# Exploring the barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions

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## Abstract

The slow progression and under-representation of women in senior scientific career positions is a well-known and persistent global problem. Current statistics indicate that women account for only 28 percent of all researchers worldwide, although Sub-Saharan Africa (SSA) has been identified amongst the region with the lowest numbers of women in science careers. To inform action for change, there is a need to go beyond numerical evidence of inequalities to understanding the underlying social, cultural and institutional drivers and processes that produce gender inequities in science careers. Nonetheless, in SSA, there is a dearth of empirical studies about how gender intersects with other individual multiple social identities to produce inequities in career progression outcomes for both women and men research scientists, as most available studies have focused only on women as a homogenous group. In this thesis, I explore the barriers and enablers to gender equitable scientific career pathways in the 'Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) funded African research institutions. The overarching aim is to produce empirical evidence from a holistic, gender comparative and intersectional perspective that can be used to develop appropriate strategies to promote career equity for internationally competitive African scientific researchers. To do this, I adopted an exploratory qualitative cross-sectional study design. I conducted in-depth interviews and key informant interviews in three purposively selected DELTAS Africa Research Consortia between May and December 2018 in English. I analysed the data inductively based on emergent themes, whilst aligning them to the developed integrated conceptual framework.

The study finds that career progression of women and men researchers is shaped by intersections between gender roles and social power relations of gender within the family, wider society, and workplace institutions themselves, mediated by macro-level forces of patriarchy, capitalism, and neo-colonialism. This leads to a highly complex and competitive environment characterised by limited access to the necessary research resources; dissatisfaction with operational policies and power structures, and institutional practices and culture; and differential gendered barriers to participation in scientific research activities. In this process, gender intersects with other aspects of identity, leading to differing work experiences and inequities in career progression. Current support mechanisms and coping strategies utilised by women and men researchers, existing enabling mechanisms at institutional level

for enhancing gender equitable career progression, and participants' own recommendations for positive change in policy and practice have been highlighted.

These findings offer important policy and practice implications for future research capacity strengthening programming, including DELTAS Africa II initiative (2021-2025) and related initiatives. They provide insights on understanding the challenges experienced, and potential strategies and actions for fostering equitable scientific research career progression for women and men in the context of sub-Saharan African research institutions.

## Declaration

I, Millicent L. Liani, declare that this PhD thesis is a presentation of my own original research work under the supervision of Dr. Rachel Tolhurst and Prof. Isaac K. Nyamongo. Materials contained herein has not been previously published, accepted, or presented for the award of any University degree. Where information has been derived from other sources, or where co-authors have inputted to published papers, this has been indicated in the thesis.

Millicent L. Liani

## Dedication

This thesis is dedicated to my research participants with gratitude and love. Insights pertaining to your lived experiences in relation to this research study have provided me with first-hand tips on how to navigate my own research career path in future.

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**God bless you all!**

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## List of Abbreviations and Acronyms

| | |
|---|---|
| 3PM | Third Party Monitor |
| AAS | African Academy of Sciences |
| AAU | Association of African Universities |
| AESA | Alliance for Accelerating Excellence in Science in Africa |
| AGM | Annual Grantees Meeting |
| AMARI | African Mental Health Research Initiative |
| APHRC | African Population and Health Research Centre |
| ARC | Africa Research Consortia |
| ARI | African Research Institution |
| Afrique One-ASPIRE | African Science Partnership for Intervention Research Excellence |
| AWARD | African Women in Agricultural Research and Development |
| CARTA+ | Consortium for Advanced Research Training in Africa+ |
| CCR | Centre for Capacity Research |
| CGIAR | Consultative Group for International Agricultural Research |
| DELGEME | Developing Excellence in Leadership and Genetic Training for Malaria Elimination in Sub-Saharan Africa |
| DELTAS Africa | Developing Excellence in Leadership, Training and Science in Africa |
| DELTAS ARC | DELTAS Africa Research Consortia |
| DFID | UK Department for International Development |
| FAWE | Forum for African Women Educationalists |
| HE | Higher Education |
| HEI | Higher Education Institution |
| HoD | Head of Department |
| HRCS | Health Research Capacity Strengthening |
| IDeAL | Initiative to Develop African Research Leaders |
| IDI | In-depth Interview |
| KII | Key Informant Interview |
| KWTRP | KEMRI Wellcome Trust Research Programme |
| LGBTQ+ | Lesbians, Gay, Bisexual, Transgender or Queer |
| LMICs | Low and Middle-Income Countries |
| LRP | Learning Research Programme |
| LSTM | Liverpool School of Tropical Medicine |
| MARCAD | Malaria Research Capacity Development in West and Central Africa |
| MCR | Mid-Career Research scientist |
| MSc | Master of Science |
| NEPAD | New Partnership for Africa's Development |
| PDF | Post-Doctoral Research Fellow |
| PhD | Doctor of Philosophy |
| PI | Principal Investigator |
| SANTHE | Sub-Saharan African Network for TB/HIV Research Excellence |
| SMAC | Studentship Monitoring and Advisory Committee |
| SOP | Standard Operating Procedure |
| SRA | Social Relations Approach |
| SSA | Sub-Saharan Africa |

| | |
|---|---|
| STEM | Science, Technology, Engineering and Mathematics |
| THRiVE-2 | Training Health Researchers into Vocational Excellence in East Africa -2 |
| UK | United Kingdom |
| UNESCO | United Nations Educational Scientific and Cultural Organization |
| WACCBIP | West African Centre for Cell Biology of Infectious Pathogens |

# Chapter 1: Introduction

## 1.1: Chapter Overview

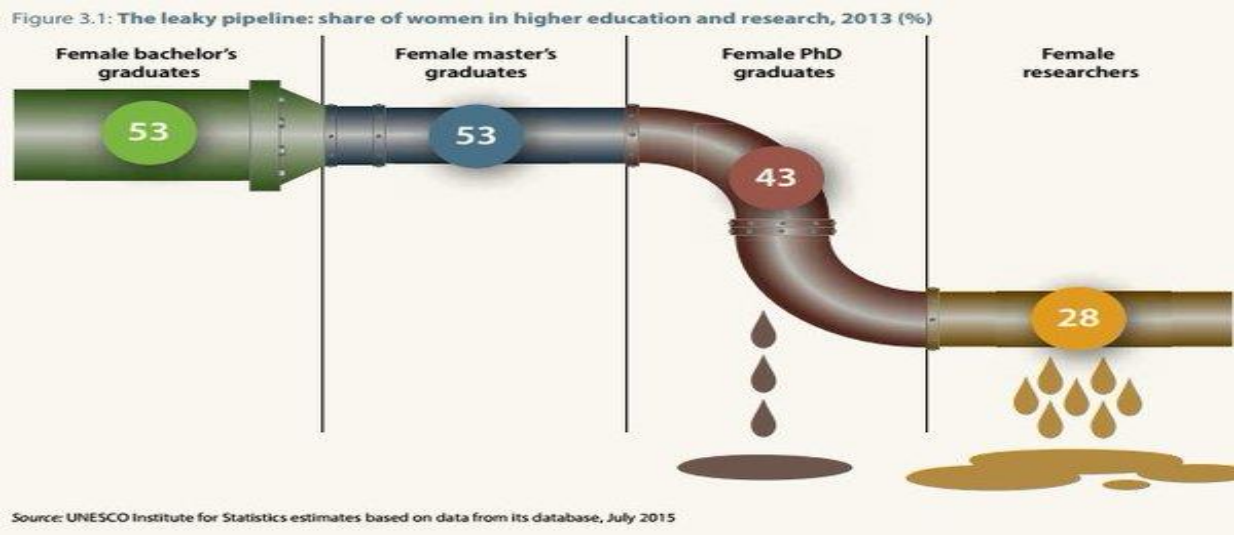
In this chapter, I provide the background information which aims to contextualise the thesis in wider discourses around gender equitable career pathways in science research. I then present the problem statement and study justification; research aims, objectives, and research questions; scope and limitations of the study; definitions of key terms used throughout the thesis. I end by providing the structure of the overall thesis. My research was set within the context of the 'Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) – a health-based scientific research capacity strengthening initiative. This was a five-year (2015-2020) initiative whose vision was to train and develop the next generation of internationally competitive African scientific health researchers and research leaders while fostering career pathways (Kay, 2015). The Learning Research Programme (LRP) led by the Centre for Capacity Research at the Liverpool School of Tropical Medicine, worked alongside the DELTAS Africa consortia to embed a 'Learning approach' for the period 2016-2020. The goal of the DELTAS LRP programme was to generate evidence about the effectiveness of various aspects of its capacity building approach and feed them back to DELTAS Africa to inform improvements within the life of the programme. Accordingly, one of the DELTAS LRP thematic area was promotion of equitable career pathways for internationally competitive African researchers including women and other under-represented groups, within which this PhD research study was nested in.

## 1.2 Background to the study

It is well known that women are under-represented in scientific careers globally (The Royal Society, 2011), whether it is in the social sciences or in the natural sciences (Thege et al., 2014). Although this problem is particularly acute within science and technology higher education careers (Donovan et al., 2005), it is also a general problem that is occurring in other professions such as business, medicine, law and academia (Valian, 2005). Accordingly, studies of scientific occupations, particularly in universities, have shown that compared to men, women tend to drop out of the career pipeline and this seems to be a global trend (Beoku-Betts, 2005). This becomes visible in the famous scissor-shaped curve, where one can observe a progressive "evaporation" or disappearance of women as they advance in the career; an occurrence, which is called the "leaky pipeline" phenomenon (Dubois-Shaik and Fusulier, 2015:4). It is clear that female scientists are increasingly under-represented at each stage of the scientific career ladder (i.e. the 'leaky pipeline') (Thege et al., 2014). In science, 2013 data shows that globally, women

are slightly over-represented at Bachelors and Master's degree level (accounting for 53 percent of total enrolments), their share drops to 43 percent at doctoral (PhD) level and falls further post-doctorally, to 28 percent of scientific research staff (UNESCO, 2015) as presented in Figure 1.2 below. This clearly indicates that the career pipeline become narrower for women as they progress up the academic scientific ladder.

