africa[3], social and professional networks of graduates and themes of PhD dissertations.

A web-based survey (one for each country) was sent to 415 traced individuals (159 in Mozambique, 132 in Tanzania and 124 in Ethiopia). The response rates were 51.6 per cent in the Mozambican case, 65.9 per cent in the Tanzanian case and 59.6 per cent in the Ethiopian case,

[3] In the case of Mozambique, South Africa has also been a partner country for PhD training.

which should be seen as comparatively high rates.[4] Data was processed using SPSS Statistics.

The qualitative sample consists of 38 in-depth interviews, which were all strategically selected from the quantitative sample. These were conducted as 'biographies' (Kenway and Fahey 2011), designed to map and explore researchers' trajectories over time, particularly on issues regarding experiences of premises in mobility, collaboration and scientific production.[5] In addition, supplementary information was gained from interviews with individuals at strategic positions at the universities and in governments.

[4] The response rate for similar studies of European PhD graduates was much lower. The MORE project had a response rate of only 11 per cent).
[5] Because of time and resource limitations, no in-depth interviews were conducted with PhD graduates from Ethiopia. The analysis and the results for Ethiopia are accordingly based on data solely from the survey.

3 Situating the PhD graduates in the global premises of internationalisation and development in higher education and research

In this chapter we will contextualise the question areas of mobility, collaboration and scientific production in relation to the current status and premises of international and national scientific work and production. The idea is to get a picture of the surrounding global and local environment, which the PhD graduates need to navigate when pursuing their careers. The contextual orientation will also be used as a frame of reference to which we will relate the policy framework of the Swedish support for research capacity building (explicitly the PhD training modality) and the analysis of our results for mobility, collaboration and scientific production.

3.1 The premises of the global science regime – collaboration, mobility and publication in the internationalisation of higher education and research

Capacity to generate science-based innovations and solutions to societal challenges and not least to generate economic growth is increasingly seen as a means to reach international competitive advantage by most governments. Although the strength of the correlation between investments in science and technology (S&T) and economic growth is not entirely clear, policy makers worldwide seem to have embraced the nexus and have elevated scientific knowledge and new technologies as important policy areas and building blocks for long-term economic growth. The former US President Obama has for example highlighted STI as *'the key to a 21st-century economy'* (New York Times 2012). This prominent policy position builds on the assumptions that the ability of countries to access, comprehend, select, carry out and practise scientific and technological knowledge is

decisive for material well-being and quality of life. It goes without saying that the substance and implications of this policy notion are as relevant for low-income countries as they are for high-income countries.

The extent to which these capacities can be developed depends heavily on factors such as (i) investment in human resources training and development; (ii) the demand for science-based knowledge and technology from society – primarily the private sector; (iii) supportive public policies, (iv) accurate and functional institutional environments and (v) the level and quality of the information and communication technology systems for dissemination of science-based results (Word Bank 2009). When these factors are developed and interact, science and technology knowledge can make important contributions to the solution of societal challenges and problems associated with poverty. As will be shown, the Swedish bilateral development aid for research is based to a large extent on the basic premises of these insights.

An enabling national environment for science and technology is also a prerequisite for international participation. The international dimension in science production is manifested in the idea of *internationalisation*, which is a well-established policy premise in most OECD countries. Within this notion, *international mobility* and *collaboration* are seen as core dimensions raising the quality of science and technology outputs (Abramo et al. 2009; Jöns 2007; Altbach 2004; Ackers 2005). The importance of internationalisation has increasingly also been reproduced as a policy area in many African countries (Jowi 2012; Teferra and Greijn 2010), which, in this context, can be seen as a bit ironic since the ways in which internationalisation manifests itself have been an integral part of African university development since its inception. Through the European colonial legacy, the conceptual understanding of the university and its organisation were largely imposed from abroad and initially most of the academic staff members were foreign or trained abroad.[6] To date a large proportion of staff

[6] The preconditions for science production in most African countries have historically been much influenced and shaped in geopolitically intertwined power and dependency relations to countries in the Global North. The colonial period, being the most prominent dependency and power relation, was an integral part of the discourse of the "civilising mission" imposed by the imperial powers (Seth 2009; Harrison 2005, McNeil 2005). Embedded in the mission was the epistemic privilege to define concepts, rules and forms of knowledge and knowledge production, which among other things implied an ideological power of science neglecting and disqualifying the value of local and indigenous knowledge traditions, asserting Western science's claims to universality (Seth; 2009).

members at PhD level at African universities have pursued their training abroad, mostly in Europe or the US. This, together with extensive, long-term international donor support for research (which also carries a Global North hegemonic perspective on scientific knowledge production) built around the idea of international collaboration and mobility as a means of supporting institutional capacity building, suggests that African higher education and research systems may be some of the most internationalised (Teffera and Knight 2008). But does the fact that most African universities have been historically accustomed to internationalisation mean that they are accurately equipped to deal with its current premises in a successful way?

Internationalisation has been reflected in a dramatic increase in scientific collaboration expressed through co-authorship of scientific publications. A recent study estimated that 25 per cent of all scientific papers include authors from multiple countries (Leydesdorff et al 2013). The increasing volume of international research collaborations is the result of an adaptation to changing premises in the science regime associated with factors such as: i) *greater impact* – there seems to be an increasing connection between joint international authorship and the impact of science articles measured in citations, (ii) *complementary advantages* – researchers seek out their peers with relatively little respect for geographical boundaries, giving them access to complementary knowledge and new ideas, (iii) *scale and complexity of research projects* – pooling of human and financial resources is increasingly necessary to take on large-scale research projects that involve many separate parts that need to be dealt with separately. Research projects on universal matters, such as climate change, public health, food security and migration are global issues that increasingly require international collaboration. In addition, the need and incentive for international research collaboration will most likely increase in the wake of the United Nations' (UN) Agenda 2030 and the comprehensive nature of the 17 sustainable development goals (SDG's), iv) *improved communication technology* – better internet connectivity worldwide has contributed greatly to the feasibility of international collaboration. For researchers in low-income countries, better connectivity provides at least potentially a gateway for collaboration with more advanced research milieus in high-income

countries and v) *capacity-building* – international collaboration could imply mutual leveraging of institutional resources (research expertise and experience, funding, facilities) between the countries involved. With reference to this study, collaboration could be particularly beneficial to partners in low-income countries.

As outlined above, the motives for collaboration are numerous and there are no indications that its importance will decline as we are increasingly faced with challenges of a borderless nature and growing demand for efficiency in science production. But given the strong incentives, what does the international landscape of research collaboration look like? Macro-level data on international science collaboration show that the composition of actors is largely centred on scientific hubs in the Global North. The picture is confirmed by scientometric studies of networks of co-authorship (Elsevier's SciVal Analytics/Science Europe 2013; Abramo et al. 2008; Schrum et al. 2007). There also seems to be a strong correlation between international research collaboration and scientific productivity (Abramo et al. 2008; Lee and Bozeman 2005; Mairesse and Turner 2005). Generally, the number of collaborating researchers is a strong predictor of productivity and higher average citation rates, and top-cited publications are found among countries with higher international collaboration rates. The role of international mobility in this nexus is yet unclear (Appelt et al. 2015).

How are Sub-Saharan countries situated within this context? Despite the fact that African countries share many of the problems associated with internationally identified global challenges (climate, environment, energy, migration, transmittable diseases), sub-Saharan African countries belong to the periphery of global network research collaboration, which is illustrated by scientometric maps.[7] Studies indicate that researchers from low-income countries are also heavily under-represented in publications that are grounded in research conducted in these countries (Dahdouh et al. 2003). In Central Africa, about 80 per cent of articles are co-written with researchers from outside the region (Boshoff 2009, in Brodén Gyberg 2013). Studies have also shown that there are few collaborations between African researchers on a regional basis. One study in the biomedical field

[7] In maps showing nodes of international cooperation, based on the logarithm of fractionally counted co-authored papers, including countries with more than 500 papers, only South Africa is included. See http://www.leydesdorff.net/intcoll/intcoll.htm

shows that only five per cent of the research papers were produced from collaborations with partners in another African country, while 77 per cent were produced with an international partner outside the continent (Royal Society 2011). In this regard, it has been argued that the domination of the Global North – South collaborative order should be seen as an advantage rather than a problem as long as the collaboration helps leverage 'metropolitan science' to address local development issues (Jacob and Meek 2013). Nevertheless, from a research capacity point of view, this position could become problematic if African researchers are not actively engaged in the research process, and are instead collaborative hostages in Global North research projects on Africa (Fellesson and Mählck 2013).

With reference to the areas in focus in this study, a recent report from the World Bank based on bibliometric analysis, looking particularly at collaboration, mobility and publication among Sub-Saharan researchers indicates a number of interesting trends (Word Bank Group 2016). Given its scope and topicality and for the purpose of comparison with the results in this study, we will leave room here for a review of the main findings of this report. The overall conclusion of the report is that Sub-Saharan Africa is growing as a research provider, in terms of both quantity and quality. According to the report, the three regions investigated (West and Central Africa, East Africa and Southern Africa) more than doubled their research output from 2003 to 2012, increasing their share of global research from 0.44 per cent to 0.72 per cent. There was also a positive trend in terms of the share of global citations, which grew from 0.,06 – 0.16 per cent for each of the regions to 0.12 – 0.28 per cent.

Reportedly, advances in health science stood out as the main driver behind the increase (with 4 per cent annual growth) and currently account for 45 per cent of all research output. Of interest to this study, the report concludes that the prominent position of health-related research demonstrates a successful outcome from development aid: ' *the impressive improvement in Sub-Saharan Africa's research capacity in the Health Sciences demonstrates that persistent support and funding from development partners and governments pays off. Sub-Saharan Africa clearly has a large scientific talent base, but this needs to be trained and nurtured*'. (World Bank Group 2016:60). On the other hand, the report presents a more daunting image of the situation in the fields of science, technology, engineering and mathematics (STEM), which tend to lag behind by international comparison. Excluding

South Africa, the share of the STEM sciences in Sub-Saharan Africa is only 29 per cent with an annual 0.2 per cent decline every year. This figure can be compared with Malaysia and Vietnam, with an average of 68 per cent. Accordingly, the critical situation is also mirrored in global citations. The report gives several explanations of the poor development within STEM sciences. The most prominent is the low quality of basic education in science and maths in higher education, priority to other disciplines such as the humanities and social sciences and skewed international research funding giving priority to health and agriculture research.

The report concludes that international collaboration and mobility constitute important factors for African research output. The greater part of research is conducted in collaboration with international partners (79 per cent in Southern Africa, 70 per cent in East Africa and 55 per cent in West and Central Africa). According to the report, international collaboration seems also to correlate with higher citation impact of Sub-Saharan Africa publications. Interestingly, the results indicate that the relative citation impact also increases for the collaboration partner as compared to that person's overall average impact, ' *…suggesting that the collaboration is a win-win situation for Africa and the international collaborators*" (World Bank Group 2016: 24). Nevertheless, the report raises concern over the high dependency on international collaboration: ' *The high level of international collaboration testifies to the noteworthy effort and interest of academia outside of Africa to support Sub-Saharan Africa's research capacity [...] it signals a lack of internal research capacity and the critical mass to produce international quality research on its own; particularly within STEM'.* (World Bank Group 2016:7). Interestingly, this conclusion runs in part contrary to the premises of *internationalisation* discussed earlier, which are based in part on the idea of international collaboration for the building of research capacity in low-income countries.

Finally, the report presents a relatively high frequency of international mobility among East and Southern African researchers, in particular. For example, mobile researchers from East Africa and Southern Africa (referred to as transitory researchers in the report) that spend at least two years in or outside the region comprise 57.2 per cent and 65 per cent, respectively, of the total researcher base. The research productivity (publications and citations) among mobile researchers was also shown to be significantly higher than for non-mobile researchers, which is explained by the pay-offs of international

collaboration mentioned earlier. The main drivers behind the high frequency of mobility are derived from insufficient research infrastructure, insufficient capacity for research training resulting in low production of local PhD graduates, limited funding opportunities and a low degree of regional coordination. Non-locals and transitory researchers constitute a large proportion of the total researcher base. According to the report, this is seen as problematic from a relevance and impact perspective, since it may prevent researchers from establishing relationships with African partners. The contribution from the returning diaspora was also shown to be important for raising the citation impact of Sub-Saharan research. Although these researchers make up a quite small share of the total researcher base (just a few per cent on average across the regions), their relative citation impact is significantly higher than that of other Sub-Saharan African researchers. From this result, the report draws the conclusion that diaspora researchers constitute an underused resource for research capacity development: the '*…finding corroborates the widespread belief that the large and well-trained scientific African diaspora in Europe, North America, and elsewhere should be further tapped to raise the quantity and quality of Sub-Saharan Africa research.*' (World Bank 2016:10).

In relation to this study, the World Bank report provides an interesting reference. The results and conclusions should, however, be treated with some caution. Firstly, the number of empirically based studies on the issue in the context of Sub-Saharan Africa is scant (the report is said to be the only one of its kind), which limits the possibility for assessment by comparison with other studies. Secondly and most importantly, the report bases the analysis only on indicators of peer-reviewed researchers' output (bibliometric analysis of publication data from three selected indexes), which implies that, to be categorised as an 'active researcher', you have to publish in peer-reviewed international journals listed in these indexes. In the context of research production in Sub-Saharan Africa, the method may exclude a significant number of 'active' researchers publishing in local or regional journals not covered by the indexes or publishing their work through other means, such as books, reports and monographs (for example a PhD thesis in the humanities and social science). Furthermore, the use bibliometric data is associated with problems of accumulation of citations seen over time, unequal distribution of citations across articles, the language of the article (for example the

use of Portuguese by Mozambican researchers) and differing practices for citations across disciplines.

For these reasons, we have applied a different approach in this study based on self-assessment of individual research output among the traced PhD graduates. As regards the methodological approach to measure mobility in the World Bank study, this is based on publication databases containing information on history of affiliations (e.g. Scopus) – addresses listed in their published articles. The problems with this approach are manifold (many associated with the ones stated for publication output), but the most serious is perhaps the absence of nationality as a background variable. This limitation results from the use of publication databases which lack information on nationality. Instead, the baseline for migratory or transitory mobility is based on the assumption that the institution of the first published article or the majority of articles constitutes the researcher's home country. This way of measuring mobility may entail implications for the PhD graduates in focus in this study who are pursuing their training within the framework of transitory sandwich programs. Since a majority of the PhD graduates were registered at Swedish institutions during their training and many worked in partnership with Swedish colleagues, their publication record may have started off from a Swedish institution and not (in this case) from an institution in Mozambique, Tanzania or Ethiopia. That said, the World Bank report still provides valuable input to the understanding of patterns of publication, collaboration and mobility among Sub-Saharan African researchers. The results of this study can be compared with this input and add complementary information.

In this connection it should also be noted that despite economic growth, expanding higher education sectors and demographic forecasts, the great majority of African countries are excluded from international data-collection initiatives to map academic mobility and collaboration, which mostly focus on the Global North (Appelt et al. 2015; Franzoni et al. 2012; Auriol 2010; MORE 2010; Ackers 2005). Except for the World Bank study, existing studies on, for example, mobility primarily discuss it in relation to statistical estimates of student mobility and outflows not including the PhD level (UNESCO 2012; Project Atlas 2011). Systematic quantitative studies and qualitatively based studies looking at the PhD level are quite rare (Fellesson and Mählck 2013; Tremblay 2009). Considering the current

state of the African research community, the absence of research into mobility and collaboration is particularly worrying.

Returning to the conditions for research production in Sub-Saharan Africa, with the exception of some institutions in South Africa, the continent harbours few concentrations of research that could be seen as centres of scientific excellence. This implies that African participation in global research production continues to be a unilateral and outbound activity in terms of internationalisation, in which, due to lack of funds and capacity shortages, African researchers are consistently required to play second fiddle to more prosperous European collaborating partners rather than initiate and lead their own international collaborations projects involving mobility. Yet, one can discern positive developments in several part of Africa (e.g. Kenya, Cameroon, Rwanda) where innovation hubs driven by both public and private financing are on the rise (UNESCO 2015).

African researchers' mobility and participation in international collaborations (and ultimately scientific production and capacity development) could also be countered by government-induced policy priority to the educational mission of higher education and research institutions in many sub-Saharan African countries (we will return to this issue later on when looking at developments in the respective countries in the scope of this study). The current trend toward mass higher education ('massification') is perhaps the most prominent factor (Mohmedbhai 2014; Altbach 2008). This, along with the escalation of private, market-driven higher education institutions, and demand from other sectors of society for highly skilled people such as PhDs, inevitably puts the conditions for scientific production and research capacity building under strain (Teferra and Greijn 2010; Mamdani 2007; Bloom et al. 2005; Teferra and Altbach 2004). In the face of the current situation there is a potential risk that persistent lack of resources (funding for research) and escalating reduction of time for African scholars to engage in research (and in collaboration and mobility) could weaken an already marginal position in global science production.

The potential effect on research production that could result from the above policy priorities raises concerns about the return on investments made specifically targeting research capacity building. International donors still provide the greater share of resourses for research at most Sub-Saharan African universities. Swedish development aid, being one of the most substantial and long-term

providers, has supported institutional research capacity building in countries like Mozambique, Tanzania and Ethiopia since as far back as the early 1970s. The objective of achieving competitive and sustainable research environments at national universities in collaborating African countries through international collaboration and mobility is at the centre of this support (Sida 2003).

3.2 Africa in the global science regime – status, premises and capacity building

Situation reports from organisations such as UNESCO and the OECD on the status of global science point unambiguously at expansion, in terms of both the policy priority by national governments and the actual development of institutions and practitioners (UNESCO 2015; OECD 2014). Being important generators of solutions and innovations to many global challenges, such as the threat to climate, energy, water and food security, universities are increasingly becoming global institutions and players in world affairs. Following on from this and the evolution of global rankings, universities are increasingly centring their activities around competition (to attract funds and the best researchers and students) and international collaboration, including mobility (to create links with other prosperous institutions).