*Figure 1.2: Global representation of women in higher education and science in the year 2013*




Evidence has shown that in most academic institutions worldwide, women comprise less than a third of university faculty and are underrepresented in top ranking positions as administrators or full professors (Beoku-Betts, 2005). Studies show that academic research careers are competitive, as the career path has a long apprenticeship (The Royal Society, 2011; House of Commons, 2014). The Royal Society (2011) highlights that typically, there is an undergraduate degree, a Masters' degree followed by a PhD, then some post-doctoral research contracts and research fellowships, and then finally a more stable lectureship or permanent research leadership position, with promotion on up the ladder to follow. A major crunch point for women comes at the appointment to lectureships, which are scarce, but subsequent promotion also seems to be problematic, leading to the metaphor of the leaky pipeline with the under-representation of women increasing at every career stage (The Royal Society, 2011). It's been argued that in reality, an academic career can take various shapes and be influenced by institutional factors such as a focus on research for the institutional or teaching (Vallentin, n.d.). More importantly,

the social background of academics including gender, ethnicity, disability and class can have a significant impact on an academic career (Vallentin, n.d.).

It is clear that women are significantly under-represented among African academic staff and decision-making bodies (Johnson, 2014). Still in Africa, it is evident that the number of women who pursue science programmes in higher education institutions are fewer than men, and the mechanisms of retaining the few women who embark on training in science disciplines need to be discussed and strategies and actions developed (UNESCO, 2012). All over the African continent, therefore, there are still very few women scientists and more so in leadership positions to articulate the inclusion of women in the management of science and technology institutions (UNESCO, 2012).

Existing evidence shows that in most African countries, women comprise less than ten percent of professioral level faculty (Rathgeber, 2003) and that African women face numerous challenges in science, which are likely to derail their careers at a much higher rate than their male counterparts (UNESCO, 2012). One explanation for this is that scientific research career tracks favour traditional male career patterns creating challenges in balancing career progression with child-rearing, career breaks and caring roles (Xie and Shauman, 2003). In addition, compared to men, women have less professional social capital, less international mobility and face more gender-based harassment (Miller et al., 2006).

Even though the obstacles women face have been researched over the last decade, there is need for in-depth studies on processes that cause gender imbalances and more research to understand the leaky pipeline – that is why women leave universities or are not able to progress to senior positions (Thege et al., 2014). Evidence from Africa highlights that there is little comparative research that addresses the concerns of gender based systems of inequality which foster the exclusion of women from and within particular professional fields in the sciences (Beoku-Betts, 2005). A key factor is that although gender is a central construct in feminist analyses on women in science, other intersecting and historically situated hierarchies of women's oppression such as race, culture, ethnicity, class, sexuality, and globalisation are ignored, marginalised, or positioned as parallel to gender rather than as intersecting constructs (Beoku-Betts, 2005). This failure to address diversity in feminist studies of science tends to silence ''those women [and men] scientists who might raise different questions about science" (Beoku-Betts, 2005:397).

There is little knowledge from Africa, about how gender intersects with multiple intersectional axes of disadvantage, such as disability, ethnicity, religious, linguistic or regional minorities, to produce inequities in career progression for both female and male men research scientists. Similarly, Jacobs (1996) argued that the focus on gender differentials alone means that relatively little attention is devoted to variation among women and men by class, race, and ethnicity. Therefore, an important aspect that is necessary to include in any research on the leaky pipeline is to adopt an intersectional approach (Hancock, 2007). Such an approach takes into account the interaction of categories of difference such as gender, age, nationality, socio-economic background, disciplinary sectors, and so on in order to identify multiple factors that work upon women and men in their scientific/academic work and careers (Dubois-Shaik and Fusulier, 2015). The intersectional approach recognises that there is a dynamic interaction between individual and institutional factors at play (Archer et al., 2015). Thus, an important aspect that needs to be elucidated is how attrition of female and male researchers from scientific career paths is shaped by other intersectional identities.

The concept of intersectionality therefore offers an approach to understanding deeply the barriers that female and male scientists face and how they are shaped by other intersecting identities in order to provide indepth insights necessary to inform the strategies needed to resolve the issues of attrition of such women and men in science. It utilises a feminist approach and goes beyond a binary construct of gender by understanding how other intersectional variables such as ethnicity, race, age, number of children, marital status, disability among others interact and shape the scientific career outcomes of female and male scientists.

It is against this backdrop that I sought to explore the barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions. The ultimate goal of this study was to produce empirical evidence from a holistic, gender comparative and intersectional perspective that can be used to develop appropriate strategies to promote career equity for internationally competitive African scientific researchers.

## 1.2 Problem statement and justification

It has been acknowledged that the number of PhD students and graduates are central indicators of a country's potential research capability (Dubois-Shaik and Fusulier, 2015). However, in the United Kingdom (UK) for instance, the transition from PhD student to postdoctoral researcher has been identified as a critical period during which a significant amount of women disappear from scientific careers (Vallentin, n.d.). Dubois-Shaik and Fusulier (2015) also confirmed that in most European countries, the bottleneck for the leaky pipeline of women falling out of scientific and academic careers is located at either the doctoral or postdoctoral level, with the difficult jump to obtaining permanent positions. They recommend the need for increased focus upon the doctoral and postdoctoral stage of the research/academic careers on behalf of research institutions and research itself (Dubois-Shaik and Fusulier, 2015). Arguably, if women were to be attracted to and retained in scientific careers, more concern should be directed to the situation of women graduates in the labour market where they are experiencing cultural discomfort, segregation and unequal power relations (Donovan et al., 2005). Elsewhere in the United States, it has been highlighted that the transition from postdoctoral fellow to faculty is a period during which a worrying number of women leave academic research (Martinez et al., 2007). Hence therefore, in my study, I chose to focus on understanding the experiences of women and men research scientists as masters and doctoral students; and staff in the cadre of postdoctoral research fellows and mid-level scientists.

A scarcity of women in senior and top positions in the fields of science means that their individual and collective opinions are less likely to be voiced in policy and decision-making processes and thus constitutes a significant gender gap (Vilnius, 2007; Thege et al., 2014). Accordingly, the loss of women's human capital means a significant loss of talents and potential in terms of new ideas and more holistic knowledge production (Thege et al., 2014:11). However, whilst that the topic of why women have more difficulty pursuing research careers than men has been extensively investigated in industrialised countries, existing literature provides little comparative evidence from less-developed areas (Campion and Shrum, 2004). Thus strategies proposed to date are grounded in the socio-cultural context of countries of the global north, which are limited in capturing the nuances of gender, culture, and higher education in developing countries, and African countries in particular (Mabokela and Mlambo, 2015). Similarly, in questioning the under-representation of women in senior posts in academy in selected commonwealth countries in Africa, Morley (2005) also underlined that the global north has produced a sizable amount of published quantitative and qualitative data and critical literature, whereas lower-

income countries have had to rely on some gender-disaggregated statistics and quantitative studies - often funded by international organizations, and unfunded research conducted by individual scholars remaining in the 'grey' literature domain. Morley (2005), further observed that the transcripts of women experiencing higher education, both as students and staff in the sub-Saharan Africa (SSA) remain relatively hidden. Moreover, in their study conducted in Ghana, Kenya and south India, Miller and colleagues (2006) pointed out that most empirical studies of gender and science focus on the developed world, yet theoretical accounts emphasize more extreme gender differences in developing areas. I therefore aimed to contribute to filling a gap in knowledge through providing qualitative evidence around the attrition of women and men, and how they are shaped by multiple social identities, in science in Africa.

Other authors have commented on a dearth of research or socio-cultural theorisation of how different structures of inequality intersect in the developing world (Morley et al., 2009). Notably, studies with examples of the practical application of an intersectional perspective in low and middle income countries are limited (Dean et al., 2017). Hence, I chose to adopt an intersectional approach towards understanding the career pathways for women and men scientists and how their experiences are shaped by their multiple social identities in SSA.

## 1.3 Thesis Aims and Objectives

The overarching aim of this thesis was to explore the barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions. This was intended to produce empirical evidence from a holistic, gender comparative and intersectional perspective that can be used to develop appropriate strategies to promote career equity for internationally competitive African scientific researchers. The specific objectives were as follows:

1) To understand how familial and socio-cultural factors shape inequities in scientific career progression for women and men, and their disadvantages in relation to their multiple social identities, along the scientific career pathway.
2) To find out how institutional environments, including values, policies, and their implementation shape inequities in scientific career progression for women and men, and their disadvantages in relation to their multiple social identities.

3) To identify the strategies that are being used within the selected DELTAS institutions to promote gender equitable career progression for women and men, and their disadvantages in relation to their multiple social identities, and document the learnings from them.
4) To establish the desired actions for change for enhancing equitable career progression for women and men, and their disadvantages in relation to their multiple social identities, to progress along the career ladder in future.

## 1.4 Research Questions

This thesis set out to answer the following four research questions:

1) How does familial and socio-cultural factors shape inequities in scientific career progression, and their disadvantages in relation to their multiple social identities, along the scientific career pathway in selected DELTAS institutions?
2) How does the institutional environments, including 'informal rules' in intersectional power hierarchies, values, policies, and their implementation shape inequities in scientific career progression for women and men, and their disadvantages in relation to their multiple social identities in selected DELTAS institutions?
3) What strategies have been used within selected DELTAS institutions to promote gender equitable career progression for women and men, and their disadvantages in relation to their multiple social identities, and what can we learn from them?
4) What are the participants' desired actions for change towards enhancing equitable career progression for women and men, and their disadvantages in relation to their multiple social identities, to progress along the career ladder in future?