On a global scale, the demand for tertiary education has never been greater, which is reflected in the continuous growth of higher education institutions and students. UNESCO predicts that the number of students worldwide will more than double by 2025 from the current figure of around 130 million (UNESCO 2015). Most of this expansion will take place in so-called emerging economies and in regions with high population growth, such as China and India, but, as will be shown, there will also be growth in many African countries. However, there is much to suggest that the last ten to fifteen years of expansion of higher education institutions in Africa has come at the expense of compromises on quality. This, together with a heavy focus on non-critical technical skills areas, helps explain why only five African universities make it into the top 500 of the world's best universities (ARC 2017). Both of these problems are directly associated with the shortage of trained and qualified lecturers and researchers.

Being central to the idea of internationalisation, the mobility of students continues to show a positive trend, but students studying abroad represent only about two per cent (4.1 million) of the total student population. With reference to this figure and of interest to this study, the UNESCO science 2015 report concludes that: *'Given this small percentage, brain drain should generally not represent a threat to development of national innovation systems, so brain circulation should remain as unencumbered as possible in higher education. Universities will remain in high demand around the world, at a time when public financial support is strained in most countries. Gains in productivity will therefore be unavoidable, despite the very competitive nature of science; in particular, the emergence of university networks to enable institutions to share their faculty, courses and project is a way forward.'* (UNESCO 2015:3-4).

The global trend in research and development (R&D) expenditure is not univocal. While we are seeing fading public sector engagement in several high-income countries, investments in R&D (both public and private) are on the rise in many low-income countries, many of which are in Africa. The available statistics from UNESCO on development in Sub-Saharan Africa reveal a steady increase in gross domestic expenditure on R&D (from USD 8.4 billion in 2007 to USD 11.1 billion in 2013). While this does indicate positive development, the R&D sector seems not to have benefited proportionally from the recent period of economic growth in many African countries. During the last ten years, the gross domestic expenditure on R&D (GERD) has remained unchanged at a level of about 0.41 per cent. In this connection, it should be noted that in 2013 the GERD for Sub-Saharan Africa still constituted only a tiny fraction (0.8 per cent) of the world share, which is dominated by the US, China, Europe and Japan (in that order). These countries together, which contain only 33 per cent of the world's population, account for about 77 per cent of the world's total investments in R&D (UNESCO 2015).

Since access to qualified researchers has long been seen as a core foundation of Swedish support for research capacity building in Sub-Saharan Africa, the current status of this human resource is of particular interest. On a global scale, the number of researchers has grown significantly over the last ten years, but the figures are obscured by great variances between countries and regions. High-income countries account for close to 65 per cent of all researchers in the world. Data for Sub-Saharan Africa from 2007 onwards indicates a

positive trend in terms of absolute numbers, but the share of global researchers has remained unchanged at the level of about one per cent (UNESCO 2015). Compared with countries in the Global North, the proportion of researchers per million inhabitants in most Sub-Saharan African countries is exceptionally low. Excluding South Africa, there is an average of 57.5 researchers per million in sub-Saharan countries, compared to an average of 3,814 researchers per million in OECD countries (UNESCO 2015).[8] The recent Africa Capacity Report explains the low figures in both GERD and number of researchers by a long-standing short-term approach to human development, which has been nourished by a reliance on external financial support (aid and Foreign Direct Investments - FDI) often targeting short-term goals (ARC 2017). According to the report, the shortage of human capacity in science has seriously affected the conditions for economic transition in many African countries: *Africa's economy, mainly natural resource-based exports, with low value added sectors hinders high productivity growth and makes African countries vulnerable to changes in global commodity demand and prices. This was evident during the 2008 global economic crises where Africa's economy suffered due to the global decline in the demand for low-value commodities. Such circumstances reinforce the urgent need for Africa to develop its STI capacity and infrastructure to diversify its economy and to create high-value added products to become competitive at the global market.* (ARC 2017:15).

An additional challenge to the growth in human capacity of skilled researchers and experts is the problem of permanent outbound migration – brain drain. Low remuneration and a lack of funding opportunities for research, along with intensive recruitment drives from universities and companies in high-income countries, constantly undermine the human resource base. According to UN and OECD statistics for 2010, one in every nine persons of origin in an African country with tertiary education lived in OECD countries (ARC 2017). The situation is particularly worrying in countries like Burundi, Algeria, Mauritania, Chad and Guinea (WEF 2014). In addition, due to bilateral funding agreements preference is often given to foreign experts/consultants over existing domestic capacities, which further

[8] In the case of Sub-Saharan Africa, there is need to clarify that data on South Africa presents a particular case, which tends to obscure the overall data for the region. For example, South Africa hosts more than one fourth of the total number of researchers in the region. There is also significant proportionate variation between countries, ranging from 8 researchers per million inhabitants in Niger, to 942 per million inhabitants in Botswana (UNESCO 2010).

increases the incentive to migrate (ARC 2017). Statistics also indicate the increasing international mobility of researchers, particularly from low-income countries. UNESCO predicts that: '*in the coming years, competition for skilled workers from the global pool will most likely intensify. This trend will depend in parts on levels of investments in science and technology around the world and demographic trends, such as low birth rates and ageing populations in some countries (Japan, EU, etc.).*' (UNESCO 2015:34).

Sub-Saharan countries' scientific output (publications) has increased by 66.2 per cent since 2008, which is indeed remarkable. The share of publications with international co-authors has increased by more than 10 per cent. However, the region remains marginal proportionally, with just 1.4 per cent of the world share of publications. South Africa stands out and accounts for more than half of these publications. Nigeria and Kenya are also major providers and along with South Africa they produce two-thirds of total publication output among Sub-Saharan countries.

Despite achieved gender parity at bachelor and master's levels globally, women still constitute a minority at PhD level (43 per cent) and researcher level (28.4 per cent). Behind the data, there are significant variations between countries, for example in the case of South Asia. The representation of female researchers in the Philippines and Thailand is above 52 per cent, while only 14 per cent in Japan and 18 per cent in the Republic of Korea (UNESCO 2015). Female researchers in Sub-Saharan Africa account for 30 per cent of the total pool of researchers. The weaker position for females in academia is associated with limited access to funding, less representation at higher positions in universities and less high-impact publishing. The existence of these factors and the driving mechanics behind them are all well established in the research literature (Mählck 2016, 2013; Morley 2005).

With this general overview of the situation in higher education and research in mind, let us now look at the situation in the three countries of investigation.

3.3 Higher education, Science and Technology in Mozambique

Since the mid-1990s, the higher education sector in Mozambique has witnessed a massive expansion in terms of institutions, from four in 1995 to 48 in 2014 (World Bank 2015; Fellesson and Mählck 2013). Student enrolment has grown from just 3,759 students in 1990 to more than 130,000 in 2014. Nevertheless, due to population growth, the gross enrolment ratio is just below six per cent (UNESCO 2014). Private institutions account for more than one-third of enrolled students. The gender balance is still quite distorted. Even though the proportion of female students has increased, it remains a problem at both public and private institutions. In 2013, female students made up only 25 per cent of the total enrolment at public institutions, and 27 per cent at private institutions. The gender imbalance problem was particularly patent in the STEM sciences, adversely affecting the admission of females to PhD training programmes. The massive expansion in enrolment (at all levels) has also meant a reduction in in faculty qualifications, resulting in declines in quality and relevance. Recent figures from the World Bank reveal that only seven per cent of staff members at higher education institutions have a PhD degree and 24 per cent a master's degree (World Bank 2015).

In view of the forecasts for economic development (spurred on by mineral and gas resources, energy and agriculture), population growth and enrolment rates in primary and secondary education, there is little to suggest that the pressure to further expand higher education opportunities will decline. Accordingly, as in other Sub-Saharan African countries, the expansion of higher education has also been induced by policy priorities based on the incentive to meet the demand for skilled human resources from a progressively advancing economy. Central policy documents for both general national development plans, such as the Poverty Reduction Strategy Plan 2011 - 2014 and the World Bank Group (WBG) Mozambique Country Partnership Strategy 2011-2015, and national area-specific policies in education, such as the Education Strategy 2012-2016, the Higher Education Strategy Plan 2012-2020 and the Science, Technology and Innovation Strategy, all emphasise access to skilled human resources as one of the most important components for development and the need for functioning, high-quality higher education institutions.

Naturally, the access and function of PhD graduates should be seen in this context.

The high policy aspirations in higher education can also been seen in the area of S&T, which is assigned the role of 'engine' of sustainable production and development in the country's ten-year strategy for science, technology and innovation (MOSTIS). The strategy also has a strong focus on poverty reduction; it 'will enable the voices of the poorest sectors to be heard by society, and science and technology will be used to give them the means to gain the upper hand against poverty'. (MOSTIS 2006:14).

The promotion of human resources is a central component of the strategy: 'In order to create the needed S&T human resources, education and training are required, as is a working environment with the right reward mechanisms and incentives so that S&T practitioners experience their role as being valued, thus securing their maximum contribution'. (MOSTIS 2006: xi). Priority is given to human resource development in the STEM sciences, while social sciences and the humanities are given a horizontal function in sustaining selected strategic research areas. The plan for human development is ambitious, with the goal to reach 5,276 researchers by 2025. The strategy is not clear on whether this should be achieved through local training or international requirement.

With regard to international collaboration and mobility, the strategy outlines what could be seen as a somewhat inbound position linked to the problem of retention of university staff. International collaboration is important for raising the quality and capacity of research institutions, but reading the strategy it seems as if much of this interaction is to take place on home turf. That is, leading international researchers should use different sabbatical programmes to spend time in Mozambique and engage in research projects together with local researchers. The importance of outbound international mobility is not reflected upon at all. Given the acknowledged premises of internationalisation and the importance of having both international inflows and outflows of students and researchers, the policy argument of retention may have hidden implications.

The many years lost through the civil war, which has caused a grave backlog in the development of research capacity, not least in the training of qualified researchers, consequently makes Mozambique a very small provider of scientific knowledge on an international scale.

The country still belongs to the weakest of research producers in Sub-Saharan Africa. There is no recent data on scientific status, but statistics from UNESCO for 2010 reveal a quite daunting picture of a country with barely 1,500 researchers (in headcounts, which does not necessarily imply full-time), equivalent to about 65 researchers per million inhabitants. By comparison, South Africa has 811 researchers per million inhabitants (figures for 2012) and Sweden 10,580 researchers per million inhabitants (figures for 2013). In 2010, the female share of total researchers had remained steady since 2006 at the level of about 30 per cent. The S&T sector is heavily dependent on international funding.

3.4 Higher education, Science and Technology in Tanzania

Knowledge as the main driver of development is clearly acknowledged in the government's overall development plan – Vision 2025. The ruling party CCM (Chama Cha Mapinduzi, in English: Party of the revolution) strongly believes that 'Human capital is the main pillar for the development of a modern economy'. Interestingly in relation to this study, Vision 2025 highlights the need for well-educated and skilled individuals as a means to counter '*donor dependency syndrome and dependent and defeatist developmental mind-set*' (Bailey et al 2010:16).

Like Mozambique, over the last ten to fifteen years Tanzania has seen major developments in the higher education sector, with substantial expansions in both institutions and student enrolment. Sources are not unambiguous, but according to figures from the Swedish embassy the country has 31 universities (12 public and 19 private) and 38 university colleges, centres and institutes (7 public and 31 private) (Swedish Embassy, Dar es Salaam 2016). Government sources from 2006 claim that there are over 200 tertiary institutions in the country (Ministry of higher education, science and technology 2006). Since the year 2000, the number of private institutions established has far exceeded that of public institutions (close to 90 per cent of new institutions have been private). In the last ten years, the number of students enrolled in tertiary education has seen a dramatic increase, from 37,667 in the academic year 2004/05 to 204,175 in 2014/15 (UNESCO 2014; Ngirwa et al. 2014). While there are now

significantly more private institutions, the majority of students (65 per cent) are in public institutions. The proportion of females has increased at a faster pace than that of male students and is in the range of 31 per cent to 36 per cent in most institutions. The total share is increasing, but the situation in the STEM sciences gives cause for concern, with an average share of female students of only 22 per cent (UNESCO 2014). Accordingly, the recruitment base among female students for PhD studies is quite limited, which ultimately leads to problems of gender parity at academic staff level. At public universities the share of female academic staff is in the range of 11 to 35 per cent, with the lower figures in the STEM sciences (Tettey 2010; Sida 2014).

Despite a dramatic increase in institutions, the gross enrolment ratio (GER) in higher education has remained relatively low, between five and nine per cent since 2010 (World Bank 2013). It should be noted that the East African member states aspire to achieve a gross higher education enrolment ratio of 25 to 30 per cent by 2025. Recent figures for 2013 indicate a drop to 5.5 per cent, which can be partly explained by demographic changes. However, a considerable share of the population does not make it into tertiary education, which indicates in turn that more needs to be done to address quality, inclusion and transition at earlier stages of the education system.

Policy-wise, the mutual relationship and balance between higher education and research in university mandates is largely vague and treated disjointedly. As in many other African countries, policy priority is given to the quantitative expansion of higher education while the science mandate is, at least resource-wise, left aside and hypothetically for international donors like Sweden to support. As in the case of Mozambique, diminutive resources allocated to research have generated a weak position as a research producer. Naturally, the limited access to trained and qualified researchers is a strong contributing factor. Figures for 2013 show there is a total number of 3,064 researchers in the country (headcounts), equal to 61 researchers per million inhabitants (UNESCO statistics 2014). Since 2010, the share of female researchers has remained at the level of about 25 per cent. The weak conditions of human resources are acknowledged in national research policy, and statements hint at the involvement of international donors: *'The government, in collaboration with other stakeholders shall: put in place a mechanism for strategic research staff training and retraining, deployment and a succession plan'.*

(Government of Tanzania 2010:20). Swedish support can be said to directly respond to this aspiration.

Government funding for research has seen a slight increase but remains proportionally at a very low level. In 2013, Gross Domestic Expenditure (GERD) was only 0.53 per cent UNESCO statistics 2014). In 2009, the government made the decision to allocate one per cent of the country's GDP to S&T through the national research council Tanzania commission for science and technology (COSTECH). But, according to an evaluation commissioned by the Swedish Embassy in Dar es Salaam, only 0.3 per cent of GDP was allocated to research – yet in real terms this means an increase (Swedish Embassy, Dar es Salaam 2016).

As regards international partnership and collaboration, we have not come across any figures on magnitude, content and direction. The government research policy admits that researchers in the country's R&D institutions have not been very successful in making notable progress towards international collaborations and partnerships. Part of the problem, according to the policy, is underutilisation of the diaspora as a facilitating resource: *'as a result, Tanzania has missed out on critical opportunities, such as capacity building in terms of human resources and facilities; rational utilization of resources; transfer of knowledge, technology and materials at the national and international levels'.* (Government of Tanzania 2010:24). As in the case of Mozambique, the policy view on the direction of international collaborations is quite inbound – collaborations are to be concerned with local issues. At the same time, the government is worried about the risk of losing valuable data as a result of international collaboration. The policy states that: *'… it is important to ensure that external researchers do not take away research material and outcomes without authorization'.* (Government of Tanzania 2010: 25). This concern may be derived from the fact that, mainly because of a lack of resources, Tanzanian researchers normally occupy inferior positions in international collaborations, especially with partners from high-income countries (Altbach 2004).

3.5 Higher education, Science and Technology in Ethiopia

Ethiopia is among the countries in Sub-Saharan Africa that have seen the most dramatic expansion in higher education. Less than 15 years ago, the country had just two universities and 17 university colleges with a student population of around 30,000 students (Saint 2004). The current situation reveals a completely changed picture in terms of both the number of institutions and the enrolment rate. Today the higher education landscape embraces 11 universities, nine technical colleges, six teacher training collages and 46 private institutions. The total enrolment rate has rushed to more than 300,000 students. The gross enrolment rate has almost tripled since 2008 and is currently at an average level of around eight per cent, but with a significant discrepancy between male and female students, 10.9 and 5.2 per cent respectively (UNESCO Statistics 2014). As Ethiopia is the second most populated country in Sub-Saharan Africa, with an annual population growth of about two per cent, this expansion is to be seen as quite remarkable. However, higher education remains a luxury restricted to very few, especially among the rural population.

The expansion should be seen in the context of deliberate policy ambitions aiming to advance Ethiopia to a middle-income country by 2025. The universities have an explicit function in the realisation of the Government's Agricultural Led Development Industrialization (ALDI) by providing skilled manpower and research. Rationales for the quantitative expansion can also be found in more area-specific policies such as the Higher Education Proclamation of 2009 (HEP) and the execution of the Education Sector Development Program IV 2010 – 2015 (Government of Ethiopia 2009 and 2010). The prime focus is on undergraduate education, where the goal is total enrolment of close to half a million students in 2016, supported by 23,000 teachers, 25 per cent of whom should be PhD holders. There is also a pronounced goal to increase the proportion of students in the STEM sciences to 70 per cent. Naturally, in the context of research capacity building, the massive expansion of institutions and students, followed by an immense demand for PhD graduates (not least in the STEM sciences), entails implications for the institutional concentration of research capacity, which has long been a benchmark for Swedish bilateral research support. In addition, the lack of qualified staff is a major threat to quality throughout the education system. The rate of

enrolment in postgraduate programmes, which constitute the breeding ground for recruitment to PhD programmes and positions as assistant lecturers, is not keeping pace with demand, resulting in recurrent recruitment of fresh bachelor's graduates to serve as assistant lecturers.

Simultaneously with the expansion of the educational mission of the higher education institutions there is also a high policy profile in the advancement of S&T. The Higher Education Proclamation and the ESDP IV both emphasise the development of research capacity throughout the system. How the aspirations for higher education and research are to be integrated and, in particular, how the limited resources for research, not least in terms of manpower, are to stand up to the quantitative expansion of institutions and student enrolment seem, at least policy-wise, not to be a concern for the government. For an outside observer, considering the prevailing weak and under-funded research situation at many universities, it appears that research activities run the risk of losing out in the end.

This challenge should be seen in the context of the general research situation in the country. Despite a significant proportional increase in the last five years, the gross domestic expenditure on R&D (GERD) remains at a very low level (0.6 per cent). Over the years, the government has strengthened its role as provider and accounted in 2013 for almost 80 per cent of the total funds for R&D, of which more than 47 per cent went to agricultural sciences in line with the country's ALDI policy (UNESCO statistics 2014). This figure challenges the picture of a donor dependent country for the advancements in R&D. According to the UNESCO statistics the share of funds coming from abroad (which are likely to be categorised as international aid or philanthropic activities) decreased from almost 30 per cent in 2010 to about two per cent in 2013. On the other hand, the category of unspecified funds increased from two to 16 per cent, which may in part hide the decrease in the former category. Yet, considering the significant growth of GDP in the last ten years, it is reasonable to assume that the amount of funds for research as a sector has increased. However, it is not clear whether these funds have trickled down to actual research activities. We emphasise this because the total amount of funds available for application from the national research council has only seen a moderate increase over the last ten years, and international donors still account for more than 80 per cent of all research activities at the leading university of the country –

Addis Ababa University. Despite the overarching goal to industrialise the agricultural sector (which presumably calls for innovation), private sector funding for research has fallen dramatically from 10.5 per cent of GERD to a negligible level of only 0.75 per cent in 2013 (UNESCO 2014).

Shortage of qualified researchers is significantly hampering the development of a functioning research system. The access to PhD graduates is in parity with the figures shown for Mozambique and Tanzania. In 2013, Ethiopia had 8,200 researchers (headcount) which is fewer than 87 researchers per million inhabitants. Numbers are increasing, but at a very slow pace and not on a par with the requirements of the expanding higher education system. Particularly alarming is the low representation of female researchers, accounting for only 13 per cent of the total number of researchers (the figure is also reflected in the empirical data material of this study). Despite the low figure, we have not come across any policy documents in the field presenting measures to raise the representation of female researchers in the system. The well-known notion of brain drain is also linked to the problem of human resources in Ethiopia. Even though this is not verified by reliable data, there is a widespread belief that many of the best and brightest academic staff have left the country or are on the move due to inadequate resources for research or as a result of political turmoil and authoritarian regimes throughout the history of the country, of which the latter links to the recurring issue of academic freedom in Ethiopia. Given the authoritarian nature of the current regime and in light of the government's pronounced development plans (in which universities and other higher education institutions have a key role and are assigned missions), there is reason to assume that the meaning and exercise of academic freedom could be compromised. The scope of interpretation in the Higher Education Proclamation of 2009 with regard to rights of academic staff nourishes this assumption by stating that: '*…every academic staff shall have the right to exercise academic freedom consistent with the institution's mission.*' (Higher Education Proclamation of 2009: 17).

4 Swedish bilateral development support for research capacity building – rationale, modality and implementation

In this part we will look at the principles and implementation of Swedish bilateral development aid for research capacity building. There will be a brief presentation of the present and historical policy framework of the support that will contain short descriptions of the specific support in each country in the scope of this study. This outline, together with the conclusions made in the previous chapter, will then form the basis for a critical discussion on conditions and challenges facing the Swedish modality for support, with an explicit reference to mobility and collaboration in the PhD training modality. Finally, we will briefly examine policy aspirations in Swedish internationalisation of higher education and research to see how these interplay with the guiding principles of collaboration and mobility in the development aid support for capacity building, specifically the PhD training modality.

4.1 Rationales and principles of Swedish bilateral development support for research

Since the early 1970s, the ability to engage and take an active part in international research collaboration has been clearly highlighted in the Swedish conceptual framework for research capacity (SAREC 1977; 1986; Government 2010; 2014). Since its very inception, the rationale for Swedish support has been based on a comprehensive and integrational understanding of national research systems, consisting of different capacities and the linkages between them – it is the strength of the functions and capacities and their interaction that determines the general capacity of a research system. The Swedish modality has also been built around the idea of resource concentration. Given the weak conditions for research in many collaborating countries, the support has been concentrated mostly on one national university

assigned the role of engine for the establishment and expansion of national research and higher education (Sida 2003).

To assume responsibility, the selected universities need a critical mass of qualified researchers. Accordingly, the training of PhD graduates and, by extension, the building of local PhD programmes have constituted a core component of Swedish research support. This support has long been built around the assumption of international mobility through the modality of 'sandwich programmes' as a principle to transfer and secure research capacity development. The principal idea behind this modality is that PhD candidates should, over the course of their training, alternate between their home institution and a foreign collaborating institution (often in Sweden but, since the late 1990s, increasingly also in South African institutions for Mozambican candidates), with the frequency depending on individual need and the level of capacity for building the local programme. The back and forth mobility approach has been quite restricted to the training situation in terms of policy. Once the candidate graduates, she or he is expected to stay and be part of the critical mass needed to advance the capacity building of the local PhD programme and, in particular, become one of the active, contributing researchers needed for national development and poverty reduction. A Sida document from the early 1990s states: 'A major intention of the 'Sandwich Model' is that the successful candidate will continue to stay in his home institution after graduation, researching in an environment with a much improved research infrastructure as a result of the support provided by SAREC over the years' (Bhagavan 1992: 21). To some degree, this statement reveals a linear assumption of the link between the training of researchers and scientific production (Velho 2004). It also ties in with the critical question of how training programmes of this type evolve over time in terms of building local research capacity, and what kind of incentives for mobility and career development they produce. The fact that the relationship between training and scientific practice is not a straightforward process has also been highlighted in evaluations. An evaluation from 2003 puts this into perspective with regard to the role of mobility in the training situation: 'most of the training programmes under the Sida/SAREC cannot be classified as Sandwich type, since the candidates return only to teach or to do administrative work and not least attending to other job commitments to secure an adequate income. Too little time is spent on research at home' (Sida 2003: 22).

Another longstanding feature of Swedish bilateral research support has been its strict focus on the academic system (specifically the research part) as the prime recipient and beneficiary. The history of guiding policy documents on modalities of research training contains no intention or positions on the relevance of possible spill-over to other sectors of society. The current strategy is also quite strong on this position: 'Support for research and analysis help build domestic capacity … Activities in this area therefore aim at long-term strengthening of capacities and capabilities of research actors, primarily in low-income countries and regions, to identify important areas for research and to allocate resources to plan, implement, utilize and make available research for the development of society…Strengthened research capacity is to be seen as the overall effect of development in different parts and at different levels of the research capacity. Contributions are therefore to foster the building of institutional, and thereby also individual, research capacities' (Swedish Government 2014:4). This policy position reinforces the impression of a linear understanding of the relationship between research training and research practice. In the result part we will see to what extent this policy notion has been materialised.

4.2 Collaboration as the guiding principle

Embedded in the guiding principle of 'research cooperation', collaboration has always been at the heart of Swedish bilateral support. Capacity in different areas of the research system is to be attained through knowledge transfer and exchange with more developed environments in the Global North, predominantly Swedish institutions (note: to some extent South – South collaborations are now also part of the contribution portfolio). As such, Swedish research support was an early carrier of the now well-established principles of internationalisation (see chapter 3). Over the years, support has stuck to the principle of collaboration as a basic premise, but, in terms of policy, the notion has not been regularly scrutinised in relation to shifts in the conditions of the support, i.e. in relation to different stages of research capacity and economic and political changes in recipient countries. For example, the implications of the current policy attention to higher education and universities' educating mission have not really been reflected upon from a collaboration and research capacity perspective. This is not to say that

the research support in its practice lacks a reflective view on the context in which it operates, but it displays a relative absence of a critical and multilayer policy discussion of collaboration (its relational premises and changing meaning over time) as the lead guiding concept in the operation of the support. Neither have evaluations addressed the issue other than from a technical point of view: '*In order to enhance inter-project collaboration, a mechanism or a set of incentives should be included in the programme*' *s setup to stimulate collaboration between the Sida/SAREC supported researchers*' (Sida 2006:41).

The principle of collaboration permeates all areas of support in the current government strategy, but does not outline its relational incentive and premise except in the case of the support for Swedish research of relevance to poverty reduction and sustainable development in low-income countries. The strategy states: 'Knowledge exchange and cooperation between researchers in Sweden and low-income and lower middle-income countries are important in order to maintain international competitive Swedish research expertise in the area of research of relevance to development' (Swedish Government 2014:6). Unintentionally or not, this statement reveals a unilateral purpose of collaboration, highlighting the Swedish researcher as the main beneficiary.

However, there have been policy-related outlooks on the premises of collaboration in the early days of research support. One of the most reflective thoughts on this was in an early policy document: 'limitation processes and lack of development relevance together with dominant political and economic forces have generated a tremendously powerful transnational intelligence industry, of which the Western research community and many of its branches in the third world are integrated parts. As many other multinationals – it imports raw material not least from the third world. Huge amounts of raw material in the form of students are processed and transformed into "intellectual Barbie-dolls" and re-exported, thus guaranteeing the successful continuation of centre dominance and mimetic development strategies' (SAREC 1977: 14, quoted in Brodén Gyberg 2013: 127). A more recent reflection is in the previous policy (2010–2014): 'The relationship between Swedish researchers and researchers from developing countries is basically unequal in terms of resources. This is also reflected in an imbalance between researchers and research groups as regards their ability to influence the formulation, implementation and reporting of research. Swedish research support is to be designed in such a way that it helps

prevent the development of a superior and an inferior status in this relationship' (Swedish Government 2010: 19). Possibly due to a demand for more streamlined policy instructions, the recent government research strategy deals with relational conditions for collaboration in a quite brief manner, stating that the support should: '… promote equal research relationships' (Swedish Government 2014: 3). Neither the meaning of equal relationships nor possible operational tools are elaborated on.

In summary, despite the long-term appliance of the mobility and collaboration based sandwich modality, the handling of equal relationships in the collaboration has remained quite generic and has not been transformed into more practical and experienced based guiding principles of implementation. Changes in the premises for collaboration between universities in the Global South and North are an important part of the capacity development process and should be accounted for, but it should be said that for an international donor to set the terms for equal collaboration in the support presents something of a challenge: 'Even the most innovative partnership funding strategies cannot resolve all of the tensions and inequalities that characterize collaborative agenda- setting processes. Using North–South partnerships as a "default" funding modality not only adds an extra layer to agenda negotiations, but also creates a problematic starting point for articulating common research goals' (Bradley 2007: 4–6).

4.3 Development aid supported research capacity building in the context of Swedish internationalisation in higher education and research

How is internationalisation in science and higher education played out in the Swedish policy context with respect to representations in collaboration and mobility? What are the implications for the development aid for research, which is greatly centred on the idea of collaboration and mobility?

The need to increase internationalisation in Swedish higher education and research has repeatedly been emphasised in the

government's policy-making over the years. In broad outline, the focus has been on student and researcher mobility (inbound and outbound) as the principal factor to increase quality in training and research (Swedish Government 2009/10:65). Looking through the last ten years of policy documents we have not been able to find any wordings on the role of development aid in Swedish internationalisation, but this has not always been the case. In the government bill 'New world - New Higher education' (Swedish Government 2004/05: 162), the government announced a position on internationalisation based on a more inclusive and coherent approach, in which the quality of education was seen as depending on the presence of a critical mass of international students, teachers, PhD candidates and researchers bringing new perspectives. In relation to the objectives of the development aid, the bill emphasises the importance of promoting understanding and recognition of other cultures and traditions and international solidarity. Notably, the proposition concludes that many societal challenges are of global concern and can only be tackled through international cooperation. Consequently, more studies of global issues need to be integrated in higher education, which can be said to be an early insight into the premises governing the implementation of the 2030 Agenda.

In the part dealing with rationales for international collaboration, the bill makes strong reference to the then new Policy for Global Development (PGD). The argument is basically that the education sector should take into account the policy objectives of the development aid. The proposition states: ' The new Swedish development policy which the parliament decided on as a consequence of the bill Shared Responsibility: Sweden's policy for global development (Govt. Bill 2002/03: 122, bet. 2003/04: UU3, Comm. 2003/04: 112) has also contributed to an increased focus on educational cooperation with developing countries. The new policy emphasises all policy areas' shared responsibility for achieving the development policy goals of equitable and sustainable global development. This includes a need for education, from the national level to the local level, to take account of the development policy objectives and act in harmony with these in its regular activities' (Swedish Government. 2004/05: 162:46). Presumably, this argument was introduced? by the development policy area, but it is positively responded to by the education side, though in a more relative and pragmatic manner: ' In higher education, this may mean that

development policy priorities are reflected in the universities' collaborations, exchanges and recruitment of foreign students' (Swedish Government. 2004/05: 162:46). To what extent this position is still valid remains unclear, as well as to what extent development policies have really influenced policy-making in higher education.

However, there is a clear example of the opposite direction in the relationship between the policy areas and the PGD. Based on the argument that Swedish higher education should meet the global competition with quality, the government introduced fees for third country students in 2011 (Swedish Government 2009/11:65). Seen from a development perspective this decision not only compromised the logic of the PGD, it also resulted in a great loss of international students from low-income countries, which fell by almost 70 per cent (EBA 2016:08). The effect on the inflow of students from Swedish partner countries in development aid was even worse, with a fall of close to 90 per cent (UKÄ 2013). Partly backed by scholarship programmes, funded substantially by aid money, the inflow is slowly starting to improve, but still remains far from the levels before the introduction of fees. With respect for the rationales behind the decision on fees, it still shows that free of charge higher education in combination with quality education constitutes a strong incentive among foreign students from low-income countries looking for the best pay-off on the global education market. It also shows the marginality of Sweden as a destination country for international students. Furthermore, it is possible that the reduced number of international students from low-income countries will affect the requirement base for PhD training and the interest in development-related issues in general, both in coursework and research. Since Swedish universities play prominent roles as collaborating partners in the bilateral development aid for research, the situation could potentially also affect future conditions for collaboration and mobility.

Turning to the position of development aid for research in national science policy, a similar pattern of omission as in higher education appears in the government bills presented in 2008 and 2012, both indicating a notable shift towards economic incentives as a basis for investment in science (Swedish Government 2008/09:50, 2012/13:30). In these bills, the separateness of the business sector from other developments in society indicates a particular policy interest in the former and expectations of science to produce results and innovations

that could be turned into marketable products. Although much of the rhetoric on the role of science to increase economic competitiveness remains, the recent ten-year bill on science paves the way for a less state-centred and more altruistic role of science by placing the 2030 Agenda and the SDGs at the centre of attention in the direction of the policy (Swedish Government 2016/17:50). The bill states: 'Education, research and innovation should be in people's services for a sustainable, solidarity, equality and equal society' (Swedish Government 2016/17:50:20, author's translation). The Policy for Global Development (PGD), re-launched in 2014, is also highlighted as a guiding principle: 'The commitment to Agenda 2030 and the global objectives is central to the relaunch of Sweden's policy for global development, where the starting point is that policy in all policy areas will be implemented in a way that takes advantage of all opportunities for the government to contribute to equitable and sustainable global development' (Swedish Government 2016/17:50:20, author's translation). With such a clear policy direction for the role of science in meeting the 2030 Agenda and SDGs within the framework of a revitalised PGD, one might have expected a discussion on innovative ways of integrating the development aid for research into the national science policy. This discussion does not materialise in the bill.

Hence, the question remains of how policy directions in national science policy relate to the objectives, modalities and outcomes of development aid for research. If we employ the economic competitive rationale, there is reason to assume that it could assert influence on what is seen as important areas of research and by extension also what type of collaboration and with whom, which leads us back to the question of representation in science – who is included and who is excluded? Looking through the recent and the two earlier government bills, we have not found any specific formulations on the relevance of involving Global South institutions and researchers in research collaborations (Swedish Government 2016/17:50, 2012/13:30, 2008/09:50). In general, the recent bill is more restrained in pointing out specific countries and regions compared to its precursors, which draw a much more direct line between a growth-centred economic rationale and geographical directions of international collaboration. Besides more traditional partners such the US, Canada, Japan and European countries, the fast growing economies of India and China along with South Korea, Brazil and Singapore have been at the centre

of attention. The government argues: 'besides research and innovation collaborations with highly industrialised countries and with countries that combine strong growth with expanding investments in science and innovations, it is also important from a long-term perspective to develop collaborations with countries having the potential to develop in this direction' (Swedish Government 2012(13:30:181-182 – the author's interpretation). Even if the wording about countries with 'potential to develop in this direction' paves the way in part for any country to qualify for collaboration, the implication of the economic rationale is undeniably a disqualifying factor for most countries in Sub-Saharan Africa, with the possible exception of South Africa. Collaborations based on other premises are not highlighted.

Accordingly, ideas, rationales and modalities of development aid for research capacity building in low-income countries have rarely been emphasised in recent government policy documents in higher education and science (with the exception of development aid as a funding resource for scholarship programmes). In fact, we have to go back to 1996 to find explicit writings on the need to include research capacities in the Global South: '…research should not only be carried out for the benefit of just rich countries, but also developing countries. It applies not only to research on environmental degradation and energy issues that more directly affect quality of life in Sweden, but also research on e.g. food security; population growth and global health issues. Cooperation with developing countries' own researchers is important in this context as well as efforts by the development aid to strengthen developing countries' own research capacity' (Swedish Government 1996/97:5). Interestingly, this statement is of general concern for the direction in science and not only in relation to foreign policy, which traditionally has been treated as a separate area in terms of policy and funding (almost exclusively development aid funding), with no funding implications for other policy areas.