## 1.5 Scope and limitations of the study

The African Research Institutions (ARIs) in this study involved those that were part of the DELTAS Africa health research capacity strengthening (HRCS) initiative. There are eleven (11) research consortia operating under the DELTAS Africa initiative and whose secretariat are based in the eight African countries namely: Kenya, Uganda, South Africa, Zimbabwe, Mali, Ghana, Senegal and Côte d'Ivoire. In undertaking this study, and due to limited financial resources, I decided to conduct the research in three purposively selected DELTAS ARCs. Therefore, the results are based on the views of a limited and purposively selected sample. I acknowledge that the eleven DELTAS ARCs are extremely diverse with a wide range of mechanisms and strategies for enhancing equitable career progression, leading to

possible limitations with the generalisability of the findings. However, findings from this study provides lessons learnt from the three consortia, selected for maximum variation regarding the diversities within the programme as a whole, which should allow for insight sharing on best practices, challenges and suggestions for improvement. In addition, while the study utilised a small non-probabilistic sample guided by its qualitative inductive approach, the findings could be theoretically generalisable to similar populations elsewhere, although this should be done with caution in unrelated contexts or settings.

## 1.6 Definition of key terms

**Career** – Refers to a person's course or progress through life as it pertains to an occupation or a profession that usually involves special training or formal education, as well as the sequence of employment-related positions, roles, activities, and experiences encountered. A career can also be considered as a person's lifework (Super, 1980).

**Career pathway** - Refers to the ability to pursue a career as well as the motivation to employ that ability (Wang and Degol, 2016).

**Career barriers** - These are events or conditions either within the person or in his or her environment that make career progression difficult (Swanson and Woitke, 1997:446).

**Career Progression** – This refers to the upward movement or advancement made by people in a particular job or profession.

**Gender** – refers to socially constructed roles and relationships, behaviours, activities and attributes that a given society considers appropriate for women and men (United Nations Statistics Division, 2011). Gender, just like culture, is leant, shared, adaptive/maladaptive and can change.

**Gender analysis** – This refers to a critical examination of how differences in gender roles, activities, needs, opportunities and rights/entitlements affect women, men, girls and boys in certain situations or contexts (United Nations Statistics Division, 2011).

**Gender norms** – This refers to accepted attributes and characteristics of being a woman or a man (ideas of how men and women should be and act) at a particular point in time for a specific society or community. They are internalised early in life and are used as standards and expectations to which women and men should conform and result in gender stereotypes (United Nations Statistics Division, 2011).

**Gender relations** – This refers to social relations between and among women and men that are based on gender norms and roles. Gender relations often create hierarchies between and among groups of

men and women that can lead to unequal power relations, disadvantaging one group over another (United Nations Statistics Division, 2011).

**Gender equity** – It means fairness of treatment for women and men, according to their respective needs. This may include equal treatment or treatment that is different but which is considered equivalent in terms of rights, benefits, obligations and opportunities (United Nations Statistics Division, 2011).

**Intersectionality –** This is a conceptual and analytical tool for studying, understanding, and responding to ways in which gender intersects with other identities and how these intersections contribute to unique experiences of oppression and privilege (Crenshaw, 2008). Specifically, intersectionality posits that individuals have multiple identities which serve as organising features in social relations. These identities are mutually constituted, reinforced through active engagement, and naturalised, thus seen as self-evident through the lens of a different category (Shields, 2008).

**Science –** This is often defined as a body of knowledge, and a set of systematic methods and procedures for collecting and organising information, and sharing of information with members of the science community (Leggon, 2006). Science is not only a system of knowledge and methods but a social institution responsible for creating reliable and verifiable true knowledge about the world. In the current proposed study, science refers to both social and biomedical sciences.

## 1.7 Thesis Structure

This is a publication-based thesis, structured into seven chapters. In this introductory chapter one, I have presented the background to the study, problem statement and justification, overarching aim, objectives and research questions, scope and limitations of the study, and definition of key terms. In **Chapter two,** I present a published literature review on emerging theories and empirical evidence on the dimensions of and reasons for the prevailing gender inequities in academic scientific research career progression in SSA. This review culminates in my development of an integrated conceptual framework for understanding intersecting gender inequities in academic scientific research career progression in higher education institutions (HEIs) in SSA. I refer to this framework in the subsequent chapters – four, five and six - to theoretically ground my analysis and interpretation of the gathered data on barriers and enablers to gender equitable scientific career progression. This chapter has been published as peer-reviewed literature in the International Journal of Gender, Science and Technology, Vol.12, No.2, Pg. 262

-288 (Liani et al., 2020) - Available at http://genderandset.open.ac.uk/index.php/genderandset/article/view/652

***In chapter three,*** I give a detailed outline of the methodology that I adopted for my study. I begin by laying out my epistemological standpoint, and how that influences the methods that I adopted for this study. This is followed by a detailed description of the study setting; research design; study population; sampling procedure; sample size and characteristics of study participants; data collection; and data processing and analysis. I present the quality assurance across thesis where I reflect on the research process by providing a description of my own positionality and reflexivity. I end the chapter with a section on ethical considerations. Notably, some repetition of methods is present within each result chapters.

**Chapters four, five and six are all results-based, presented in the form of papers**. In **chapter four**, I present my findings for the first research question: 'How does familial and socio-cultural factors shape inequities in scientific career progression, and their disadvantages in relation to their multiple social identities, along the scientific career pathway in selected DELTAS institutions?' This paper has been accepted for publication in the Global Health Research and Policy Journal subject to minor changes which I have addressed, and resubmitted. The preprint is available online at https://www.researchsquare.com/article/rs-105425/v1

***In chapter five*****,** I present findings for the second research question: 'How does the institutional environments, including 'informal rules' in intersectional power hierarchies, values, policies, and their implementation shape inequities in scientific career progression for women and men, and their disadvantages in relation to their multiple social identities in selected DELTAS institutions?' This paper has been submitted to the Health Research Policy and Systems Journal. The preprint is available online at https://www.researchsquare.com/article/rs-479855/v1

***In chapter six,*** the final results chapter, I present findings on the strategies that are being used within the selected DELTAS institutions to promote equitable career progression for women and men, and their disadvantages in relation to their multiple social identities; as well as the participants' desired actions for change for enhancing equitable career progression for women and men, with differing social

identities, to progress along the career ladder in future. This paper has been submitted to the AAS Open Research Journal.

Finally, in ***chapter seven***, I synthesise and discuss the findings from all the three separate results chapters, relate them to each other, and to consider my contribution to the current literature/new knowledge that could inform policy and practice. Limitations of the thesis are also discussed as well as the conclusions made.

# Chapter 2: Literature review

## 2.1 Chapter overview

In this chapter, I present the literature review, consisting of findings from a systematised narrative review that I conducted as part of this thesis from January 2017- September 2019. The findings are comprised of emerging theories and empirical evidence on the dimensions of and reasons for the prevailing gender inequities in academic scientific research career progression in SSA. Based on this, I proposed an integrated conceptual framework, identified available empirical findings to support it and developed a preliminary explanation of observed inequities, which I utilised in guiding this study. This chapter has been published as peer reviewed literature at the International Journal of Gender, Science and Technology, Vol.12, No.2, Pg. 262 -288, and I have included it in full in its published form without changes (Liani et al., 2020). There is therefore some overlap in chapters one, four and five, necessitated by the structure but I have tried to keep this to a minimum.

**Understanding intersecting gender inequities in academic scientific research career progression in sub-Saharan Africa**

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**IN:** Guidance and support with conceptualisation, Validation of conceptual framework, Writing – review and editing, PhD Supervision

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## 2.2 Abstract

The slow progression and under-representation of women in senior scientific career positions is a well-known and persistent global problem, especially among university-based academics, particularly in sub-Saharan Africa (SSA). To inform action for change, we need to go beyond numerical evidence of inequalities to understanding the underlying social, cultural and institutional drivers and processes producing gender inequities in science careers. This requires a theoretically rigorous gender analysis framework that is relevant to SSA and sufficiently accounts for variations among both women and men. Since no such framework is available, we conducted a literature review of emerging theories and empirical evidence on the dimensions of and reasons for the prevailing gender inequities in higher education institutions in SSA. Based on this, we propose an integrated conceptual framework, identify available empirical findings to support it and develop a preliminary explanation of observed inequities. Our findings demonstrate that women's (lack of) progression in academic/scientific research careers is shaped by intersections between gender roles and social power relations of gender within the family, wider society and academic institutions themselves. We argue that this integrated model provides implications for theory, practice at institutional and policy level, and future research.

## 2.3 Introduction

The slow progression and under-representation of women in senior positions in scientific careers is a well-known and persistent global problem, especially among university-based academics (Mavriplis et al., 2010; The Royal Society, 2011). The "leaky pipeline" metaphor has often been used to describe the slow advancement and increasing under-representation of women at each stage of the scientific career ladder (Miller and Wai, 2015; Thege et al., 2014). Specifically, in science, 2013 data show that while globally, women are slightly over-represented at Bachelors and Master's degree level (accounting for 53 percent of total enrolments), their share drops to 43 percent at PhD level and falls further post-doctorally, to 28 percent of scientific research staff (UNESCO, 2015). Accordingly, the combination of factors that slows down and reduces the proportion of women at each stage of a scientific career include: the graduate-level environment; the maternal wall/glass ceiling; performance evaluation criteria; lack of recognition; lack of support for leadership bids; and unconscious gender bias (UNESCO, 2015).