The marginalisation of Global South collaboration and specifically the bilateral development aid for research in national science and higher education policy may appear strange, as the activities of this policy area contain the most prominent components of internationalisation, many developed over a long period of time and with close links to partners at Swedish universities. Potentially, the very practice and outcome of most programmes in the bilateral support accord very well with the conceptual understanding of

internationalisation. This raises concerns over both the value ascribed to development aid related collaborations in Swedish research and effectiveness in the coherence between policy areas in the government.

5 Mobility, collaboration and scientific output among PhD graduates in Mozambique, Tanzania and Ethiopia

In this chapter we will present empirically based findings on mobility, collaboration and scientific output among PhD graduates that have been supported by Swedish development aid for research capacity building in Mozambique, Tanzania and Ethiopia. This part of the study should be seen as an empirical account of conditions and outcomes for mobility, collaboration and scientific outcome that are potentially influenced and shaped by the different contexts outlined in the previous chapters, i.e. i) the status and premises of internationalisation in the global science regime, ii) policy development in national higher education and research and iii) policy and operation of an international donor for research capacity building. The findings are presented in three mutually connected parts. The first part deals with the magnitude, features and premises of international, sectoral and vertical mobility. The second part presents results for magnitude, features and premises of international research collaboration, while the last part looks at the premises and magnitude of scientific production in terms of publications output.

5.1 International, sectoral and vertical mobility

As we have seen, international mobility as a premise for scientific advancement (from both an individual and an institutional perspective) is at the core of the internationalisation discourse. This is because it is recognised as making a significant contribution to the dissemination and improvement in quality of scientific knowledge on both a national and a global basis (OECD 2010). It is also known that researchers exhibit particular mobility patterns (Appelt et al. 2015). A study from OECD/UNESCO (which features no researchers in sub-Saharan Africa) shows that an average of 14 per cent of individuals with a doctorate had been internationally mobile in the previous ten years (Auriol et al. 2013). In addition to policy, the interest in

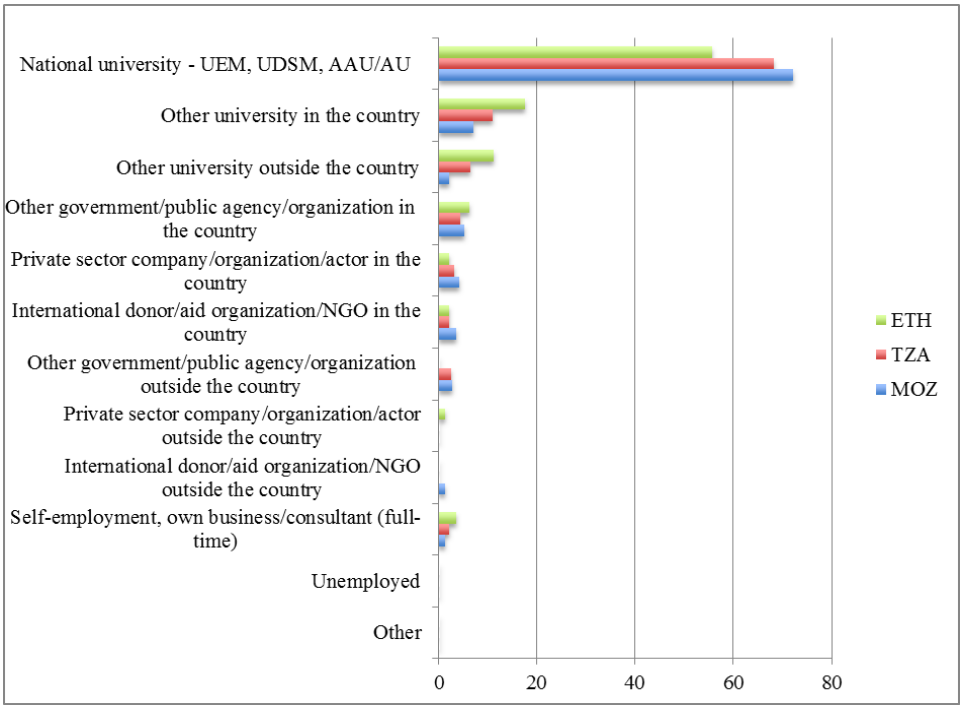
mobility is also shown in the frequency of studies on researcher mobility. However, the majority of these studies focus on patterns of mobility among researchers in the Global North, such as the large-scale study of the mobility patterns and career paths of EU researchers (MORE) and the OECD/UNESCO study of careers for PhD holders (MORE 2010; OECD 2007). The results of the MORE study showed that 56 per cent of the sampled PhD graduates (working in academia) had spent at least three consecutive months in another country. Of the incentives for mobility, professionally related motives such as personal research agendas, opportunities for career advancement and salary exerted the greatest influence (MORE 2010). With regard to sectoral mobility, PhD holders in science and technology were found to be more likely to remain in academia and engage in research than their counterparts in the social sciences and humanities, who had greater mobility towards non-research sectors in society (Auriol 2010).

Presumably, the policy-induced rationales for mobility are as important for researchers from low-income countries as they are for researchers in Europe and the US. Nevertheless, mobility is conditional and does not follow on naturally as a function of the position as a PhD graduate. Among other things, geopolitical preconditions for international research production could determine access to international academic positions and positioning in the competition for them (Fellesson and Mählck, forthcoming). Since, in most cases, mobility means exposure to new research contacts, it can also be an incentive factor for the establishment of international research collaborations.

When considering the findings on mobility among the PhD graduates in this study, we should bear these factors in mind (and the general rationales for mobility in the context of internationalisation presented earlier), while also reflecting on the conditional framework of the capacity-building approach taken by the Swedish development support for research training, which sees a more stationary role for the graduates at their home institutions as being important for the building of a much needed critical mass of qualified researchers at the selected national universities.

To start with, it is interesting to see how many of the PhD graduates have remained in academia after graduation. The overall results for three countries show a generally low degree of sectoral mobility (see diagram 5.1).

Diagram 5.1: Sectoral mobility - Percentage of graduates per type of sector and country (%)



Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

The great majority have remained at the same university since graduation, which, in most cases, means the same university as during the period of training (a majority of candidates in all three countries were staff members at the time of recruitment). A notable difference could be observed in the Ethiopian case, where 56 per cent have remained at the university of origin (Addis Ababa University or Alemaya University) compared to 68 per cent in the Tanzanian case and 72 per cent in the Mozambican case. However, the lower figure for Ethiopia in this category is compensated by a greater share of graduates working at other universities in the country and abroad. Taken together, the results show that 84.5 per cent of the Ethiopian PhD graduates have remained in academia. The corresponding figures for Tanzania and Mozambique were 85.8 per cent and 81.4 per cent, respectively. Compared to the other countries, a clearly larger share of

the Ethiopian graduates reported that they held positions at universities abroad, indicating a higher frequency of international mobility. A significant share of these graduates were in medicine, reporting that they had left for positions in the US or Europe (mainly UK). Among those that had left academia for positions elsewhere, the large majority in all three countries were in various government and public agencies in each country. A significant share of the Ethiopian graduates also had their own businesses (full-time), mostly in consultancy. In particular, many graduates reported that they were involved in consultancy from time to time as a way of increasing their income, but did this outside of work. By far the largest share of part-time consultancy was among graduates with positions in academia. Furthermore, it should be noted that graduates with positions at universities also reported that they had left temporarily for employment outside academia, but for various reasons had chosen to return. The sectoral mobility among female graduates was generally lower than for male graduates in all three countries. This was particularly observable in the mobility towards the private sector. There were also no female graduates among those reporting that they had their own full-time business. Finally, if we look at patterns of sectoral mobility between graduates from different periods of time, there is a small but clear tendency towards an increase in mobility to sectors outside academia among the younger generation of graduates (from 2005 onwards). This was especially clear in the case of graduates in the social sciences in Ethiopia and Tanzania.

Incentives to remain in academia were many, but dominated by arguments about interest, status, solidarity, loyalty and influence. Despite frequently reported poor working conditions (low salary, teaching load, research facilities and lack of funding and time to conduct research), alternative employment was not seen as an option for most of the graduates who had chosen to remain in academia. In most cases, our interviews revealed a quite strong dedication to the role of researcher and lecturer. This was based not just on personal motives, but also involved feelings of a more altruistic nature. Many respondents stated that their dedication was spurred on by the exclusiveness and selectiveness of their positions and the expectations from government and society to develop the research capacity and find solutions to developmental problems in their country. The respondents, especially in the Mozambican case, also frequently expressed feelings of loyalty, giving back and compensation for the

opportunity of PhD training. The following two quotations give an insight into the arguments presented to explain the low frequency of sectoral mobility.

'I was a staff member for quite some time before entering the PhD training. I have always felt that my place is at the university, so when the opportunity came up to be part of the Sida program it really meant a lot to me personally. But it also made me feel that I was part of a bigger plan to build a functioning university. This becomes obvious to you when you see the needs and the shortage of trained researchers' (PhD graduate, social sciences)

'Conditions are not the best. Especially the salary is problematic. I been offered higher salary by other universities, but so far I have turned them down. For some reason I have remained at UEM. For me it's much about status and interest in research and training. I want to be part of the leading university in the country and I want to make use of my training.' (PhD graduate, science)

The extent of vertical mobility (climbing the academic career ladder) did not vary much between the countries. Due the nature of our data, with graduates from different periods of time, it is not meaningful to display general and comparative results on the extent of vertical mobility from an individual perspective. However, the results showed that a good deal of the graduates had reached high positions within the university (professor, head of department, vice dean, dean and vice chancellor), but quite a few had also remained in the same position as before entering the PhD training programme, though upgraded to associate professor. In the latter case, continuance in the position of lecturer was reportedly not the result of failed career ambitions, but a deliberate choice made on the basis of research ambitions. The argument put forward was that the PhD degree had served to legitimise their status and position as researchers and, given the limited time and resources available for research, a lecturing position was the closest to research. The positions of vice chancellor, vice dean, dean or head of department were seen by many as being more administration oriented and hence a step away from research.

'Being a lecturer is more in line with my ambition as a researcher. You know, we have very little resources for research and time is limited, but having that position allows for at least some space to do research. I look at my colleagues being deans and head of department. They are all absorbed with other duties.' (PhD graduate, science)

'I saw a good opportunity to develop when I was offered the position as vice dean, but I see it as the temporary position it is. So far, I have not been able to do any research, which is sad. The administration has been heavy and the salary is only marginally higher, so when my period is over I think I will go back to my previous position as lecturer.' (PhD graduate, dean)

The share of graduates in the same position as before training was about the same in all three countries (57.5 per cent in Mozambique, 54.9 per cent in Tanzania and 61.5 per cent in Ethiopia). We did not find any significant variations when controlling for scientific discipline. A recurring issue brought up by those reporting that they had returned to the same position after graduation was that the PhD degree had not resulted in any significant raise in salary. This applied to all three countries. According to respondents, the situation could partly be explained by the premises of the Sida Sandwich model, which, in combination with the practice of staff member recruitment, oblige the candidate to remain in the position for the duration of the training, except for temporary interruptions when in Sweden or South Africa (in the case of Mozambique). According to respondents, renegotiating the salary under these conditions after graduation proved to be difficult.

Vertical mobility was more common among male graduates. The representation of female graduates in the upper categories of positions was significantly lower in all three countries. In the Mozambican case, female graduates make up only one-third of professorships, heads of department or associate professorships. The corresponding figure for Tanzania was slightly better and reached close to 32 per cent, while the female representation in these categories barely reached 21 per cent in Ethiopia. However, these figures should be treated with some caution. Firstly, because the statistical base of female representation is small for all three countries (which is an indication of a problem in itself) and secondly, the intake of female candidates has gradually improved during the time frame of the study, which implies that a significant share of the female graduates in our data are in the early stages of their careers.

By presenting the results for international mobility, we can make a distinction between two types of representation: i) international mobility of a more permanent nature – the graduate moves to another country to take on a permanent position for an indefinite period – and ii) international mobility of more temporary nature – the graduate

moves to another country for a short-term assignment, on leave from the permanent position at the home university. In the part presenting the results on sectoral mobility, we touched upon the first representation, which showed that only a small share of the graduates in all three countries had left the country, though with a notable exception in the Ethiopian case with regard to medicine. Our results show that 93.7 per cent of the Mozambican graduates were still in the country, and the corresponding figures for Tanzania and Ethiopia were 91 per cent and 87.5 per cent, respectively. However, it is important to remember that these results apply only to graduates responding to our questionnaire and not the total sample in each country. We say this because we noticed that a certain share of those not responding was traced to employers outside the country. Whether these non-responding graduates worked at these employers permanently or not we do not know.

Looking at the other type of representation for international mobility, the overall results display a fairly coherent picture. According to our criteria of at least one month of continuous stay at an institution abroad, 26.8 per cent of the Tanzanians, 21.5 per cent of the Mozambican graduates and 29.6 per cent of the Ethiopians had been internationally mobile since graduation. As displayed in table 5.1, these overall figures contain significant variations when controlling for scientific discipline and frequency. In all three countries, graduates in medicine, science and agricultural science reported a higher frequency of international mobility compared to social science and the humanities. Medicine in Ethiopia stands out, but this figure is weakly supported by comparatively few respondents. In addition, Ethiopian graduates in medicine were shown to make up a significant share of those who had left their country permanently, which might explain the higher frequency of international mobility among those who had remained.

Potentially, the frequency of international mobility increases with time after graduation. Hence it is important to understand that our results may not be a fair representation on an individual basis, but are aggregated data from all respondents within a scientific discipline. Because of longitudinal data limitations, it has also not been possible to display variations in respondents' international mobility over time. Notably however, the results show that many graduates from 2005 onwards reported a somewhat higher frequency of international mobility. It is difficult to say whether this is the outcome of generally

stronger mobility aspirations during the early years of their academic career or an indication of a tendency towards more international mobility throughout their career.

Table 5.1 Frequency of international mobility after graduation, by scientific discipline and country (%/absolute figure)

Discipline/Country/ Frequency	no mobility	1 time	2 times	3 times	4 times	5 times	‹ 5 times
Medicine / TZA	66.6/14	4.7/1	0/0	0/0	0/0	4.7/1	23.8/5
Medicine / MOZ	57.7/11	15.8/3	10.5/2	0/0	15.8/3	0/0	0/0
Medicine / ETH	27.2/6	13.6/3	13.6/3	0/0	9/2	0/0	36.2/8
Science / TZA	75/12	18.7/3	6.2/1	0/0	0/0	0/0	0/0
Science / MOZ	73.4/17	13/3	13/3	0/0	0/0	0/0	0/0
Science / ETH	75/12	12.5/2	6.2/1	6.2/1	0/0	0/0	0/0
Social Science / TZA	76.2/16	14.3/3	4.8/1	4.8/1	0/0	0/0	0/0
Social Science / MOZ	88.2/15	5.9/1	5.9/1	0/0	0/0	0/0	0/0
Social Science / ETH	88.8/8	11.1/1	0/0	0/0	0/0	0/0	0/0
Humanities / TZA	80/4	20/1	0/0	0/0	0/0	0/0	0/0
Humanities / MOZ	100/5	0/0	0/0	0/0	0/0	0/0	0/0
Humanities / ETH	100/4	0/0	0/0	0/0	0/0	0/0	0/0
Technology / TZA	63.6/7	27.3/3	9.1/1	0/0	0/0	0/0	0/0
Technology / MOZ	75/6	12.5/1	0/0	12.5/1	0/0	0/0	0/0
Technology / ETH	70/7	20/2	0/0	10/1	0/0	0/0	0/0
Agricultural science / TZA	77.7/7	11.1/1	11.1/1	0/0	0/0	0/0	0/0
Agricultural science / MOZ	76.9/10	15.4/2	7.7/1	0/0	0/0	0/0	0/0
Agricultural science / ETH	61.5/8	23.1/3	7.7/1	7.7/1	0/0	0/0	0/0

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

Turning to the geographical direction of the graduates' international mobility, Africa and the EU/ESS are dominant as destination regions. As shown in table 5.2, notable variances could be observed at the discipline level, but also between the countries. The most notable result is the comparatively high frequency of North America as a

destination region for Ethiopian graduates in science and medicine. For the latter, the figure should, however, be treated with some caution for reasons stated in the previous paragraph.

Table 5.2 Geographical direction of international mobility since graduation, by scientific discipline and country (%/absolute figure)

Scientific discipline/ Country / Region	Africa	EU/ESS/EEA	North America	Latin America	Asia
Medicine / TZA	33.3/7	52.4/11	4.7/1	0/0	9.5/2
Medicine / MOZ	31.6/6	52.6/10	15.8/3	0/0	0/0
Medicine / ETH	27.2/6	50/11	22.7/5	0/0	0/0
Science / TZA	43.8/7	43.8/7	12.5/2	0/0	0/0
Science / MOZ	38.1/8	52.4/11	0/0	9.5/2	0/0
Science / ETH	37.5/6	50/8	12.5/2	0/0	0/0
Social Science / TZA	55/11	30/6	15/3	0/0	0/0
Social Science / MOZ	61.1/11	27.8/5	0/0	11.1/2	0/0
Social Science / ETH	55.5/5	33.3/3	11.1/1	0/0	0/0
Humanities / TZA	60/3	40/2	0/0	0/0	0/0
Humanities / MOZ	71.4/5	28.6/2	0/0	0/0	0/0
Humanities / ETH	75/3	0/0	25/1	0/0	0/0
Technology / TZA	45.5/5	36.4/4	9/1	0/0	9/1
Technology / MOZ	50/4	37.5/3	0/0	12.5/1	0/0
Technology / ETH	40/4	50/5	10/1	0/0	0/0
Agricultural science / TZA	55.5/5	33.3/3	11.1/1	0/0	0/0
Agricultural science / MOZ	53.8/7	38.4/5	0/0	7.7/1	0/0
Agricultural science / ETH	53.8/7	46.2/6	0/0	0/0	0/0

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

With some exceptions in the Ethiopian case, Europe is twice as common as Africa among graduates in medicine and science, while the opposite holds true for social science and humanities. The relatively high frequency of inter-continental mobility among the graduates in all three countries and across disciplines is interesting given earlier

mobility biographies during training centring around Europe (Sweden) as the prime destination region (with the exception of Mozambican graduates going to South Africa). The growing Asian economic presence in all three countries, from primarily China and India, seems not to have generated an increase in mobility to this region, which, according to our results, is still quite peripheral as a destination region, though with some exceptions in the disciplines of technology and science. The same holds true for Latin America. Mobility to this region was marginal and applied exclusively to graduates from Mozambique.

Development opportunities (for research), working conditions and salary were the most prominent incentives for international mobility among the graduates in all three countries. Many graduates saw international mobility as important for the benefit of their own individual development, but also from a broader capacity building perspective. With regard to the latter, a significant level of inbound and outbound mobility was seen as a crucial factor for the creation of an internationally competitive research milieu at the home universities. Many respondents asserted that they had become aware of the importance of mobility during their period of training while spending time in Swedish institutions with a high degree of diversification in terms of researchers from different countries. What had been an integral and recurrent part of the graduates' training had become a much more exclusive and infrequent occurrence after graduation for most respondents. A frequently highlighted issue was the limited access to programmes involving mobility, such as different post-doctoral programs. Quite a few also stressed that they had not been successful in their applications for positions in Europe and the US. Coming from a less resourceful and renowned university in Africa was mentioned as a disqualifying factor. Another excluding factor highlighted was the difficulty of accessing different international research networks that could be of help for establishment and recognition in a research field, which in turn could lead to a better chance of being considered in the selection processes for positions.

'*I really enjoyed the way the sandwich model was working. Yes it had its problems, but generally, going back and forth every six months the way I did was very important for my research. It was not just about supervision. Unfortunately there are very few options of going abroad after graduation. Even for shorter stays. […] Very few of the colleagues at my department have been on sabbatical abroad since graduation and I'm not*

just talking about the Sida funded staff members. […] With the increasing number of students and classes it has not been easier. I will not say it is impossible, but it's not really encouraged.' (PhD graduate, social sciences)

'*I see it as a vicious circle. You need to be connected to stand a chance in the selection committees. That's how it works. If you are not part of a powerful network, it is difficult to reach through. Especially if you come from an African university.*' (PhD graduate, medicine)

While the idea of mobility as a capacity enhancing factor was well understood, its conversion into practice seemed to be more complicated. Respondents asserted that due to the heavy pressure on the PhD graduates as teaching capacity, the university leadership did not actively promote the option of mobility. On the contrary, mobility could be a hampering factor for career development. Respondents stressed that by leaving the university for temporary positions abroad there was a risk of being disconnected from regular promotion procedures even if the mobility would result in further qualifications. Respondents even said that there had been cases in which applications for leave of absence had been turned down on account of a shortage of lecturing staff.

'*The promotion of mobility is something that well-established universities can afford. It works fine when there is a balance between outgoing and incoming researchers and lecturers. But this is not the case for us. If someone leaves it is difficult to fill that position. If that person has a PhD degree, than it's a real problem.*' (PhD graduate, dean)

5.2 Modes and premises of international collaboration

Contemporary research collaborations increasingly include scientists based in different countries. This is partially driven by the need to engage with interdisciplinary science, access innovative approaches to problem solving, and acquire expertise beyond that which your own research group covers. It is also a great way to establish a worldwide network of colleagues with a variety of backgrounds—scientific and cultural.

As has been shown, the idea of collaboration and exchange is at the heart of Sweden's bilateral development support for research capacity

building in low-income countries. This is an approach well aligned with the premises of internationalisation. Looking at the long-term support for the three countries in the scope of the study, collaboration is perhaps most visible in the organisation of the PhD training modality, which is based on the idea of collaboration with primarily Swedish and South African institutions to achieve a gradual transfer of capacity to build local PhD training programmes. In this context, collaboration as a method should not solely be seen as a unilateral transfer exercise. It also aims to enrich the partner institutions with new perspectives and areas of research. Furthermore, the mobile premise of the sandwich model is intended not only to sustain the individual PhD candidate's link with the home institution. It also includes the potential for international collaboration in research, coursework development, lecturing and supervision, etc. Thus, by getting accustomed to the value of collaboration in research during their period of training, it is reasonable to assume that they will want to continue on this path as a way of developing their research ideas after graduation, and possibly also as way of counterbalancing inadequate resources for research at their home universities. A continuation of research activities based on international collaboration is also important from a broader institutional perspective and could be seen as a measurement of the level of capacity established through investments made in PhD training. Consequently, the magnitude, direction, content and premises of international collaboration among this specifically targeted group of individuals, who are expected to constitute a core capacity, should be of interest to international donors interested in supporting the building of research capacity.

Before presenting the results on international collaboration, the methodological framework and delimitation of the data need to be clarified. Since the study has not followed the PhD graduates longitudinally, we have not been able to collect quantitative data covering variations in the frequency, direction and mode of international collaboration over time on an individual level. This means that the data presented only reflects the situation at the specific time of the survey. To some extent we will be able to present a more nuanced picture of variances over time with the help of narratives in the individual interviews.

Taken together, a majority (45.3 per cent) of the PhD graduates reported that they were involved in some type of international collaboration at the time of the survey. There was a slight but notable

variance between the countries, with an average of 43.4 per cent in the Tanzanian case across disciplines, 47.3 per cent in the Mozambican case and 45.1 per cent in the Ethiopian case. Looking at variances between scientific disciplines, graduates in science, medicine and agricultural science generally reported a higher frequency of international collaboration than their colleagues in the social sciences and the humanities in all three countries. Graduates in medicine in Tanzania stood out as the group with the highest frequency of international collaboration (68 per cent), followed by medicine in Ethiopia (63.4 per cent) and science in Tanzania (60.3 per cent). At the lower end of the scale, Mozambican graduates in the humanities reported the lowest frequency of international collaboration (17.5 per cent), followed by graduates in the humanities in Ethiopia (22.3 per cent) and graduates in the social sciences in Mozambique (27 per cent). In reading these results it is important to bear in mind the statistical distortion in the representation across scientific disciplines. The results for medicine, science and to some extent also agricultural science are generally supported by larger numbers of respondents in all three countries than the social sciences and the humanities, which is largely due to policy priorities in the composition of science areas in the agreements between Sweden and the governments of concern.

Africa and Europe are very much at the centre among PhD graduates reporting any type of international collaboration. As displayed in table 5.3, graduates in science in all three countries and the Ethiopian graduates in agricultural science seem to be oriented towards collaboration with European partners to a greater extent than their colleagues in other disciplines. Collaboration with African partners was frequent across disciplines. It was observed that graduates in medicine, science, technology and agricultural science are generally involved to a greater extent in collaborations with partners in both Africa and Europe simultaneously, while there is a more one-sided orientation among graduates in the social sciences and the humanities towards collaboration with African partners. Though North America and Asia are established and advancing international research regions, collaboration with partners there was relatively infrequent among respondents in all three countries and across disciplines, with the notable exception of Ethiopian graduates in medicine. Collaboration with Asian partners was infrequent in all three countries and across disciplines. The growing Chinese economic presence in all three countries seems not to have generated a higher

frequency of collaboration with Asian partners among the graduates. Collaboration with partners in Latin America was also infrequent and applied exclusively to graduates from Mozambique.

Table 5.3 Region of international collaboration, by country and scientific discipline (%/absolute figure)

Discipline/Country/ Region	Africa	EU/ESS/EEA	North America	Latin America	Asia
Medicine TZA	57.1/12	66.7/14	14.3/3	0/0	4.8/1
Medicine MOZ	63.2/12	57.9/11	5.3/1	15.8/3	0/0
Medicine ETH	72.7/16	50/11	36.4/8	0/0	4.5/1
Science TZA	62.5/10	87.5/14	6.2/1	0/0	0/0
Science MOZ	73.9/17	73.9/17	8.6/2	4.3/1	0/0
Science ETH	87.5/14	81.2/13	18.8/3	0/0	6.2/1
Social science TZA	85/17	30/6	5/1	0/0	5/1
Social science MOZ	94.1/16	29.4/5	5.9/1	17.6/3	0/0
Social science ETH	88.9/8	33.3/3	11.1/1	0/0	11.1/1
Humanities TZA	80/4	20/1	0/0	0/0	0/0
Humanities MOZ	85.7/6	14.3/1	0/0	14.3/1	0/0
Humanities ETH	100/4	0/0	0/0	0/0	0/0
Technology TZA	81.8/9	45.4/5	9.1/1	0/0	9.1/1
Technology MOZ	75/6	50/4	0/0	12.5/1	0/0
Technology ETH	80/8	60/6	10/1	0/0	0/0
Agricultural science TZA	88.9/8	50/4	0/0	0/0	0/0
Agricultural science MOZ	92.3/12	53.8/7	7.7/1	7.7/1	0/0
Agricultural science ETH13	100/13	84.6/11	15.4/2	0/0	7.7/1

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

Participation in joint research projects was the dominant type of collaboration among the graduates in all three countries and across disciplines. There were no significant variations between countries and between disciplines.

Table 5.4 Type of international collaboration, by country and scientific discipline (%)

Discipline/Country /Type of collaboration	Publication	Research project	Application for funding	Administrative collaboration
Medicine TZA	66.7/14	80.9/17	23.8/5	4.7/1
Medicine MOZ	57.9/11	47.4/9	15.8/3	0/0
Medicine ETH	54.5/12	63.6/14	36.4/8	0/0
Science TZA	43.8/7	43.8/7	12.5/2	0/0
Science MOZ	60.9/14	52.2/12	26.1/6	0/0
Science ETH	50/8	43.8/7	37.5/6	6.2/1
Social science TZA	25/5	55/11	45/9	0/0
Social science MOZ	23.5/4	70.5/12	23.5/4	0/0
Social science ETH	33.3/3	77.8/7	11.1/1	0/0
Humanities TZA	20/1	80/4	0/0	0/0
Humanities MOZ	28.6/2	85.7/6	0/0	0/0
Humanities ETH	25/1	75/3	0/0	0/0
Technology TZA	36.4/4	72.7/8	36.4/4	0/0
Technology MOZ	25/2	75/6	25/2	0/0
Technology ETH	20/2	80/8	0/0	0/0
Agricultural science TZA	33.4/3	55.5/5	44.5/4	0/0
Agricultural science MOZ	46.2/6	92.3/12	23.1/3	0/0
Agricultural science ETH	23.1/3	84.6/11	38.5/5	0/0

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

As shown in table 5.4, the correlation between collaboration in joint research projects and joint publication is not straightforward, i.e. joint research projects do not automatically lead to co-publication. This is particularly notable in the social sciences and the humanities. Generally, joint publications seem to be more frequent in medicine and science than in other disciplines, especially in the case of Tanzania, which stands out. The frequency of collaboration on applications for funding varied significantly between the countries and disciplines.

Graduates in medicine, science, technology and agricultural science seem to be much more involved in collaborations on joint applications than their colleagues in the social sciences and humanities, especially in the case of Ethiopia. Purely administrative collaborations were generally very infrequent.

It is reasonable to assume that graduates who pursue their training within the framework of a modality based on collaboration with a specific country try to maintain and develop this relationship after graduation as well (given that the graduate values the collaboration). The frequency of continued collaboration with the institution of training in Sweden and South Africa after graduation could be seen as an integrational measurement of the degree of match between the research interest of the graduate and that of the researcher(s) in the collaboration institution. The results show that a majority of respondents (73 per cent in the Mozambican case, 63.3 per cent in the Tanzanian case and 51.2 per cent in the Ethiopian case) have maintained some type of collaboration with the partner in Sweden or South Africa after graduation. However, significant variations can be observed between scientific disciplines in all three countries. Generally, graduates in medicine, science, technology and agricultural science reported a higher frequency of collaboration. For example, in the case of Tanzania, more than 84 per cent of the graduates in medicine reported some type of continued collaboration with the Swedish partner. Looking at frequencies by type of collaboration displayed in table 5.5, collaboration in research projects was by far the most dominant type across all disciplines in all three countries. The most significant variation between disciplines was observed in collaboration on supervision. Graduates in science and medicine seem to be more involved in collaboration on co-supervision than other disciplines. An interesting observation, given the capacity building approach, is also the generally low level of collaboration on course work.

Table 5.5 Collaboration with partner in Sweden/South Africa after graduation, by type of collaboration (%/absolute figure)

Discipline/Country/Type of collaboration	Research project	Lecturing	Co-supervison of PhD candidate	Course work
Medicine TZA	76.2/16	23.8/5	61.9/13	4.8/1
Medicine MOZ	89.5/17	15.8/3	57.9/11	0/0
Medicine ETH	90.9/20	13.6/3	83.4/19	4.5/1
Science TZA	81.1/13	25/4	75/12	0/0
Science MOZ	95.6/22	8.7/2	86.9/20	0/0
Science ETH	87.5/14	31.2/5	68.8/11	0/0
Social science TZA	95/19	50/10	35/7	5/1
Social science MOZ	88.2/15	29.4/5	29.4/5	0/0
Social science ETH9	88.9/8	33.3/3	44.4/4	0/0
Humanities TZA	80/4	40/2	20/1	0/0
Humanities MOZ	85.7/6	14.3/1	14.3/1	0/0
Humanities ETH	50/2	0/0	0/0	0/0
Technology TZA	90.9/10	27.3/3	63.6/7	0/0
Technology MOZ	75/6	25/2	50/4	0/0
Technology ETH	75/7	20/2	50/5	0/0
Agricultural science TZA	88.9/8	22.2/2	22.2/2	0/0
Agricultural science MOZ	92.3/12	7.7/1	46.2/6	0/0
Agricultural science ETH13	84.6/11	7.7/1	15.4.7/2	0/0

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

While the above statistics on international collaboration provide an insight into the magnitude, geographical direction and type, they tell us nothing about the relational premises of graduates' international collaboration. Thus, we need to turn to the qualitative data material. The specific experiences of respondents varied with respect to the conditions of international collaboration, but there was a general feeling of relative subordination. Regardless of the type of collaboration, respondents reported that they often embarked on international collaboration with fewer resources – funding, time and academic qualifications (publications) – and that this fact determined their position with regard to influence, role and consequently range of collaboration, for example academic output (publications).

The consequences of the imbalance in resources were particularly noticeable in collaboration with partners in European countries and in North America. In these cases, the Mozambican and Tanzanian researchers were more often assigned a predetermined role in the collaboration project – not defined by them. The following two quotations aptly capture the conditions for research and collaboration expressed by several respondents:

'As an African researcher you have to actively search for collaboration opportunities, they are rarely offered you. We are not on the international radar for research collaboration.' (PhD graduate, science)

'In some of my international collaboration projects I have not been able to assert much influence. For example, in a project together with German and Dutch partners I was invited to be part of an application for funding where my role was already set, I just had to accept. And you say yes. Of course it is flattering to be invited, but sometimes the role and motives are unclear and don't really fit your interest. It makes you wonder about the intentions.' (PhD graduate, social science).

The frequently unclear and inferior basis for participation in international collaboration projects aroused feelings of being a collaborative hostage among participants – reduced to the status of a kind of 'token presence' in high-income countries' research projects on Africa. Because of more prosperous funding opportunities, many of the projects originated with partners in the high-income countries, which accordingly placed the responsibility and control for the collaborative project with those institutions. Consequently, access to and knowledge of funding opportunities became an early determinant in the 'pecking order' of the partners involved in the collaboration. The African researchers' lack of insight into and access to funding opportunities in high-income countries significantly reduced their ability to influence and control. The impression of being a collaborative hostage also originated from an awareness of the policy-induced requirements of many research-funding agencies in high-income countries to have increased internationalisation in higher education and research. Demonstrating collaboration with an African partner had thus become a reinforcing component of applications for research funding.

'I have repeatedly been part of research projects with partners at European institutions without having any salary from it. For some reason

I was supposed to work in the project for free, just being grateful for the opportunity to be included' (PhD graduate, medicine).

'*All these endorsements for research collaborations. You sign but you rarely hear from them again… In many cases I have a feeling that there is no genuine interest for collaboration, it's just a formality in application processes*' (PhD graduate, dean).

The collaboration situations reportedly sometimes involved the African researcher having to sit by passively and simply await instructions, particularly in collaboration with partners in high-income countries. Respondents reported that active participation was commonly limited to phases in the collaborative research process that contained practical elements to do with data collection and field work – for example, bureaucratic procedures for research permits and the hiring of research assistants to carry out interviews, or collecting samples. Once data collection was completed and the research entered the phases of analysis and writing-up, respondents reported their roles in the collaboration to be more blurred and peripheral. Responsibility and finalising activities progressively moved to the collaborating institution in the high-income country. Reportedly, this was justified by collaborating institutions in Sweden on the grounds of greater research capacity, a superior international position and greater access to international dissemination channels.

However, this situation, which has elements of an autocratic relationship, did not encounter any pronounced opposition from the African PhD graduates. The interviews showed that they actively managed and regulated the unequal collaboration conditions because – given the weak general research capacity at their home universities – they saw individual advantages to being associated with institutions in high-income countries. Many respondents said they were willing to accept what they saw as an inferior research position in a collaboration project for the sake of their individual academic careers. In some cases, the same individualistic motivation has been visible in the reluctance of PhD graduates to transfer their training programmes from institutions in high-income countries to institutions in low-income countries (which is the basic idea of the capacity-building approach). The basic argument has been that a Swedish exam confers higher status (Fellesson and Mählck 2013).

This is an important institutional element in the support for PhD training, which extends beyond the individual. Several factors determine the development of this transfer of capacity, which among other things concerns control, implementation and agenda setting, and these are not always consistent. These factors also influence the link between established PhD training collaborations and other types of collaboration after PhD training. The result from our survey, displaying a low level of co-supervision involvement on the Mozambican and Tanzanian side in all scientific disciplines, could be read as an indication of inertia in the transfer process. Despite long-term collaborations, the transfer process also seems to be held back for reasons relating not only to the actual conditions for the academic development of the programme, but also to vested interests on both sides of the collaboration. The following narrative mirrors the possible presence of economic incentives for maintaining the status quo in the transfer of training capacity.