Sub-Saharan Africa (SSA) is particularly lacking in such gendered data, although the region has been identified as having the lowest numbers of women in science careers (Beintema, 2017). This is

hampered by incomplete statistics for Africa's tertiary institutions, which do not reflect the likely complexity, with potential for great variation between countries and higher education institutions (HEIs) (Mama, 2006). Nonetheless, women are still predominantly located in relatively marginal and junior positions (Mama, 2006). Although more detailed quantification of the nature and degree of gender inequalities in higher education, including science, are required, this will not in itself explain such differences or suggest remedial strategies (Mabokela and Mlambo, 2015; Morley, 2005). Studies on gender and institutional culture in the context of the African university and their convergence in the post-colonial historical period have, largely, been neither described nor theorised, nor mapped to evidence in an integrated way (Mama and Barnes, 2007). To inform action for change, there is a need to understand and document the underlying social, cultural and institutional drivers and processes that produce gender inequities in science careers in HEIs in Africa, which has not been done in a holistic manner to date (Beoku-Betts, 2005; FAWE, 2015; Mama, 2006; Mama and Barnes, 2007; Morley, 2005; Thege et al., 2014). Furthermore, African scholars, such as Mama (2006) have emphasized the need for studies on gender equity in African Universities anchored by a theoretically rigorous gender analysis framework/theory, and grounded in a thorough and respectful understanding of African realities. Unfortunately, no such framework is currently available as most studies that focus on the qualitative experiences of women once they gain entry into academic careers in SSA remain largely untheorized (Morley, 2005).

Commentators have also highlighted the binary notion of gender that tends to be the central construct and category of analysis in most of the literature on science careers in higher education in the developing world (Morley, 2005), with relatively little attention devoted to variation among women and men (Jacobs, 1996). Failure to address diversity in studies of gender and science by ignoring other intersecting and historically situated hierarchies of oppression such as race, culture, ethnicity, and class among others, tends to silence those women [and men] scientists who might raise different questions about science (Beoku-Betts, 2005). There is little knowledge from Africa, about how gender intersects with multiple intersectional axes of disadvantage, such as disability, ethnicity, religious, linguistic or regional minorities, to produce inequities in career progression for both female and male research scientists.

This paper aims to contribute towards efforts to develop a theoretically informed and holistic analysis of the issue by positing an integrated conceptual framework for explaining gender inequities in scientific career advancement for women and men, and their intersections with multiple social axes of disadvantage in SSA. To achieve this goal, this paper draws on recent empirical literature review on gender inequities in academic and scientific career progression in higher education institutions in the African context, as part of a wider ongoing programme on 'Developing Excellence in Leadership, Training and Science (DELTAS) Africa Learning Research Programme'.[1] The paper is organized as follows: Section 2.4 lays out the methods used for the literature search; Section 2.5 presents an analysis of existing frameworks, concepts and theories based on the global literature; Section 2.6 presents our proposed integrated conceptual framework and describes its components based on available empirical evidence from SSA literature. Section 2.7 highlights the implications and study limitations, while Section 2.8 draws conclusions for policy, practice and future research.

## 2.4 Method

We conducted a systematic search and narrative review of literature from Africa. Such an approach involves a comprehensive search process to produce 'best evidence synthesis' of what is known and recommendations for practice through narrative synthesis (Grant and Booth, 2009). Our strategy involved systematized searching for published peer reviewed articles through exploring multiple bibliographic electronic databases, including: Project MUSE, EBSCO Discovery Service, Scopus, Web of Science, Education Research Complete, ERIC and Science Direct. Google scholar was also used to identify additional studies, including those present within the grey literature. Search terms and their variations were tested for their appropriateness with expert advice and assistance from the LSTM librarian.

*Table 2.4: Search terms that were used in the identification of literature materials*

| Bodies of literature /theme | Search terms |
|---|---|
| Gender, Disability, Ethnicity and Language | gender inequalit* OR gender inequit* OR gender equalit* OR gender equit* OR gender OR women OR men OR under-represented OR Disability OR disabled OR impairment OR Minorities OR Ethnicity OR Language OR Discrimination OR intersectionality |
| Career pathways and Institutions | Career pathways OR scientific career pathways OR trajectories OR scientific career progression OR career advancement OR education OR institutions OR higher education OR research institutions OR educational institutions OR Tertiary education OR opportunities OR experiences OR enablers OR barriers |
| Geographical context (Africa) | Africa OR sub-Saharan Africa OR LMIC OR low resource OR low-income countr* OR developing countr* OR low to middle income |

The search encompassed English, French and Portuguese language studies published anytime up to 2019 by combining the search terms under the three themes. The search identified 6,954 papers, all in English. Abstracts of published papers were reviewed for relevance to the study topic; relevant papers were retrieved for review and narrative synthesis based on emergent themes. Additional articles and reports were obtained through targeted internet searching of key institutional websites such as United Nations Educational, Scientific and Cultural Organisation (UNESCO), Association of African Universities (AAU) and African Women in Agricultural Research and Development (AWARD). In total, 35 relevant papers, including 25 peer-reviewed articles, 5 reports, 3 theses and 2 book-chapters were included in the present review of empirical evidence from the existing African literature. These were published between 2003 and 2019 and mainly focused on women in academic careers (See Appendix A).

## 2.5 An analysis of existing empirical evidence, frameworks, concepts, and theories based on global literature

The last few decades have witnessed unprecedented interest in women's under-representation and attrition in science careers globally. The 'problem' has largely been framed in terms of women's numerical representation at different levels and the barriers to their career progression (Vilnius, 2007). Such barriers are often conceptualized as arising at individual, socio-cultural and institutional levels, which interlock to cause 'leaks'/attrition or 'getting stuck' at various segments in the science pipeline (Miller and Wai, 2015). Some studies also focus on identifying existing 'enablers' to progress. In SSA, there is a paucity of empirical studies with comparable data on gender and higher education (FAWE, 2015; Raburu, 2015). Of those scholars who have investigated the problem of persistent gender

inequities in scientific career progression within SSA, only about a third explicitly articulate their theoretical and conceptual approaches. The majority of these included theories that might loosely be considered intersectional. For example, theories used to explore the experiences of women as doctoral students, academics and administrators have included Critical Race Feminism theory (Snyder, 2014), Black feminist theory (Mabokela and Mlambo, 2015), intersectionality (Johnson, 2014), 'gendered organizational cultures' (Mabokela and Mawila, 2004), and 'Getting On' and 'patriarchal closure' (Beoku-Betts, 2005). Notably none of these studies included a comparative consideration of men's experiences. In addition, the social model of disability has been used to examine the experiences of female and male university students with physical disabilities in their struggles around entry and career progression in academia in Africa (Matonya, 2016; Moswela and Mukhopadhyay, 2011). These studies focused mainly on the influence of disability but did consider intersection with gender to some extent.

All these varied theoretical and conceptual lenses remain useful in illuminating some of the experiences and challenges facing women at different levels. However, used on their own, they fail to sufficiently account for numerous and complex individual, socio-cultural and institutional drivers and processes that produce intersecting gender inequities in career progression for women and men. There is a growing recognition that a holistic approach is required, which identifies the complex interaction between contributing factors and processes in order to create sustained change both individually and collectively (Wilson et al., 2017). Our review did not identify a single framework or model that went beyond a list of 'challenges' to a deeper, holistic analysis of the complex structural constraints and processes that produce intersecting inequities in scientific career progression of women and men in HEIs in SSA. To consolidate and integrate the existing empirical evidence from a conceptual point of view, we considered relevant explanatory theoretical models or frameworks from the available global literature in relation to science careers. There are multiple career development theories and models. These include, among others, the social learning theory of career decision making (Krumboltz, 1979); social cognitive career theory (Cinamon et al., 2016); role identity theory (Wilson et al., 2017); and the social capital theory of career success (Seibert et al., 2001; Obers, 2015). However, most elucidate a single explanatory framework, rather than providing a comprehensive and holistic approach that encompasses the range of factors contributing to inequities in career progression. Therefore, we focused on those frameworks that might support us to answer our research question – that is those that holistically identify factors at individual, socio-cultural and institutional levels that shape career progression of women and men academic scientific researchers from junior to senior levels. We selected three theories

and models: Systems of Career Influences Model (Magrane et al., 2012); the Social Relations Approach (Kabeer, 1994; Kabeer and Subrahmanian, 1996; March et al., 1999); and Intersectionality theory (Crenshaw, 1991; Hancock, 2007) which we describe and analyse below.

### 2.5.1 The Systems of Career Influences model

This model was developed by Magrane and colleagues in response to a 2007/2008 call by the United States National Institutes of Health Working Group on Women in Biomedical Careers for research to address the persistent gap in the evidence for approaches to advancing women in biomedical science, despite a steady increase in enactment of policies that aim to level the playing field in medical school and doctoral science programmes (Magrane et al., 2012).The model serves as a tool for exploring factors influencing women's progression to advanced academic rank, executive positions, and informal leadership roles in academic medicine. It is based on a summary of empirical literature on women's career development, best practices in professional development programs, and the collective experiences in academic leadership development in the USA context. The model situates faculty as agents within a complex adaptive system consisting of a trajectory of career advancement from early career, through mid-career to senior levels; a dynamic system of influences of organizational policies, practices, and culture; and a dynamic system of individual choices and decisions. Within these systems, women weigh competing influences to make choices and decisions, which may either promote or inhibit their career advancement. We selected this model because it was the only one that we identified that provides a structured approach for exploring the range of influences on women's career advancement along the scientific pathway, across organizational, individual, and societal dimensions. However, this model takes an individualistic focus on women's choices towards career progression rather than accounting for the gendered structural influences on those 'choices'. As such it reflects broadly neo-liberal and liberal feminist theoretical stances, which risk obscuring the specificities of the multiple oppressions faced by women of colour and women of the global south at the intersections of patriarchy and (post)colonial power relations. Tikly (2011) reminds us of the importance of pursuing a post-colonial analysis when researching on education systems in Africa, which could have implications for disadvantaged groups who encounter differential barriers in accessing quality education. We therefore decided to utilise a framework developed specifically in the global South to deepen our analysis of structural context.

### 2.5.2 Social Relations Approach

Gender inequity in higher education is a feature of social relations, as it shapes the production and reproduction of gender privileges and disadvantages which are inextricably linked to career progression of women [and men] (Morley, 2005). However, there has been little sustained attention globally to the role that higher education plays in challenging and reproducing gender privileges and disadvantages based on existing social relations (Morley, 2005). There are numerous commonly used gender analysis frameworks such as the Harvard Analytical Framework (also referred to as the Gender Roles Framework or the Gender Analysis Framework), Longwe's women's empowerment framework, Moser's gender needs assessment framework, and capacities and vulnerabilities analysis framework (March et al., 1999). A commonly used gender analysis framework focusing on social relations in institutions is the Social Relations Approach (SRA), developed by a Southern feminist - Naila Kabeer - in collaboration with policy makers, academics and activists primarily from the global South (Kabeer, 1994). The SRA draws on post-colonial socialist feminist thinking as a theory for feminist change, which challenges and contests the fixity of gender, race, and culture, and directs attention to intersectional factors as socially produced through historical, socio-economic and political processes of colonialism (Kabeer, 1994). It therefore offers an institutional analysis of how gender inequities are produced as a constituent part of 'social relations', which describe the structural relationships within institutions that create and reproduce systemic differences in the positioning of different groups of people including those of class, race, ethnicity, and so on (Kabeer, 1994; Kabeer and Subrahmanian, 1996; March et al., 1999). The core premise of SRA is that gender analysis should go beyond analysing roles and responsibilities for men and women to include how gender inequities are created and perpetuated through the patterns of social interactions in different contexts. Kabeer (1994) reminds us that for SRA to be useful, it is important if the institutional analysis of gender relations is linked with the general macro-economic policy/context which are informed by broader set of social relations through which production is organised and human needs are met (pg. 285).

The four key institutions identified in the SRA are the: state, market, community and family; with the family as taking a logical starting point for such an analysis because of its central role in enabling, constraining and differentiating its members' participation in the economy and society at large. Kabeer argues that social relations in all these institutions are defined by five distinct, but inter-related, dimensions of social relationships which are key to gender analysis and which include: (i) '*rules',* which may be formal or informal, with the latter expressed through norms, values, laws, traditions, and

customs that determine how things are done through allowing or constraining: what is done; how it is done; by whom it will be done; and who will benefit. (ii) '*resources'* include financial, social capital, or physical resources, the mobilisation and distribution of which often corresponds to an institution's rules (iii) '*people'* refers to the inclusion or exclusion of individuals in social processes, assignment of resources, tasks, and responsibilities and positioning in hierarchies (iv) '*activities'* refers to differing roles performed by individuals, based on routinized pattern of allocation and practice for carrying out tasks, through which certain tasks get attached to certain social groups (v) '*power*' determines who decides and in whose interest decisions are taken in institutional relations of authority and control. Kabeer (1994) posits that power in the analysis of SRA is inherent in the social relations which enable men to mobilize a greater range of resources - symbols and meanings, authority and recognition, objects and services- in greater range of institutional domains, including political, economic and familial, which are shaped by intersections of patriarchy, capitalism and racism (pg.66).

The SRA thus provides deeper insight into the specificities of how structural gender relations and other social inequalities operate within institutional contexts, which we found to offer a good 'fit' in explaining the varied dimensions of gender disadvantage emerging from the empirical literature. However, since the theory is general and does not identify specificities of social relations within academic institutions, we argue that it may be productive to integrate it with Magrane's framework. In addition, whilst the SRA advocates for the need to go beyond gender in understanding the structural relationships that create and reproduce systemic differences for different groups of people characterized by class, race, and ethnicity; it is evident that most studies on career advancement of women treat them as homogenous group (Magrane et al., 2012). It may therefore be important to draw specific attention to the importance of heterogeneity among women and men, by drawing on the insights generated by the application of intersectionality theory, which specifically considers how the intersection of multiple axes and drivers of inequity constitutes unique and shifting positions for individuals within a complex web of power relations.

### 2.5.3 Intersectionality Theory

The concept of intersectionality originates among Black feminists in the United States, with the term being coined by Crenshaw (1991) to denote how connected and interdependent systems of race, class, gender, ethnicity, and other markers of difference (such as sexuality, religion, age and (dis)ability, marital status) intersect and interact with institutions and structures in society to privilege certain

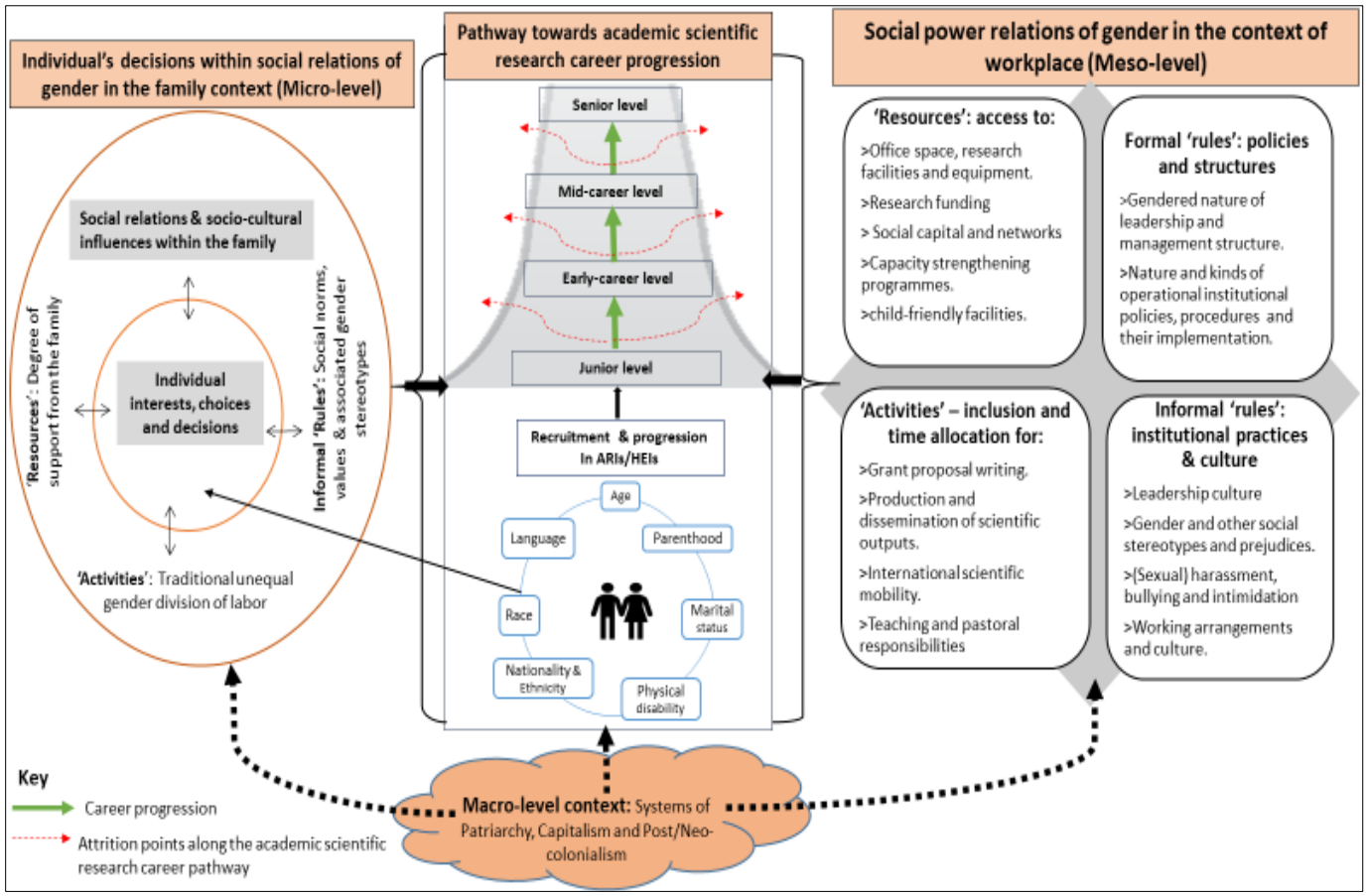
groups over others, and to maintain power. The intersections of gender with other dimensions of social identity (at the micro level of the household and community, as well as the individual or 'self') are therefore the starting point of this social theory (Crenshaw, 1991). These intersections occur within a context of connected systems and structures of power in institutions at the meso level (e.g. state laws, policies, bureaucracies, religious institutions, media). Through such processes, interdependent forms of privilege and oppression shaped by macro-level historical forces such as colonialism, imperialism, racism, homophobia, ableism and patriarchy are created (Hankivsky, 2014). Using an intersectionality lens therefore entails a multi-level analysis to understand the effects between and across micro, meso and macro levels in society. Attending to this multi-level dimension of intersectionality also requires addressing processes of inequity and differentiation across levels of structure, identity and representation, while acknowledging that social inequalities are context specific, and which reveal themselves through the process of intersectional research and discovery (Hankivsky, 2014). In an institutional context, intersectionality theory is concerned with how institutionalized systems of oppression interconnect to create specific manifestations of discrimination, and disadvantages, sometimes simultaneously with privilege and advantages, for particular individuals or groups of people based on their socio-demographic characteristics, known as their social 'location'. There is some debate about the degree to which an intersectional approach adds to social relations analyses of gender (which are arguably already informed by these insights) and the legitimacy of specifying gender as a focus within intersectional analyses (Hancock, 2007). In our view, the lack of consideration of intersecting inequalities in many accounts of women's disadvantage in academic institutions merits an explicit consideration of intersectionality in a comprehensive framework, which is complementary to a social relations approach when researching scientific career progression (Dubois-Shaik and Fusulier, 2015; Hancock, 2007). However, current lack of clarity about operationalizing intersectionality at an analytical level suggests the utility of retaining social relations theory as a clear framework for analysis.