'Even after now twenty years of collaboration, the Swedish institution has still a strong grip on the PhD training program.[...] We now have some of the coursework in place, but we are still far from launching our own training program. Of course, there is money involved. The Swedish counterpart still wants us around and not only for academic reasons.' (PhD graduate, agricultural science).

5.3 Magnitude, modes and premises of scientific output

Built into the idea of Swedish development support is the assumption of a gradual increase in scientific output, in terms of qualitative and development relevant publications, as institutional research capacity develops. Naturally, the supply of trained researchers is a core premise, but the proficiency of this group will not develop if not backed by a permissive and supportive surrounding environment. This insight has informed Swedish support since its inception and this is why support for PhD training is seen as part of a broader institutional package of functions (laboratories, equipment, ICT, administrative support, libraries, research councils, etc.) to form a scientific environment capable of producing high-quality research.

In the best of worlds, the Swedish model implies that a PhD graduate would return to a home university capable of promoting a

continuation of the capacity and scientific groundwork developed during training. Specifically, this would imply the ability to balance the different roles assigned to a university-employed lecturer, such as engaging in national and international research, lecturing and communication with society. If we assume that the Swedish support for PhD training is specifically about building institutional capacity for research, the implementation of the research activity is dependent on two crucial factors. One is the accessibility of funding for research after graduation and the other is the space for research in terms of time. The funding factor has long been part of the Swedish model through the support for national research councils, but this has largely been directed towards the building of institutional administrative capacity. Nevertheless, despite this effort, the funding capacity of most research councils in the Sida collaborating countries is very insufficient. Funding opportunities at the universities are also very limited in most cases and only cover small, very time-restricted projects.

While funding is a more straightforward restricting factor for research, the time factor is subtler. The time factor is involved in all parts of the research process, from formulation and application to implementation, analysis, publication and outreach. In our case, in addition to conducting their own research, the PhD graduates are also expected to take on roles associated with the building of local PhD programmes, such as supervision and coursework development. Accordingly, in a competitive national and international research environment, in most cases there is a strong correlation between the time available to work on the different stages of the research process and the quality of the scientific work, whether it be applications for funding, data collection or publication. In this study, there is a particular reason for highlighting the time factor since it may highlight a potential tension between policy aspirations and developments in national higher education in the countries of concern and policy aspirations in the research capacity building approach of the Swedish development support. Both these aspirations depend heavily on the presence of PhD graduates and, moreover, they are accommodated in the same function of being a university lecturer.

Turning to the funding factor, the results from our surveys display a fairly comparable picture as regards the proportionality of funding sources. Among those respondents reporting that they conduct research, only 4.3 per cent of the Mozambican graduates, 6.1 per cent

of the Tanzanian graduates and 5.7 per cent of the Ethiopian graduates said that the government was funding them. The result can be said to mirror a continued weak capacity of the national research councils in the three countries. International donors and foundations seem to be the main providers of external funds for research in all three countries and accounted for 11.3 per cent in the Mozambican case, 14.5 per cent in the Tanzanian case and 21.4 per cent in the Ethiopian case. In all three countries, the private sector accounted for less than two per cent of the research funds, indicating a low degree of interaction between academia and the national business sector. Regardless of funding source, respondents from science, technology, engineering and mathematics (STEM sciences) along with medicine accounted for the largest share of recipients of funds. Taken together, respondents in these disciplines accounted for almost 68 per cent of those reporting that they were externally funded. Interestingly, money from own savings and consultancy outside academia was reported to be a major source of funding for research. 56.7 per cent in Mozambique, 44.3 per cent in Tanzania and 39.5 per cent in Ethiopia reported using this type of funding to cover part of their research activity. Respondents in social science and the humanities made up the majority of this group.

Table 5.6 Time for research after graduation, by scientific discipline and country (%/absolute figure)

Discipline/country/% of full-time	Not at all	< 25%	25%	50%	75%	100%
Medicine TZA	4.8/1	28.6/6	38.1/8	19/4	0/0	9.5/2
Medicine MOZ	5.2/1	31.6/6	47.4/9	10.5/2	5.3/1	0/0
Medicine ETH	9.1/2	31.8/7	50/11	4.5/1	4.5/1	0/0
Science TZA	12.5/2	37.5/6	37.5/6	12.5/2	0/0	0/0
Science MOZ	13.6/3	50/11	31.8/7	4.8/1	0/0	0/0
Science ETH	18.8/3	25/4	50/8	0/0	0/0	6.2/1
Social science TZA	5/1	40/8	50/10	5/1	0/0	0/0
Social science MOZ	11.8/2	47/8	41.2/7	0/0	0/0	0/0
Social science ETH	0/0	77.8/7	22.2/2	0/0	0/0	0/0
Humanities TZA	20/1	60/3	20/1	0/0	0/0	0/0
Humanities MOZ	14.3/1	57.1/4	28.6/2	0/0	0/0	0/0
Humanities ETH	50/2	25/1	25/1	0/0	0/0	0/0
Technology TZA	9.1/1	45.4/5	45.4/5	0/0	0/0	0/0
Technology MOZ	12.5/1	37.5/3	37.5/3	12.5/1	0/0	0/0
Technology ETH	0/0	20/2	40/4	40/4	0/0	0/0
Agricultural science TZA	11.1/1	22.2/2	55.6/5	11.1/1	0/0	0/0
Agricultural science MOZ	7.7/1	38.4/5	38.4/5	15.4/2	0/0	0/0
Agricultural science ETH	0/0	38.4/5	46.2/6	0/0	15.4/2	0/0

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

As displayed in table 5.6, the great majority of respondents in all three countries reported that they conduct research to some extent, but the results also indicated a weak correlation between completed PhD training and increase in research activity measured in time devoted to research. In the Mozambican case, 67.3 per cent reported that their PhD training had not resulted in an extension of the time to conduct research. The corresponding figures for Tanzania and Ethiopia were 59.5 per cent and 71.4 per cent, respectively. In the interviews respondents frequently complained about the gradually shrinking time for research. Quite a few even asserted that they had spent more time on research activities before the training than after. For many, the period of training had so far been the most research-intensive period in their careers. Generally, the limited time for research reportedly had nothing to do with a lack of willingness or engagement, but was

frequently explained by the increasingly heavy workload tied to lecturing, supervision and administration. The following two quotations give an insight into the problem:

'Lack of funding opportunities is really a barrier for my development as a researcher. After you graduate you are left with very few opportunities for funding. To stand a chance to secure international funding you have to spend time to write a good application and time is not just there. It is really frustrating. With so many classes even in the evenings, how could you have time. But even if you have funds to do research, you probably have to leave the university to get time to do it. I will not say that the university has become research hostile, but the last ten years have not pointed in the right direction.' (PhD graduate, science)

'Because of the Sida support we are now quite a few PhD holders at my department, but I have to say that research activities have not increased substantially and this is not because of lack of engagement. We all really want to do research. No, the main reason is the heavy teaching load put on all of us ... The current situation of mass intake of students and the administrative burden following on this is really working against the building of the research capacity at this university.' (PhD graduate, social science)

As shown in table 5.6, the vast majority (94.4 per cent) of respondents in all three countries (94.1 per cent in Mozambique, 93.2 per cent in Tanzania and 95.9 per cent in Ethiopia) spent 25 per cent or less of their time on research. However, there were a few notable variations between the countries and between scientific disciplines. It was a common feature of all three countries that graduates in social science and the humanities reported spending significantly less time on research than graduates from other disciplines, while respondents from medicine and science reported spending the most time. Tanzanian and Ethiopian graduates in medicine reported the highest frequency of time spent on research. The results for the latter may appear a bit strange given the reported high frequency of outbound mobility among Ethiopian graduates in medicine. Generally, there was a strong correlation between reported access to funds for research and reported time spent on research.

Limited access to research funding after graduation in combination with shrinking space for research potentially provides poor conditions for scientific output in terms of publications. In our attempt to measure the scientific publication output among the graduates,

respondents were asked to give an account of their publication output since graduation. Publications in peer-reviewed international journals are generally seen as the prime output of high-quality scientific knowledge production, but generally these publications are preceded or followed up by other publications, such as working papers, articles in national journals, book chapters. These other publications are rarely captured by the international bibliographical databases such as the Web of Science (WoS) database and Elsevier's Scopus database. As a result, they tend to be inaccessible and unavailable for comprehensive studies of research performance. Even though more and more African journals are being indexed by the major databases and other sources are also expanding their coverage of scholarly literature from African countries such as African Journals Online, the coverage is still insufficient for large-scale systematic comparisons (ACR 2016). Given these conditions, a true and fair assessment of the graduates' whole span of scientific output becomes a quite complicated and time-consuming operation, requiring very close individual follow-up. For this reason we have applied a self-assessment method. In viewing the results, one needs however to be aware of certain limitations associated with this type of method as applied in this study. Firstly, since the respondents have graduated at different times from 1990 onwards, their publication record cannot be comparatively measured unless we aggregate data for individuals from a specific year of graduation. Secondly, it does not display variations in the intensity of publication and variations in type of publication over time since graduation. Lastly, in relation to reported publication in peer-reviewed international journals, it is not possible to discern the quality of the publication in terms of international ranking. Nevertheless, using this method we can get a comparative picture of magnitude and types of publication in the graduates' scientific output in the three countries and in different scientific disciplines.

The graduates have given their account of scientific output in relation to three types: peer-reviewed international journals, peer-reviewed national journals and working papers (conference, seminars, etc.). The result for the frequency of publication in peer-reviewed international journals is presented in table 5.7. The most notable result is the comparatively high frequency of international publication among graduates in medicine in all three countries. The explanation for this may be that medicine is one of the more long-term and established disciplines in the Swedish support, generating a critical

mass of researchers and, potentially, institutional capacity over the years. Another explanation brought up in the interviews was the presence of an institutional culture giving preference to international publication as a result of the comparatively higher frequency of international collaboration compared to graduates in other disciplines (see table 5.4). The results for other disciplines accord largely with the general picture shown so far. The frequencies of international publication in the STEM sciences are significantly higher than those for social sciences and the humanities. In the STEM sciences, agricultural science stands out with generally high publication rates, which may be explained by the same factors stated for medicine. Importantly, the results only provide a rough account of the frequency of international publication among the graduates. I do not claim to attribute the results to specific quality aspects of scientific research, other than to note that graduates in certain disciplines seem to have a higher frequency of publication in international journals that meet current international premises for quality research output. On an overall level, we are not able to say anything about the value of the result in an international comparative context, i.e. whether the overall reported frequency of international publication is a good or bad result, given the conditions for scientific work in each country.

Table 5.7 Frequency of publication in international peer-reviewed journals since graduation, by country and scientific discipline (%/absolute figure)

Discipline/Country/ Number of publications	No publ	1-3 publ	4-6 publ	7-9 publ	10-12 publ	13 publ or more
Medicine TZA	4.8/1	14.3/3	14.3/3	28.6/6	19/4	19/4
Medicine MOZ	5.3/1	26.3/5	21/4	26.3/5	5.3/1	15.8/3
Medicine ETH	9.1/2	27.3/6	22.7/5	9.1/2	9.1/2	22.7/5
Science TZA	6.2/1	37.5/6	18.8/3	18.8/3	0/0	18.8/3
Science MOZ	8.7/2	26.1/6	43.5/10	0/0	13/3	8.7/2
Science ETH	6.2/1	37.5/6	25/4	12.5/2	6.2/1	12.5/2
Social science TZA	15/3	50/10	30/6	0/0	0/0	5/1
Social science MOZ	17.6/3	35.1/6	41.2/7	0/0	5.9/1	0/0
Social science ETH	11.1/1	55.6/5	22.2/2	0/0	11.1/1	0/0
Humanities TZA	20/1	60/3	20/1	0/0	0/0	0/0
Humanities MOZ	-	-	-	-	-	-
Humanities ETH	25/1	50/2	25/1	0/0	0/0	0/0
Technology TZA	9.1/1	36.4/4	45.4/5	9.1/1	0/0	0/0
Technology MOZ	12.5/1	62.5/5	12.5/1	12.5/1	0/0	0/0
Technology ETH	10/1	20/2	50/5	10/1	10/1	0/0
Agricultural science TZA	0/0	44.4/4	11.1/1	22.2/2	22.2/2	0/0
Agricultural science MOZ	7.6/1	46.2/6	23.1/3	15.4/2	7.6/1	0/0
Agricultural science ETH	7.6/1	15.4/2	23.1/3	38.4/5	15.4/2	0/0

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

In view of the results for publication in peer-reviewed international journals, the results for publication in peer-reviewed national journals revealed a somewhat different picture. As presented in table 5.8, graduates in social science and the humanities have a higher frequency of publication in this type of journal than their colleagues in other disciplines, especially in the case of Tanzania. National publication seems also to be a more frequent option among graduates in agricultural science in Tanzania and Mozambique. An observation

from the interviews was that articles published in national journals were more often the product of solitary work than articles in international journals, which commonly involved co-authorship (more often in medicine and the STEM sciences). Based on the interviews, national publication as a fall-back (if not accepted in international journals) seems also to be more frequent among graduates in the STEM sciences and in medicine, particularly in the case of the latter. In the interviews, graduates in social science and also to some extent in agricultural science claimed the topical coverage of national journals, which focus more often on developmental issues from a local perspective, as the motive for first option publication. Graduates in both disciplines also claimed that their scientific output in this type of publication resulted more often in policy dialogue with government stakeholders. The following quotations give an insight into this:

'*For me, publishing in national journals is more direct. It is about time, relevance and response. You are able to publish faster and you feel more connected to the national development…if I look at my publication record, articles published in national journals have more often been picked up by policy makers.*' (PhD graduate, social science)

'*It is a dilemma. As researcher you know that you should strive for international publication, but in doing so you need collaboration. Publishing alone is difficult if you want to do it in an international journal, but collaboration often means compromises. I have more control if I write alone and publish in national journals… and I feel more attached to the issues in need of research in this country.*' (PhD graduate, agricultural science)

Table 5.8 Frequency of publication in peer-reviewed national journals since graduation, by country and scientific discipline (%/absolute figure)

Discipline/Country/Number of publications	No publ	1-3 publ	4-6 publ	7-9 publ	10-12 publ	13 publ or more
Medicine TZA	**14.8/3**	**57.2/12**	**28.6/6**	**0/0**	**0/0**	**0/0**
Medicine MOZ	27.8/5	55.6/10	16.7/3	0/0	0/0	0/0
Medicine ETH	13.6/3	31.8/7	45.4/10	9.1/2	0/0	0/0
Science TZA	31.2/5	43.8/7	6.2/1	18.8/3	0/0	0/0
Science MOZ	26.1/6	52.2/12	13/3	0/0	4.3/1	4.3/1
Science ETH	12.5/2	31.2/5	43.8/7	6.2/1	0/0	6.2/1
Social science TZA	4.8/1	9.5/2	14.3/3	52.4/11	14.3/3	5.8/1
Social science MOZ	0/0	5.9/1	58.8/10	58.8/1	29.4/5	0/0
Social science ETH	0/0	0/0	22.2/2	44.4/4	33.3/3	0/0
Humanities TZA	0/0	80/4	20/1	0/0	0/0	0/0
Humanities MOZ	0/0	88.9/8	11.1/1	0/0	0/0	0/0
Humanities ETH	-	-	-	-	-	-
Technology TZA	0/0	54.4/6	36.4/4	9.1/1	0/0	0/0
Technology MOZ	12.5/1	75/6	12.5/1	0/0	0/0	0/0
Technology ETH	20/2	70/7	10/1	0/0	0/0	0/0
Agricultural science TZA	11.1/1	44.4/4	11.1/1	11.1/1	11.1/1	11.1/1
Agricultural science MOZ	23.1/3	53.8/7	15.4/2	0/0	7.7/1	0/0
Agricultural science ETH	23.1/3	7.7/1	46.2/6	0/0	15.4/2	7.7/1

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

The production of working papers forms a substantial part of the research process and often constitutes an early manifestation of results intended for publication. Consequently, the amount of working papers produced by an individual researcher could be seen as an indicator of research activity. The results, presented in table 5.9, follow a similar pattern to those for international publication. Graduates in medicine account for the highest frequency of working papers followed by graduates in agricultural science. Notably, graduates in social science score relatively high, indicating that a substantial part of the working papers never reach international

publication, although part of them may be published in national journals, as indicated in table 5.8. A factor not covered by the statistical compilation presented in this study is that researchers in social science and the humanities also disseminate their research through books and non-peer reviewed reports. In all three countries, graduates in these disciplines reported a significantly higher frequency in these types of publication than the others.