## 2.6 The Provisional Integrated Conceptual Framework

Based on insights from the three models, we developed an integrated conceptual framework (Figure 2.6) that builds upon the 'systems of career influences' model of career progression (Magrane et al., 2012), combining this with a social relations gender analysis framework to explain how institutional social relations and processes produce and perpetuate gender inequities (Kabeer 1994; March et al., 1999) and an intersectional perspective that focuses on how gender intersects with other social relations of power (Crenshaw, 1991; Hancock, 2007). We propose this framework as an integrated

approach to conceptualising how gendered social relations and processes in the institution of the family intersect with those in academic institutions to shape opportunities to progress along the academic scientific research career pathway within African research institutions. This is in ways that are shaped by their multiple social identities within wider social relations.

*Figure 2.6: An integrated conceptual framework for understanding intersecting gender inequities in academic scientific research career progression in HEIs in SSA*




The model by Magrane et al. (2012) provides the central core of the framework, which focuses on the interplay between individual and organizational factors at different career stages. Kabeer's (1994) framework identifies key dimensions for an institutional gender analysis, expressed as 'rules' (formal and informal), 'resources' and 'activities', which are all permeated by 'power'. 'People' are located as individuals at the centre of the family and as entrants into the career pathway. The intersectionality lens is then explicitly added to highlight the multiple social identities and related power of these individuals according to aspects such as age, professional cadre, marital status, ethnicity, language minority,

(dis)ability, and parenthood. We applied this framework to the available empirical findings from Africa by mapping the existing evidence onto it and developed a preliminary explanation of observed inequities. In the next section we describe this integrated framework through unpacking its various components based on our synthesis of available scholarly evidence on gender inequities in academic scientific career progression in HEIs in SSA.

### 2.6.1 Pathway towards academic scientific career progression for researchers in Africa (middle box)

*The academic scientific career pathway* typically progresses from undergraduate to post-graduate level (junior level), through 'early career' or post-doctoral positions, to mid-level academic scientific research positions and finally to senior level, culminating in professorships (The Royal Society, 2011), although the process may not be linear, especially in SSA. We take gender as a key entry point into analysing the positionality of individuals shaping this pathway, who according to intersectionality perspective, may further be identified as (dis)advantaged based on other multiple intersecting social categories. Disadvantage may shape barriers to entry and progression, as well as retention in academic scientific careers: some may 'leak' out of the pathway by leaving academia or science altogether.

As represented by the pyramid, women are typically increasingly under-represented and slowly progressing along the pathway to senior positions (Teferra and Altbach, 2004). Females account for a consistently lower proportion of the graduate student population in science [technology, engineering and mathematics] than males across African HEIs although there is little evidence of higher drop-out among female students (FAWE, 2015; Masanja, 2010). As a result, fewer women enter academic positions, particularly beyond junior levels (Mabokela and Mlambo, 2015) and ultimately comprise less than 10 percent of professorial level faculty in most African countries (Mama and Barnes, 2007). Notably, unlike industrialized countries where significant research takes place in specialized types of institutions, in Africa most of research is conducted in universities, which are thus the main sites of where research knowledge dispensed, acquired, and produced (Assié-Lumumba, 2006). Much of the available literature on scientific career progression in Africa therefore focuses on higher education institutions. The following sections explore how the social relations of gender in the family and academic and scientific institutions intersect with each other and with other social power relations to influence women's entry, retention and progression in their careers.

### 2.6.2 Individual's decisions within social relations of gender in the family context: Micro-level (left box)

This denotes the '*micro-level context*' in which social relations of gender are produced, shaped and propagated to other levels. There is considerable evidence from African studies that the persistent allocation of the brunt of reproductive labour to women slows down their career progression (i.e. Beoku-Betts, 2004, 2005; Callaghan, 2016; Jansen Van Rensburg, 2007; Lumby and Azaola, 2014; Mabokela and Mlambo, 2015; Prozesky, 2006, 2008; Thege et al., 2014). In most African contexts, women are socially identified as wives, mothers and carers, and spend on average significantly more time caring for children and the elderly than men (Beoku-Betts, 2004). Women's disadvantage with regard to time availability for their careers is particularly related to marriage and child-bearing, which for the majority occurs whilst they are still in post-graduate education (Beoku-Betts, 2004; Nyamongo, 2007). However, the extended nature of most African families means that women tend to have domestic responsibilities regardless of their marital status; for example responsibility for raising the children of less privileged family members, which may be particularly acute in context of conflict and economic crises (Beoku-Betts, 2005). Professional women are therefore constrained in competing with their male counterparts in terms of allocating time to activities that contribute to career progression such as grant and scientific writing and publication (Beoku-Betts, 2005).

Reproductive responsibilities reduce many women's opportunities to take up opportunities to study or work internationally, which can be an important source of academic capital and networks that support progression. For example, a study in Rwanda reports that many women 'stuck' at junior levels turn down scholarships for studying abroad due to concerns about the impact on their marriage or having young children whom they are unable to leave behind because of lack of support at home (Masanja, 2010). Conversely, the social expectation to 'follow' a spouse as they develop their career can lead to postponement, 'fractures' or changes in direction in women's careers (Mabokela and Mlambo, 2015; Prozesky, 2008).

In contrast, many women cite supportive family relationships from their spouses, mothers, siblings, including members of the extended family, as integral to their professional success strategy through childcare and moral support (Mabokela and Mlambo, 2015). For women without such support, career progression may come at high personal cost. For instance, one female academic in a study at the University of Ghana reported that she made a difficult and painful decision to leave her 15 month- old

baby to pursue a doctoral degree overseas, in order to keep her position at the University, which contravened societal norms (Mabokela and Mlambo, 2015). For some women, the social costs of career progression may include divorce or separation (Beoku-Betts, 2004), or strategic decisions to challenge socio-cultural norms and expectations by not getting married (Mabokela and Mlambo, 2015). Unequal allocation of reproductive responsibilities thus account for a cumulative disadvantage to women in representation and progression in science careers in ways that may be alleviated or exacerbated by life stage, family support and social context (Masanja, 2010). There is a lack of information from existing studies about how 'informal rules' of gender in the family and society beyond girls' and women's reproductive roles, such as gender stereotypes and constraints in subject choice, may influence women's career progression (Assié-Lumumba, 2006).

### 2.6.3 Social power relations of gender in the context of workplace: Meso-level (the right box)

There is evidence from the empirical literature of how *gender power relations within academic institutions* further intersect with gender power relations within the family and wider society to create disadvantage for women, in ways that may be exacerbated or mediated by other social power relations. Institutional power relations are manifested in operational policies and power structures (*formal rules*); institutional practices and culture (*informal rules*); access to the necessary research infrastructure or *resources*; as well as inclusion in and expectations of research *activities.*

***Formal 'rules': policies and structures.*** Studies from SSA have characterised universities as persistently male-dominated spaces (Mama and Barnes, 2007; Teferra and Altbach, 2004), particularly in terms of representation, decision making procedures and leadership, with gender-blind and discriminatory policies (FAWE, 2015; Onsongo, 2006, 2007). Power structures are generally rigid (Johnson, 2014), whilst decision-making cultures are often conservative and inflexible (Onsongo, 2006), offering few opportunities for influence beyond the male dominated leadership positions.

The paucity of women involved in the leadership levels of HEIs compounds the lack of gender-responsive policies. Where there are policies in place, their translation into practice is not adequately or effectively done or monitored, resulting in the maintenance of the status quo (FAWE, 2015). Without bodies or persons designated to ensuring that these policies are acted upon, they often remain reference documents that are used to show that efforts have been made to address gender inequality rather than demonstrating commitment to action (FAWE, 2015). 'Gender blindness' is manifested

through lack of policies and effective sanctions against sexual harassment, sexual violence and bullying (FAWE, 2015).

***Informal 'rules': institutional practices and culture.*** Gendered power relations are enacted and reinforced through everyday institutional practices and culture within the work environment. Studies have shown that even though academic institutional cultures in many African contexts are visibly opening to women's participation, they continue to perpetuate working cultures that are not favourable to women's social and cultural experiences (Mabokela and Mlambo, 2015). Broader societal norms and values in Africa influence professional relationships, experiences and organizational practices, which are still male-dominated, and tend to marginalize "women's ways of knowing and doing" (Mabokela and Mawila, 2004) as well as reflecting gender stereotypes and practices. For instance, women in a South African university argued that beliefs and attitudes portraying women as inferior and incompetent were rooted in patriarchal culture, and were extended to institutions of higher learning, such as in a proverb stating that "if you give an institution to a woman, it will collapse", with men believing that they had the "divine right" to occupy all leadership positions (Mabokela and Mawila, 2004: 406). The gender relations of family are also carried over into the workplace, with female academics reporting male colleagues taking a negative attitude towards women who prioritize their careers over marriage and family obligations (Beoku-Betts, 2005) and undermining their status and expertise by expecting them to "serve them like their wives would at home" (Mabokela, 2003: 142). Reflecting on their early career experiences in a public university in Ghana, participants experienced some form of belittling or discrediting as women, including a female assistant professor being addressed as 'Mrs' whilst male colleagues were addressed as 'doctor' (Beoku-Betts, 2005). African Universities are thus spaces and places intricately marked with codes for man-as-thinker, man-as-aggressive-debater, man-as-athlete, boys-becoming-men (Mama and Barnes, 2007).

Gender stereotypes may also intersect with other social stereotypes such as those related to age and race. For example, another study in Ghana documented that women academics perceived their young age or youthful appearance as a barrier in gaining respect as a professional among their colleagues and students (Mabokela and Mlambo, 2015) regardless of scholarly accomplishments, which has the potential to negatively impact career progression of young women. By drawing attention to the experiences of the South African Black women scholars through a qualitative study, Mabokela and Mawila (2004) report that participants reflected on how their race negatively impacted on their

professional experiences as female academic staff. Specifically, they complained that their Indian and White male colleagues often negatively criticized their professional contributions, were overtly hostile and enacted subtle discriminatory practices. They often treated them as if they were "nothing" and colluded against them to keep their position of privilege (Mabokela and Mawila, 2004).

Such gendered relations play out in formal processes such as promotions panels. In Kenyan universities for example, interview panels for promotion are usually male-dominated, and female candidates for managerial or professorial positions are often subjected to irrelevant, gender-biased questions (Onsongo, 2006). Still in Kenya, several studies have identified the importance of male power and patronage networks in promotion decisions (Raburu, 2015), in addition to other non-merit factors that also affect men, such as tribalism, nepotism and political loyalties (Onsongo, 2006).

Educational organizations in SSA are often unfriendly environments for women due to a spectrum of behaviours from bullying and discrimination to sexual harassment and gender-based violence (Assié-Lumumba, 2006; Johnson, 2014; Mama and Barnes, 2007), creating constraints to their progression (Onsongo, 2007). Women experience 'everyday' hostility and bullying in the form of male intrusion in their areas of responsibility, interruption of meetings run by women managers, and political interference (Onsongo, 2007). Practices such as scheduling important decision-making meetings outside of core working hours indirectly discriminates against many women by effectively excluding those with reproductive responsibilities (FAWE, 2015; Onsongo, 2006).

***Availability and access to research-oriented 'resources.*** There is some empirical evidence from SSA showing perceived gender inequities in allocation and distribution of tangible institutional research '*resources*', especially for junior level faculty, such as computers in the case of Ghana and Kenya (Campion and Shrum, 2004) and laboratory supplies and equipment in sub-Saharan Africa in general (Beoku-Betts, 2005). In South Africa, findings from a qualitative study conducted amongst Gauteng-based female early career academics in the Science, Engineering and Technology fields found that women between 30 and 35 years are often penalized in research funding allocation (Thege et al., 2014). Participants felt that reviewers, most of whom are men, view this life-stage as dominated by childcare responsibilities and thus allocate resources to male counterparts who are seen as having more time to dedicate to research (Thege et al., 2014).

The social and professional capital and networks, including peer groups/collegial networks, mentors and role models, are highly influential on scientific career progression. Empirical evidence suggests that compared to men, women tend to have weaker social capital and networks, particularly as a result of limited mobility for conference attendance due to reproductive responsibilities (Obers, 2015). In addition to the constraints on taking up networking opportunities, 'old boy' networks tend to exclude women when discussing career progression matters such as promotions and scholarships informally over lunch or evening drinks, as reported by a study in Kenya (Raburu, 2015).

In SSA, Beoku-Betts (2004) found that African women as graduate students in the sciences perceived peer groups as influential on academic achievement, but the majority reported a lack of positive peer group experiences or collegial support from fellow (female and male) graduate students (Beoku-Betts, 2004). Moreover, with fewer women in senior positions, junior academic male staff are more likely than females to have role models and career mentors with experience of career progression (Mabokela and Mawila, 2004) and who are able and willing to promote their interests within institutions (Raburu, 2015). In a qualitative study of female academics in South Africa, Mabokela and Mawila (2004) found that none of their subjects had had mentoring or support on research and publication; instead, participants exclaimed that "*they simply put you in an office and you'd better figure out how you are going to survive"* (Mabokela and Mawila, 2004: 404). The same study attributed lack of mentorship to the limited recognition of this role in promotion considerations.

There is also evidence of inequities in allocation of career development/capacity strengthening opportunities in academic institutions (Morley, 2006). For instance, Beoku-Betts (2005) found that women in early career positions in SSA complained of exclusion from career development opportunities such as grants, scholarships, and fellowships. In addition, the built environment and services of many African universities has not been inclusive of women's needs as students and academic staff in terms of child care facilities (Mama, 2006; Raburu, 2015). In Ghana for instance, childcare was a concern for all women academics with young children, who perceived the absence of child support facilities within the university as evidence of the lack of institutional commitment to support women staff to achieve a reasonable work-life balance and to compete with their male colleagues on a level playing field (Mabokela and Mlambo, 2015).

***Inclusion and time allocation for 'activities.*** In terms of '*activities*', neo-liberal labour relations in academic institutions, driven by macro-level forces of academic globalisation, increasingly focus on 'productivity measures' of scientific outputs such as peer-reviewed journal articles and grant income. These are often constructed as 'additional' to teaching loads, which implicitly assume time elasticity on the part of employees (Beoku-Betts, 2005; Callaghan, 2016; Obers, 2015; Prozesky, 2006). Progression in academic scientific careers also demands a very high level of international mobility (Ackers, 2004), because of the importance of visibility and engagement with global networks of scholars (Prozesky, 2006). Empirical evidence suggests that women scientists in Africa publish in peer reviewed international journals less than their male counterparts (Beoku-Betts, 2005; Prozesky, 2006), and also view grant writing grant proposals and applications to obtain institutional funding as a time consuming exercise that is often not fruitful, as highlighted in qualitative study conducted in Ghana (Mabokela and Mlambo, 2015). Due to their lack of time elasticity, many female scientists have opted for focusing on teaching responsibilities, which are seen as 'core' duties (Callaghan, 2016). This, together with gender stereotyping, contributes to a vicious cycle, whereby women tend to be allocated higher lecturing, administration, counselling and mentorship workloads compared to men (Raburu, 2015). Such duties are overlooked in the promotion process, which emphasizes almost exclusively research and publication outputs (Mabokela and Mawila, 2004; Onsongo, 2007). Men are therefore advantaged in the competitive process of applying for salary increases, promotion and professional recognition (Beoku-Betts, 2005).

### 2.6.4 Macro-level context: Systems of patriarchy, capitalism and post/neo-colonialism

We recognise that the social relations of gender at individual, societal and institutional level with differential implications to women and men who maybe disadvantaged by multiple social identities within HEIs in Africa, are in/directly reinforced by an overarching macro level context characterised by patriarchy, capitalism and post/neo-colonialism. Tikly (2011) emphasises the need to understand the post-colonial context, which matters when investigating challenges and enabling environment within the African continent. We refer to this as the macro level context, in line with Kabeer's (1994) SRA which highlights the need for a macro-structural analysis of gender relations within the realms of capitalism, racism and patriarchy, which may be interdependent (pg.67). By echoing Kabeer's (1994) sentiments, Gordon (1996) accentuates on the importance of theorising the relationship among structures of capitalism and patriarchy as intersecting macro-level social processes that provide the context for people's actions and beliefs, and how and why they change, and which are conditioned by historical and

contemporary forces that produce differential inequities for women and men within each African society.

Available empirical evidence from SSA indicates that historically, women in Africa under colonial rule generally entered academia later than their male counterparts, as a systematic and deliberate colonial policy ensured that African women were excluded from the various "ivory towers" that dotted the continent (Adusah-Karikari, 2008). A variety of factors, including the emphasis on domestic chores, and the overarching influence of patriarchy, combined to make access to academic institutions for women an impossibility for much of the colonial period (Adusah-Karikari, 2008). Specifically, social structures put pressure on women to start a family ahead of professional considerations as the society expects women to bear the burden of caring for the young, elderly and the sick or disabled; a colonial legacy that left African women with a burden of having to pursue their academic interests while fulfilling their traditional or social responsibilities, a task which they bears with little or no help from the males (Adusah-Karikari, 2008).

Even though research on the experiences of women in higher education in Africa in the past few decades indicates that women's access to education has generally increased, feminist researchers have suggested that patriarchy still dominates post-colonial life as much as it dominated colonial, everyday life, as women continue to remain in subordinate positions (Adusah-Karikari, 2008). Morley (2005) observed that many of the explanations for the gendered division of labour in the academy or women's lack of seniority stem from norm-related discourses of heterosexuality and patriarchy, which continue to create barriers for many women. More recently, Prozesky and Beaudry (2019) have accentuated that patriarchy still pervades the majority of African societies, and that its resulting gender-based divisions of labour both within the home and in the academic workplace have a negative impact on the careers of African women scientists.

Mama and Barnes (2007) have argued that the post-liberation state in Africa has been a disappointment for women, exacerbating inequalities in public higher education. Specifically, the governments which took over after independence kept African state structures and systems as they were, and so tended to revert to traditional social and political systems and values which reproduced the repressive characteristics of the past (Mama and Barnes, 2007). In addition, for a long time in sub-Saharan African countries, there has been non-conducive environment for research as most national governments have

not come to a recognition and appreciation that funds allocated for research are a good investment (Whitworth et al., 2008; Owusu et al., 2017). This has severely compromised the research environment, which is constrained by poor institutional facilities, heavy teaching loads, lack of mentorship programs for young faculty among other challenges that impact negatively on African research scholars (Owusu et al., 2017). As a result, majority of research capacity strengthening initiatives in SSA aimed at bridging this gap are funded by global North, who tend to exacerbate historical inequalities and colonial exploitation and replication of persisting macro-economic inequalities characterised by draining of expertise, dependence on their funding, and power imbalances between researchers and institutions from the North and the South (Bowsher et al., 2019).

## 2.7 Implications

Our proposed integrated conceptual framework provides insights into understanding how the myriad of barriers faced by female academic scientific researchers to equitably progress along the career pathway is shaped by gendered social relations. A considerable number of authors have placed emphasis on unequal burdens of reproductive work, mainly family responsibilities, which remains a significant barrier that cuts across others, particularly to women's career progression in science in Africa. Our findings imply that although women's reproductive labour is seen as a critical stumbling block in their career progression, it is important to look at how this interrelates with other gendered drivers and to consider how gendered labour relations in the wider political economy lie at the root of this problem. Existing evidence from SSA points to the fact that women are equally under-represented in natural sciences and engineering in general, and particularly at high levels (Beaudry and Prozesky, 2017; Masanja, 2010; Okeke et al., 2017; Jesse, 2006). Therefore, this proposed framework which is based on review of empirical evidence on scientific and academic careers in SSA, may also be applicable to careers in disciplinary fields of technology, engineering and mathematics. However, this should be done with caution given that we did not specifically look for mathematics, engineering and technology disciplines in our literature search, which might be a limitation for application to such fields as whole.