Table 5.9 Frequency of working papers (conferences, seminars, etc.) since graduation, by country and scientific discipline (%/absolute figure)

Discipline/Country/Number of research papers (unpublished)	No	1-3 papers	4-6 papers	7-9 papers	10-12 papers	13 papers or more
Medicine TZA	0/0	4.8/1	14.3/3	0/0	52.4/11	28.6/6
Medicine MOZ	0/0	0/0	10.5/2	42.1/8	36.8/7	10.5/2
Medicine ETH	0/0	0/0	45.4/10	36.4/8	4.5/1	13.6/3
Science TZA	0/0	6.2/1	62.5/10	31.2/5	0/0	0/0
Science MOZ	0/0	0/0	78.2/18	17.4/4	4.3/1	0/0
Science ETH	0/0	6.2/1	18.8/3	50/8	18.8/3	6.2/1
Social science TZA	0/0	5/1	15/3	55/11	25/5	0/0
Social science MOZ	0/0	5.9/1	17.6/3	47.1/8	29.4/5	0/0
Social science ETH	0/0	11.1/1	44.4/4	22.2/2	11.1/1	11.1/1
Humanities TZA	0/0	40/2	60/3	0/0	0/0	0/0
Humanities MOZ	-	-	-	-	-	-
Humanities ETH	0/0	25/1	75/3	0/0	0/0	0/0
Technology TZA	0/0	27.2/3	27.2/3	36.4/4	9.1/1	0/0
Technology MOZ	0/0	12.5/1	37.5/3	25/2	12.5/1	12.5/1
Technology ETH	0/0	10/1	40/4	30/3	10/1	10/1
Agricultural science TZA	0/0	0/0	22.2/2	44.4/4	22.2/2	11.1/1
Agricultural science MOZ	0/0	15.4/2	53.8/7	0/0	23.1/3	7.7/1
Agricultural science ETH13	0/0	7.7/1	15.4/2	53.8/7	7.7/1	15.4/2

Note: ETH = Ethiopia, TZA= Tanzania, MOZ= Mozambique

6 Conclusions, policy implications and recommendations

Few question the important role that Science, Technology and Innovation (STI) has played for economic development, poverty alleviation and quality of life throughout the 20th century. Hence, in view of current global developments, there is little to suggest that the importance of access to national capacity for research will decrease. On the contrary, there is a consensus about the growing role of science and innovation as a means of positioning in an increasingly competitive and growth-centered global economy. As we have seen, this is well articulated in most countries' policy-making, Sweden being no exception.

STI has also been given a prominent role as a means of meeting the global challenges put forward in the 2030 Agenda and the Sustainable Development Goals (SDGs). The importance of STI cuts across most of the goals and is specifically mirrored in Goal 17 on means of implementation.

STI as a prerequisite for economic positioning is equally important for low-income countries as for any OECD country. Given their on-going inferior position in the global exchange of goods and services, it is even justified to claim that African countries are in greater need of STI to stand a chance of levelling out uneven terms in these types of transaction. This argument is further strengthened by the great need for STI capacity to deal with the challenges of the SDGs, many of which affect African countries the most.

Most African countries have incorporated STI in their national, regional and international development policies and plans. The issue has also been brought to the fore in a pan-African context. The African Union's Agenda 2063 puts STI at the forefront as one of the most important means for achieving its development goals. The adoption of a ten-year Science, Technology and Innovation Strategy for Africa (STISA-2024), the establishment of a conference of Ministers in Charge of Science and Technology (AMCOST) and the Consolidated Science and Technology Plan of Action (CPA) are all concrete examples of how the relevance of STI is incorporated in policy frameworks and dialogue forums in an African development context.

What these initiatives have in common is that they all share the same view on the importance of building institutional research capacity at national and regional level and that different forms of collaboration are key to achieving this capacity. The localisation of the challenges in the SDGs requires research capacity in place that is able to contribute to context-specific solutions while simultaneously being part of and contributing to the overall international science community. There is also a strong consensus on the importance of research training to form the backbone of the research capacity. In a survey of 43 African countries undertaken to assess the capacity needs in STI, over 90 per cent of African countries consider research training to be a high or very high priority area (ARC 2017).

Although the aim of this study has not been to evaluate Swedish development support for research in full, only the outcome of PhD training, the review of current developments in the global science regime, looking at challenges, premises, resources and policy aspirations, together with the recognition of STI as a means of tackling the global challenges in the SDGs, shows great consistency with the targets set in the government's strategy for research cooperation. It seems that time has caught up with the Swedish comprehensive approach to institutional research capacity building, which has long been operating in relative isolation from the rest of the community of international donors (many of which have started to reformulate their policies for research support, often with the Swedish approach as their model). From time to time, research support has also been questioned within the Swedish development collaboration itself, expressed in decreasing administrational capacity and cuts and readjustments in the budget. However, it is commendable that the approach of the support has never been compromised, which suggests that the position of the Swedish commitment, in an international context, is expected to remain intact.

The fact that the long-term Swedish model for research capacity building seems more than ever to be in tune with the needs and policy priorities of the international community and countries receiving development aid suggests an opportunity for leading internationally by example. This insight, which is intimately linked to the specific approach to supporting PhD training in low-come countries, represents a prominent overall conclusion of this study.

The study has paid much attention to the idea of internationalisation in higher education and research. This was partly

because the concept coincides with the basic premises of collaboration and exchange in the research support, but more importantly it constitutes a conceptual meeting point between two policy areas: policies in higher education and research and development aid policy. Our review shows that internationalisation, as a well-theorised and applied concept, contains elements of selection governed by certain premises, among which the economic rationale seems to be the most prominent. In practice, these premises, which cut through all aspects of scientific work (not least mobility, collaboration and publication), are linked to the issue of representation and function – who is included and on which terms. Due mainly to weak institutional capacity, representations from the low-income countries tend to be left out as potential collaborating partners in the context of high-income countries' policy-making on internationalisation. In conclusion, regardless of the rationales, the relative exclusion of low-income countries' international research production from policies on internationalisation will have implications for the way we approach research issues of global concern, such as those made viable through the 2030 Agenda and the SDGs. There are high expectations on the international community of science and technology as a means of coming up with solutions and innovations that could advance the fulfilment of the goals and this undeniably puts the focus on the problem of representation – 'the grand challenges of our day cannot be addressed solely through empirical study. They must also be recognized as terrains of cultural and political contestation over who is included and excluded when any label is applied to a problem or a population' (Vavrus and Pekol 2015:9). Our review of the Swedish policy framework for internationalisation specifically and higher education and research generally confirms the picture of relative selectiveness and exclusion of low-income country representation. Besides this, the most notable conclusion is the absence of a policy connection with the development cooperation's support for research, which operates fully within the rationales of internationalisation.

In an attempt to contextualise the mobility, collaboration and scientific output of the PhD graduates in this study, we have performed a brief review of the status and premises for science production globally, in Africa and in the countries of concern. Hardly surprisingly, the most notable overall conclusions are that resources and capacities for science are unevenly distributed and that Africa is in short supply of most of the indispensables for science. Limited access

to qualified researchers is perhaps the most critical issue, which directly affects the scientific performance measured in magnitude and quality of scientific output and the quality of education at the universities. The development of higher education and research in each country in the scope of the study displays a quite uniform picture. On the positive side, growing policy priority is given to higher education (a precondition for the development and sustainment of research capacity) and also to STI. While the first priority has led to a significant increase in institutions and students in all three countries, the policy priority of STI seems not to have been incorporated in any noteworthy measures in terms of additional resources.

Given the interlinked nature of higher education and research, the current imbalanced resource allocation, giving priority to the first, potentially raises concerns about the development and sustainment of research capacity in all three countries, particularly at the national universities in the scope of the Swedish support, which were originally selected as offering the best breeding grounds for research. With the current escalation in the number of institutions and the massive intake of students, there is an imminent risk that existing capacity for research will be compromised, which, by extension, constitutes a threat to the model of building research capacity applied in the Swedish support. If the principal objective of Swedish development support for PhD training is to prepare individuals to become researchers, such a priority represents a major threat to the investments made so far.

Turning to the specific investigation of mobility, collaboration and scientific output, which were selected because they constitute important elements in science production, the findings should be seen as an expression of the institutional conditions for continued individual career development. The most notable conclusions may be summarised as follows:

International, sectoral and vertical mobility:

With a few exceptions, the degree of sectoral mobility was generally low. The large majority of the PhD graduates in all three countries have stayed in academia and most of them have also remained at the same university. This means that the majority are still at the national universities receiving Swedish research support and thus constitute a policy-envisioned critical mass for building research capacity.

For most of the graduates, the doctoral degree has meant an upgrading of their positions in academia (vertical mobility). Many have reached high positions, particularly male graduates. On the downside, seen from a research perspective, many of the high positions are of an administrative nature, which undermines the space for research activities.

International mobility was generally low in all three countries and, with a few exceptions, across scientific disciplines. Europe and other African countries seem to be the prime destinations among those with mobility experience. A notable observation was also that international mobility seems not to be actively encouraged at the universities. On the contrary, it is seen as an act disqualifying further career development at the universities, which accords with international research into the dynamics of promotion at academic workplaces.

The incidence of low international mobility should not be seen as unequivocally beneficial to the development of research capacity at the universities. While a low degree of international mobility means greater availability of qualified individuals at the national universities in the three countries, it could also mean the loss of the competencies, experience and contacts acquired through mobility. This is because mobility can be both an important conduit for expanding collaboration networks and an outcome of mobility episodes. In this regard, it has been suggested that the mobility of researchers is an indicator of their competence and flexibility (MORE 2010). In the context of the Swedish support for research, the issue may not be whether mobility is good or bad, but how to find a balance between outbound research and the need to retain a critical mass of researchers at home.

Modes and premises of international collaboration:

A majority of the PhD graduates are involved in some type of international collaboration. In all three countries, graduates in science, medicine and agricultural science generally reported a higher frequency of international collaboration than their colleagues in the social sciences and the humanities. Africa and Europe are very much at the centre of collaborations, which may be the result of earlier contacts during the period of training. Many had also maintained collaboration with their Swedish counterparts after graduation. Participation in joint research projects seems to be the dominant type

of collaboration among the graduates in all three countries and across disciplines.

The specific experiences of respondents varied with respect to the conditions of international collaboration, but there was a general feeling of relative subordination. Regardless of the type of collaboration, respondents reported that they often embarked on international collaboration with fewer resources – funding, time and academic qualifications (publications) – and that this fact determined their position with regard to influence, role and consequently range in collaboration, for example academic output (publications).

Despite long-standing research capacity development at the three universities, elements of inequality in international collaboration still persist, perpetuating inferior positions for the PhD graduates' participation. Essentially, the inequality stems from the unequal conditions for research production, which prevent the PhD graduates from actively initiating and leading international research collaboration projects. Our result does not suggest any deliberate intention of controlling and dominating among partners in the Global North, but still it displays an institutionalised relationship of knowledge of a postcolonial nature, in which the available positions for the PhD graduates are those of informants rather than research partners.

The findings display an inherent tension in the Swedish development aid programme for research. On the one hand, this programme is altruistically geared to increase the capacity for local knowledge production and international participation, based on the needs defined by the partner country; on the other hand, this mission is largely pursued in a context that is informed by the science regime of high-income countries, and inevitably reproduces institutional structures of superiority and subordination in the relations between the African researchers and their international partners in Sweden and elsewhere in the Global North. We are not suggesting the existence of a deliberate institutional polarised division between African researchers and research partners in high-income countries, but there is at least potentially a risk that the long-term engagement of Swedish institutions in the capacity building programmes, many of which are organised around PhD training, has gradually generated a normalisation of unequal roles in the relationship that is also reproduced in collaborations after the period of training.

Magnitude, modes and premises of scientific output:

The long-term donor support to raise research qualifications among university staff members at the national universities seems not to have resulted in any notable expansion or intensification of research activities, measured in time and available funding for research, after they completed their PhDs, as compared to what they were able to do while benefiting from the Swedish programmes. Lack of resources for research after graduation and the current expansion of undergraduate enrolment are the two main impediments to the emergence of a research culture at the universities of concern, and they undoubtedly have a negative effect on scientific output. Although the study is restricted to the variables of time and resources (funding) in research production and hence does not take account of capacity-development efforts in other areas of the national research and higher education systems of the three countries or address matters of institutional leadership, mission or administrative infrastructure to support greater focus on research, the results require reconsideration of the context in which the Swedish support for research capacity development operates.

Recommendations

Recommendations from this study fall into two categories; those of an overall policy nature linked to the issues of global cooperative responsibility and internationalisation in the policy nexus between Swedish higher education and research and development support for research; and those of more operational nature linked to the findings on mobility, collaboration and research output in the support for research capacity building.

Overall policy recommendations:

The significance of capacity for science, technology and innovation in low-income countries for the implementation of the 2030 Agenda needs to be acknowledged. The call for STI-based solutions to the SDGs is clearly presented in the 2030 Agenda and further acknowledged in the Addis Ababa Action Agenda on Financing for Development (FfD), which contains a specific action area on science, technology, innovation and capacity building (one out of seven). These global agendas, highlighted as basic principles in the recent ten-year government bill on science and innovation, are based on the idea of

universality and collaboration. Finding science-based solutions the global challenges are therefore a matter of international collaboration in which context-specific contributions could be brought together to form larger entities of science-based knowledge. Given the global nature of many of the SDGs, capacity for research in low-income countries is essential. Often, these countries are also the ones most affected by the global challenges. Weak capacity for research will mean an inability not only to take on context-specific research, but also to take in and implement results from international research relevant for own development. As shown in the review of the international developments in STI, many low-income countries lag behind on most science parameters compared to high-income countries (access to qualified researchers being one of the most prominent). In the spirit of the 2030 Agenda – 'leaving no one behind', the current situation calls for efforts to counterbalance the uneven conditions for research. Sweden, having an excellent reputation as a long-term provider of holistic support for research capacity building in low-income countries, is very well positioned to take the international lead in the work of raising the level of attention and mobilising resources. There will be opportunities to highlight this at the upcoming UN Science, Technology, Innovation Forum (STI Forum), the Financing for Development Forum (FfD forum) and the High Level Political Forum (HLPF) of the 2030 Agenda (all taking place during spring and summer 2017), and also through the Swedish engagement in the World Bank and other regional development banks as well as in different UN organisations. In addition, the African Capacity Building Foundation has an important function, continuing to stress the link between research capacity and societal development.

Development aid for research needs to be part of Swedish internationalisation in research and higher education. The current global development agenda, fronted by the 2030 Agenda and the SDGs along with the operative financing modality of the Addis Ababa Action Agenda and Paris Agreement on Climate (COP21), raises the need to highlight the seemingly weak and unclear relationship between Swedish development aid for research and Swedish policy aspirations in science and higher education, specifically as part of policies on internationalisation. As has been shown, the Swedish collaborative approach to capacity building, for example through PhD training, accords perfectly with what is seen as basic and recognised premises in internationalisation. For many years, Swedish institutions have been

heavily involved in development aid funded collaborations with partners in low-income countries. Over the years, a great number of researchers from these collaborations have spent considerable time in Swedish institutions during their PhD training, and have continued to collaborate after graduation as patterns of mobility, collaboration and scientific output have shown. Nevertheless, and given the fact that approximately 40 per cent of the aid budget for bilateral collaborations is allocated to Swedish institutions, this group has never been recognised in Swedish policy-making on internationalisation. Swedish policy on internationalisation needs to include, value and make use of these collaborations.

Create policy incentives for increased collaboration between development aid for research and national higher education and research. Development aid for research and specifically the bilateral support for capacity building, as part of policy-making on internationalisation, could pave the way for potential collaborations between the two policy areas. If these collaborations were valued beyond their unilateral importance and seen also as important components in the Swedish institutional capacity for research, it would create a common meeting-ground for the two policy areas, in which they could set an example and develop coherent policies in accordance with the Policy for Global Development (PGD).

Operational recommendations

The post- doc situation and the conditions for research after graduation need to be addressed. The comprehensive view of the support for research capacity building, of which PhD training constitutes a part, needs to be supplemented by a context-specific understanding of the conditions for research after graduation. Measures are needed to counter the current low pay-off for having a PhD degree in terms of ability to conduct research. One bottleneck is the absence of post-doctoral opportunities, which could provide both mobility and research leave from lecturing. Support for post-doctoral programmes is under way in some collaborating countries, but these are still in their initial phase and need to be scaled up. Another option is to consider developing sabbatical programmes that will encourage leading international researchers to spend their sabbaticals at the national institutions of concern, thus allowing high-quality interaction between local researchers and their international colleagues.

Increase the support for PhD training as the backbone of bilateral research collaboration. Over the years, the Swedish support for PhD training has contributed substantially to the building of a critical mass of qualified researchers at the three universities. Nevertheless, these universities have comparatively few staff members who hold a PhD degree. Our result showed a low degree of sectoral mobility among the PhD graduates. Not only did the graduates stay in academia, they also tended to remain at the national universities selected as offering the best breeding ground for research capacity development in each country. Consequently, Swedish development aid has been successful in its contribution to the building of the core function of research, namely access to qualified local individuals who can initiate, implement and communicate research that could be transformed into innovations and solutions to meet societal challenges. An example of a successful transfer is PhD training within the framework of the African Economic Research Consortium (AERC). Nonetheless, the opportunities available to the PhD graduates are under severe strain from the current massive expansion of institutions and students that threatens to undermine the further development of their capacity as researchers. It should be said that the policy priority to higher education should be seen as a positive development provided that quality can be maintained, but unfortunately most reports indicate difficulties in this regard, due mainly to a lack of qualified staff members (among whom PhD graduates are the most sought-after).

Address and clarify the role of the support for research capacity building in relation to current developments in higher education. The current trend of policy priority to the universities' educational mission, especially at undergraduate level, along with the results for the degree of research activities among the PhD graduates raises the question of the Swedish support's position and objective – should the support comprise the goal of building overall capacity at a university (including training at all levels and research) or should capacity for research be exclusively addressed as now stated in the government strategy. This will have implications for how we look at the function of PhD training – as something that could promote the need for qualified teaching capacity or something that could initiate and develop research. A combination of teaching and research would have been the ultimate situation, but, as our results indicate, the latter has been seriously compromised.

Maintain the concentration of support on PhD training for the national universities. The national universities are still seen as the most prestigious institutions by the PhD graduates themselves, which partly explains the low level of mobility from them. In comparison with other institutions in the three countries, the national universities still occupy the uppermost position in terms of capacity and preconditions for research. Research capacity is under pressure, but if these institutions are to have a chance to develop into centres of excellence and stand a chance to reach international levels of recognition (in, for example, university rankings), they must benefit from the larger share of resources allocated to research.

Address the premises of the relational orders in international collaboration by instituting a new programme. There must be a process of critical assessment to overcome the determinants of relational order and structure in the PhD graduates' international collaborations. An important bottleneck in the development of sustainable research capacity is the absence of control over own research funding and post-doctoral opportunities, which could provide both mobility and research leave from lecturing. Unilateral control over resources for research in international collaborations may result in dissimilar conditions for those involved, and researchers from low-income countries often lose out in this regard. To counterbalance this and to provide an option to continue doing research after graduation, one might consider earmarking a certain proportion of the Swedish Research Council's 'Development research call for applications' so that it is open only to researchers from low-income countries who apply as project leaders (and project owners) in research projects with Swedish partners. This could be a way of shifting the balance of power and creating incentives to develop locally owned research programmes in low-income countries.

Address the situation of low international mobility. A high degree of international mobility among students and researchers is an important factor for successful internationalisation, since high inflows and outflows of researchers and students are assumed to increase the quality of an institution's activities. To prevent the universities in the scope of the study from becoming isolated from the international sphere of research, there is a need to acknowledge the problem of low mobility among the PhD graduates. The establishment of different post-doctoral and sabbatical programmes could be a way to increase mobility.

The scientific output of the PhD graduates needs to be further examined. Because of methodological difficulties and restrictions in the scope of this study, it has not been possible to conduct a bibliometric and citation analysis to get a deeper and more nuanced picture of the PhD graduates' publication output. Despite difficulties accurately measuring the graduates' total publication output, a bibliometric and citation study could complement the findings in this study and provide a picture of the PhD graduates' international outreach in relation to internationally recognised measurement principles.

Finally, it is of great importance to relate the results and recommendations from this study to the context from which they originate. One could argue that the findings on modes and conditions for mobility, collaboration and scientific output among PhD graduates in the three countries accord to a large extent with those of Swedish PhD graduates. Indeed Swedish PhD graduates may also experience shrinking space for research, a low degree of mobility and international collaboration and difficulties in reaching out with scientific work in international publications, but there is one major difference in relation to the conditions for Mozambican, Tanzanian and Ethiopian researchers – that of belonging to a well-established and strong institutional structure capable of producing science of such quality that it places the country (Sweden and Swedish researchers) in the upper segment of STI countries in the world. Due mainly to weak capacity in terms of qualified researchers, Mozambique, Tanzania and Ethiopia all belong to the lower segment in this hierarchy. The proportionally small number of researchers in relation to the need and demand for science-based solutions to societal challenges in these countries means that they become a much more sensitive and strategic resource compared to countries with greater proportions of researchers. Accordingly, shrinking space for research and a low degree of international mobility and collaboration will have a greater impact on weak research environments consisting of fewer individuals. In addition and partly supported by this study, Swedish researchers also hold a position in the global community of science that is very different from that of researchers from Mozambique, Tanzania and Ethiopia. This is why issues of mobility, collaboration and scientific output are more delicate in the context of the research capacity building in these countries.

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Appendix: Web-based questionnaire

Survey on mobility and career development of Ph.D. graduates in the Swedish research cooperation with Tanzania

Information about the survey

This study is conduced by the Nordic Africa Institute, Uppsala, Sweden

This questionnaire is part of a project conducted by the Nordic Africa Institute in Uppsala, Sweden on mobility and career development of donor supported Ph.D. graduates in African countries. The overall objective of the project is to longitudinally and comparatively map and analyse modes and rationales behind mobility and career paths/choices among Ph.D. graduates in different academic disciplines funded within the frames of different donor's support to institutional research capacity building in Africa. The project will primarily investigate the extent and direction of geographic and sectorial mobility over time and perceptions and individual rationales behind mobility and career choices. An important part of the project is also to investigate experiences made from participating in Ph.D. training programs.

The main objectives of the questionnaire are:

- to collect internationally comparable data on the careers of holders of advanced research qualifications.

- to establish and analyse trends in the career paths and mobility of highly qualified people in Africa.

This survey is specifically designed for the Ph.D. graduates that have been trained within the Swedish research cooperation (Sida) with Tanzania. The survey covers all Ph.D. graduates that have graduated between 1990 and 2013.

In this survey we will ask you questions about your participation in the Sida funded Ph.D. training program and your mobility and career development since graduation.

Any information publicly released (such as statistical summaries) will be in a form that does not personally identify you.

Your response is voluntary and failure to provide some or all of the requested information will not in any way adversely affect you.

Actual time to complete the questionnaire may vary depending on your circumstances. On average, it will take about 10- 20 minutes to complete the questionnaire.

Your assistance is essential to ensure that the results are meaningful. Your answers will be kept strictly confidential and used for statistical purposes only.

The findings of the study will help the stakeholders involved in the research cooperation (Government of Tanzania, Swedish development actors and universities) to set up appropriate policies with regard to highly qualified people in order to ensure their career developments and to improve development support to research training.

For further information about the project please visit the web site www.nai.se or contact the project leader Måns Fellesson - mans.fellesson@nai.uu.se

Thank you very much for your time and collaboration

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Module I : Socio-demographics

1. Gender

- ◯ Female
- ◯ Male

2. Year of birth

3. Country of birth

4. Country of residence

5. Marital status

- ☐ Married
- ☐ Single
- ☐ Divorced
- ☐ Widowed
- ☐ Partner
- ☐ Other

6. Do you have children?

- ◯ Yes
- ◯ No

7. If yes, how many?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 and more

Module II : Educational attainment

8. Year of starting Ph.D. training

9. Year of graduation Ph.D. degree

10. Country of graduation Ph.D. degree

- ☐ Sweden
- ☐ Tanzania
- ☐ Other, please specify

11. Discipline of science Ph.D. degree

- ☐ Social science

- [ ] Science
- [ ] Medicine
- [ ] Humanities
- [ ] Technology
- [ ] Agricultural science

12. Was your Ph.D. training organized in accordance with the "Sandwich" model?

- ◯ Yes
- ◯ No, please specify how it was organized

13. Which university did you belong to when starting your Ph.D. training?

- [ ] Dar es Salaam University
- [ ] Muhimbili University
- [ ] Other university, please specify

14. What type of dissertation did you write?

- [ ] Dissertation by monograph
- [ ] Dissertation by articles

15. What was your position at the time of starting the Ph.D. training

- [ ] Post-graduate student
- [ ] Staff member
- [ ] Other. Please specify

16. If graduating in Sweden, how many months in total did you spend in Sweden during your period of Ph.D. training?

- ☐ 0 - 6 months
- ☐ 7 - 13 months
- ☐ 14 - 19 months
- ☐ 20 - 26 months
- ☐ More than 26 months

17. What was the average number of months each stay?

- ☐ 2 - 3 months
- ☐ 4 - 5 months
- ☐ 6 - 7 months
- ☐ 8 - 9 months
- ☐ 10 - 11 months
- ☐ 12 -

18. How did you experience the period of training in relation to the following aspects?

	Mostly very good	Mostly good	Mostly difficult	Mostly very difficult
Period of research training while at the host university in Sweden	○	○	○	○
Period of research training while at the home university in Tanzania	○	○	○	○
Supervision in Sweden	○	○	○	○
Co-supervision in Tanzania	○	○	○	○
Resources (equipment and time) for research at the host university in Sweden	○	○	○	○
Resources (equipment and time) for research at the home university in Tanzania	○	○	○	○
Access to information on administrative rules and regulations of the	○	○	○	○

department at the home university in Tanzania				
Access to information on administrative rules and regulations of the department at the university in Sweden	○	○	○	○
Collegial support and research networks at your department of training in Tanzania	○	○	○	○
Collegial support and research networks at your department of training in Sweden	○	○	○	○

19. Did you experience any problems entering the EU/Sweden during training?

- ☐ Yes, many times
- ☐ Yes, a few times
- ☐ No

20. To what extent have you during the time of Ph.D. training while in the Swedish academia experienced discrimination ranging from unwanted attention to direct harassment on the basis of the following?

	To a very large extent	To a large extent	To a small extent	Not at all
Gender	○	○	○	○
Age	○	○	○	○
Ethnic background	○	○	○	○
Socio-economic background (class)	○	○	○	○
Color of skin	○	○	○	○
Sexual orientation	○	○	○	○
Disability	○	○	○	○
Position at the workplace	○	○	○	○
Family situation (caring responsibility children, parents, etc)	○	○	○	○

21. If you have experienced discrimination in the Swedish academia, was this expressed in any of the following ways?

	Yes	No
Physical harassment	○	○
Sexual harassment	○	○
Verbal harassment	○	○
Being ignored	○	○
Other, please specify	○	○

22. To what extent have you during the time of Ph.D. training while at your home university in Tanzania experienced discrimination ranging from unwanted attention to direct harassment on the basis of the following?

	To a very large extent	To a large extent	To a small extent	Not at all
Gender	○	○	○	○
Age	○	○	○	○
Ethnic background	○	○	○	○
Socio-economic background (class)	○	○	○	○
Color of skin	○	○	○	○
Sexual orientation	○	○	○	○
Disability	○	○	○	○
Position at the workplace	○	○	○	○
Family situation (caring responsibility children, parents, etc)	○	○	○	○

23. If you have experienced discrimination in the Tanzanian academia, was this expressed in any of the following ways?

	Yes	No
Physical harassment	○	○
Sexual harassment	○	○
Verbal harassment	○	○
Being ignored	○	○

Other, please specify	○	○

Module IV : Employments/positions since graduation - sectorial mobility

24. Where is your current principal employment/position?

- ☐ Dar es Salaam University or Muhimbili University
- ☐ Other university in Tanzania. Please specify below which university
- ☐ Other university outside Tanzania. Please specify below which country and university
- ☐ Other government/public agency/organization/actor in Tanzania. Please specify below which agency/organization/actor
- ☐ Private sector company/organization/actor in Tanzania. Please specify below which agency/organization/actor
- ☐ International donor/aid organizations/ NGOs in Tanzania. Please specify below which organization/NGO
- ☐ Other government/public agency/organization/actor outside Tanzania. Please specify below which country and agency/organization/actor
- ☐ Private sector company/organization/actor outside Tanzania. Please specify below which country and agency/organization/actor
- ☐ International donor organizations/ NGOs outside Tanzania. Please specify which country and organization/NGO
- ☐ Self-employed. Own business/consultant
- ☐ Unemployed
- ☐ Other. Please specify

Specify:

25. Do you currently have more than one income generating employment/job/activity?

- ○ Yes
- ○ No

26. What is your current position?

- ☐ Executive (minister, director general, etc)
- ☐ Professor
- ☐ Associate professor
- ☐ Head of department
- ☐ Lecturer
- ☐ Professional staff (medical doctor, agronomist, forester, etc)
- ☐ High official/official government organization, international organization, NGO
- ☐ Senior management, middle management (private sector)
- ☐ Consultant
- ☐ Other, please specify

27. Are you working on research with researchers in a country other than the one you are living in any of the following ways?

	Yes	No
Working on a joint publication with people in another country	○	○
Collaborating at a distance on a joint research project with researchers in another country	○	○
Fund raising collaboration, joint applications	○	○

28. If you have collaboration with researchers in other countries, which region does it mainly concern?

- ☐ Africa
- ☐ Europe
- ☐ North America
- ☐ Latin America
- ☐ Asia

Module VI : Working conditions

29. To what extent do you think that your Ph.D. degree has contributed to your current position?

Very much	Much	Little	Very little
○	○	○	○

30. To what extent do you think your current work tasks correspond to your academic qualifications?

To a very large extent	To a large extent	To a small extent	Not at all
○	○	○	○

31. Please rate your satisfaction with your current position

	Very satisfied	Satisfied	Dissatisfied	Very dissatisfied
Salary	○	○	○	○
Working conditions	○	○	○	○
Job security	○	○	○	○
Opportunities for career advancement	○	○	○	○
Intellectual challenge	○	○	○	○
Level of responsibility	○	○	○	○
Degree of independence	○	○	○	○
Contribution to society	○	○	○	○
Social status	○	○	○	○
Overall level of satisfaction	○	○	○	○

32. To what extent have you from time of graduation up to your current position experienced discrimination ranging from unwanted attention to direct harassment on the basis of the following?

To a very large extent	To a large extent	To a small extent	To a very small extent	Not at all

Gender	○	○	○	○	○
Age	○	○	○	○	○
Ethnic background	○	○	○	○	○
Socio-economic background (class)	○	○	○	○	○
Color of skin	○	○	○	○	○
Sexual orientation	○	○	○	○	○
Disability	○	○	○	○	○
Position at the workplace	○	○	○	○	○
Family situation (caring responsibility children, parents, etc)	○	○	○	○	○

33. Besides your current position, how many employment/positions have you held since graduation?

- ☐ 1 - 2 positions
- ☐ 3 - 4 positions
- ☐ 5 - 6 positions
- ☐ 7 - 8 positions
- ☐ 9 - 10 positions
- ☐ More than 10 positions

34. How many employments/positions at an university as researcher/teacher/administrator

- ☐ 1 - 2 positions
- ☐ 3 - 4 positions
- ☐ 5 - 6 positions
- ☐ 7 - 8 positions
- ☐ 9 -10 positions
- ☐ More than 10 positions

35. If you have had employments/positions outside the university, what type? The selection of multiple options is possible

- ☐ Other government/public agency/organization/actor in Tanzania. Please specify below which agency/organization/actor
- ☐ Private sector company/organization/actor in Tanzania. Please specify below which agency/organization/actor

- [ ] International donor/aid organizations/ NGOs in Tanzania. Please specify below which organization/NGO
- [ ] Other government/public agency/organization/actor outside Tanzania. Please specify below which country and agency/organization/actor
- [ ] Private sector company/organization/actor outside Tanzania. Please specify below which country and agency/organization/actor
- [ ] International donor organizations/ NGOs outside Tanzania. Please specify which country and organization/NGO
- [ ] Self-employed. Own business/consultant
- [ ] Other. Please specify

Specify:

Module V : Employments/positions since graduation - geographic mobility

36. Have you ever worked abroad since graduation?

- ◯ Yes
- ◯ No

37. if yes, please provide the name(s) of the country (countries) and duration of stay for each country

38. What kind of work/positions did you have during your stay(s) abroad? Several options possible

- [ ] Researcher
- [ ] Lecturer
- [ ] Official (government, international organization, NGO)
- [ ] Employee in the private sector
- [ ] Consultant
- [ ] Other, please specify

39. How important have the following aspects been for your decisions to work abroad?

	Very important	Important	Minor importance	Not important at all
Working conditions/facilities for research	○	○	○	○
Salary	○	○	○	○
Career development	○	○	○	○
Language/culture	○	○	○	○
Recognition of educational degrees	○	○	○	○
The existence of leading experts in your field	○	○	○	○
Existence of alternative employments	○	○	○	○
Development opportunities for family members (schools, employment, etc)	○	○	○	○

Other important aspects:

40. If you have a position at an university, to what extent do you conduct research?

Full-time	75 % of full-time	50 % of full-time	25 % of full-time	Less than 25 % of full-time	No at all
○	○	○	○	○	○

41. If you conduct research, how is it financed?

- ☐ The government
- ☐ International donor
- ☐ International research funding (foundations)
- ☐ Private funding (business, industry)

☐ Other, please specify

42. If you conduct research to what extent have you, since graduation, published your research results in the following types of publications?

	To a large extent	To some extent	To a small extent	Not at all
Peer-reviewed international journals	○	○	○	○
Peer-reviewed national journals	○	○	○	○
University reports	○	○	○	○
Other reports (government/international organizations, NGOs, private sector)	○	○	○	○
Books	○	○	○	○
Teaching material	○	○	○	○
Papers for seminars/conferences/workshops	○	○	○	○

43. To what extent are you involved in following types of research network?

	To large extent	To some extent	To a small extent	Not at all
International (global) research networks involving researchers from many countries	○	○	○	○
Pan-African or regional research networks involving researchers from African countries	○	○	○	○
National research networks involving researchers from Tanzanian research institutions	○	○	○	○

44. If you have a position at an university, to what extent are you involved in coursework lecturing?

	Full-time	75 % of full-time	50 % of full-time	25 % of full-time	Less than 25 % of full-time	No at all
	○	○	○	○	○	○

45. Do what extent do think your research results have contributed to the following ?

	To large extent	To some extent	To a small extent	Not at all
Policy development (government)	○	○	○	○
Poverty reduction in Tanzania	○	○	○	○
Advancement of the international research frontline	○	○	○	○
Advancement of the national research frontline	○	○	○	○

46. How many publications of the following types have you had since graduation?

	No publications	1 - 3	4 - 6	7 - 9	10 - 12	13 or more
Peer-reviewed international journals	○	○	○	○	○	○
Peer-reviewed national journals	○	○	○	○	○	○
University reports (non peer-reviewed)	○	○	○	○	○	○
Books	○	○	○	○	○	○
Papers for seminars/conferences/workshops	○	○	○	○	○	○

Module VII : Future plans

47. If picture yourself three years from now, to what extent do thing you are doing the following?

	Most likely	Possibly	Not likely	Don't know
Work at the Dar es Salaam/ Muhimbili	○	○	○	○

University as a researcher				
Work at the Dar es Salaam/ Muhimbili University as a lecturer	○	○	○	○
Work at another university/university collage in Tanzania	○	○	○	○
Work at an university/research institution in another country in the region	○	○	○	○
Work at an university/research institution in another country outside Africa	○	○	○	○
Work for a government agency in Tanzania	○	○	○	○
Work for an international organization/NGO in Tanzania	○	○	○	○
Work for an international organization/NGO abroad	○	○	○	○
Work for a private business company in Tanzania	○	○	○	○
Work for a private business company abroad	○	○	○	○
Having my own business (consult)	○	○	○	○

48. Would you be interested in positions at universities or other employments abroad?

○ Yes
○ No

49. If yes, how do you rate the importance of the following potential obstacles for mobility?

	Very important factor	Important factor	Not so important factor	Not important at all
Lack of employment opportunities	○	○	○	○

Language limitations	○	○	○	○
Family situation	○	○	○	○
Risk of discrimination (gender, age, ethnic and social background, skin color, disability, sexual orientation)	○	○	○	○

Many thanks for your participation

Please do not forget to send back the questionnaire

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