Our review of the literature found few explorations of how intersecting social inequities may influence men's career progression, since most studies focused exclusively on women. This demonstrates the importance of having more male comparative studies. Such comparative studies can aid in establishing commonalities between the drivers of inequity for women and men who maybe disadvantaged by existing power relations, which may potentially form a basis for making strategic alliances and designing holistic interventions. Moreover, we did not come across empirical literature on learning from any

successful interventions that have been used taken to address these issues. This clearly indicates that urgent attention should be paid to conducting research on HEIs in Africa, particularly from a gender and social inclusion perspective, to provide up-to date evidence on which to develop targeted policies and programs to address the impediments to equitable scientific and academic career progression of female and male researchers.

Overall, the findings confirm that women in academic scientific research careers in Africa work under difficult circumstances characterised by issues of discrimination and segregation, gender-based violence and sexual harassment, time constraints, negative gender stereotypes and poor infrastructural services among others, and which can consequently impede their career progression. Moreover, academic and scientific institutions see combining family and career as a "private affair" for women; this could explain why there is minimal or absence of child care facilities in scientific institutions (Vilnius, 2007) and why career structures are generally considered to be 'gender neutral'. Analyses tend to be focused on the experiences of individual women, which though very important, can act to obscure the structural underpinnings of their experiences in the gendered political economy and to clearly distinguish the commonalities and differences from the experiences of male academics.

### 2.7.1 Study Limitations

We acknowledge that our empirical literature review is based on limited gender disaggregated published literature from SSA on this topic. Thus, many gaps in the evidence arise from the lack of comparative accounts of scientific career progression barriers for women and men as characterised by multiple social identities and as shaped by gendered social relations. Generally, the available evidence has focused on women, in studies whose titles denote gender. Similarly, the majority of the studies have treated women in academia and research careers as a homogenous group, without considering their differences and the complexities of how these may interact with gender relations. Moreover, we were unable to locate a study exploring barriers to equitable academic scientific career progression for women and men at each stage of the academic scientific career pathway.

We also recognise that the growing inequities in academic career progression of women and men in African HEIs differ by regions and countries which are characterised by unique history, culture, and political environments, in the way that they are positioned. However, Adisa and colleagues (2019) recently established that there seems to be a paucity of research about the challenges and impact of patriarchy on women's career progression in academia, specifically in the non-Western context, where patriarchy is highly prevalent. Our review led us to conclude that most studies tend to merely deduce,

rather than directly investigate a link between patriarchy, capitalism and post/neo-colonialism, which is barely present in the empirical literature on career progression in HEIs in Africa.

## 2.8 Conclusions

Based on our review of existing empirical evidence from SSA, we have identified and analysed the individual, socio-cultural and institutional level barriers that negatively impact the ability of women in institutions of higher education to climb the academic scientific ladder resulting in their diminished representation in senior and institutional leadership positions. Our analysis of the empirical literature confirms the need for a new, integrated conceptual framework, since many of the existing empirical studies lack explanatory power due to the lack of application of social theory, whilst most view women as a homogenous group. However, our ability to demonstrate the explanatory 'fit' of our proposed framework is itself constrained by the limitations stated above, as there is a lack of empirical studies with adequate comparative, intersectional, gender analyses, particularly to support a deep understanding of the effects of intersecting power relations.

We have made a case for our proposed framework in order to stimulate critical discussion on the problem of inequitable academic scientific career progression with a gender and social inclusion lens. Thus, it serves as a starting point towards understanding the problem and informing development of viable strategies and mechanisms for enhancing equitable career progression, that are grounded in, and based on available evidence from specific SSA contexts. This framework could be used by institutional research leaders and policy makers in considering areas in which they need to act through devising potential strategies to enhance equitable recruitment and career progression of academic and scientific researchers as well as improving their retention within specific institutions and in scientific careers in general.

Nonetheless, there is need for more comparative studies to ascertain the usefulness of the framework in explaining inequities in scientific career outcomes. For example, guided by this integrated conceptual framework, the first author (a PhD student) is currently conducting an empirical qualitative study that is aimed at examining the experiences of academic researchers at various career stages with regard to intersectional gender equity in their scientific career pathways, within the context of DELTAS Africa – a health-based scientific research capacity strengthening programme. The ultimate goal of this study is to produce evidence from a holistic, gender comparative and intersectional perspective of existing barriers and enablers that can be used to develop strategies to promote career equity for internationally competitive African scientific researchers while acknowledging their multiple social identities. Going

forward, there is an urgent need for such studies to expand the focus beyond women as a single homogenous category, to develop comparisons with male scientists, to consider diversity in HEIs, and to move beyond individual experiences to identify the structural drivers of barriers and enablers in the wider gendered political economy.

### 2.8.1 Acknowledgement and Funding

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**ENDNOTES**

[1]The DELTAS Africa, a health -based research capacity strengthening programme initiated by the Wellcome Trust, is a flagship programme of the Alliance for Accelerating Excellence in Science in Africa (AESA) at the African Academy of Sciences, aimed at developing science strategies and funding research in Africa. The DELTAS Africa 'Learning Research Programme' (LRP), embedded within the DELTAS Africa initiative, is led by the Capacity Research Unit of the Liverpool School of Tropical Medicine. One of its goal is to produce research-based learning about how to equitably develop internationally competitive and effective researchers and research institutions in SSA. Available at: https://www.lstmed.ac.uk/research/centres-and-units/centre-for-capacity-research/resources (site accessed on March 20, 2020).

# Chapter 3: Methodology

## 3.1 Chapter overview

The overarching aim of my thesis is to explore the barriers and enablers to intersectional gender equitable scientific career pathways within the DELTAS-funded African research institutions. A consolidated summary version of the methods adopted in this study is included within the result chapters. However, this chapter provides an opportunity to present a more detailed methodology and methods used in conducting this study. I begin with a description of my epistemological stance and the premise of my methodological choices. I then provide a detailed description of the study setting and design. This is followed a description of the study population, and the sampling procedure for DELTAS ARC and study participants. I move on to provide the sample size and the sample characteristics, and data collection methods, data processing and analysis and trustworthiness of the data. I conclude this chapter by discussing the ethical considerations for this study.

## 3.2 Epistemological and methodological stance

The research undertaken takes social constructionism as the philosophical approach, which assumes that the reality is socially constructed by individuals as a result of historical, social and political processes (Cohen et al., 2004; Green and Thorogood, 2009). Unlike positivist approaches, which obscure the links between individuals and their social worlds, social constructionism elucidates these links, facilitates a greater understanding of the relationship between individual and social context, and encourages researchers to challenge dominant prescriptions of behaviour (Cohen et al., 2004). Constructivists embrace subjectivity as a pathway deeper into understanding the human dimensions of the world in general as well as whatever specific phenomena they are examining, and thus aim to capture and report multiple perspectives rather than seek a singular truth (Patton, 2002). This involves a focus by the researcher on the participants' expressions of their perceptions, experiences, activities and beliefs as constructed within a research setting (Charmaz, 2006). Indeed, constructivists are more interested in deeply understanding specific issues within a particular context than in hypothesising about generalisations (Patton, 2002:267). Nonetheless, social constructivists' findings are explicitly informed by attention to praxis and reflexivity, that is, understanding how one's own experiences and background affect what one understands and how one acts in the world including acts of inquiry (Patton, 2002). I therefore adopted social constructionism as an epistemological lens to achieve a deep understanding of

the barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions.

**Feminist epistemological lens**

I utilised two feminist approaches in my inquiry - the Social Relations Approach (SRA) and intersectionality theory as previously described in chapter two. Feminist approaches have an underlying theoretical perspective which posits that women and men occupy different social positions and therefore have different world-views and experiences (Green and Thorogood, 2009:19). Feminists value justice and freedom, a commitment to social change, implying existence of power relations that becomes untenable (Green and Thorogood, 2009). In research, a particular feminist epistemological framework adopted determines both the research question and subsequent research design. Specifically, feminists emphasise the need to produce research knowledge that is grounded in the standpoint of women and other oppressed groups as culturally situated knowledge makers (Green and Thorogood, 2009). In this chapter, I provide additional insights on the use of intersectionality as an approach to my inquiry.

Feminist analysis has moved beyond the longstanding critique of the focus on binary and essentialist approaches towards the theoretical recognition of the importance of the intersection of multiple inequalities to shape individual social positions and thus life experiences (Walby et al., 2012). Intersectionality as a theoretical perspective emphasises the multiple identities of an individual and how these result in various experiences of disadvantage or advantage (Moodley and Graham, 2015; Walby et al., 2012), and thus serves as feminist epistemological position of 'situated knowledges' (Tolhurst et al., 2012). It is premised on the notion that social phenomena and lived realities are multidimensional and our understanding of them may be inadequate if we view them only on a single dimension (Mason, 2010). Therefore, using an intersectional approach is an effort to make visible the perspective and needs of women and men who remain invisible under mainstream gender analyses by probing beneath single identities markers to account for the complex set of social relations that produces differences between human beings (European Union, 2012).

From a research angle, intersectionality often relies more heavily on qualitative methods because they appear to be more compatible with the theoretical language and intent (Shields, 2008). Thus intersectionality serves as a theoretical and methodological lens to understanding qualitatively different

experiences of marginalisation based on the multiple dimensions of social identities that people hold (Moodley and Graham, 2015; Reimers and Stabb, 2015). Most qualitative researchers have the goal of describing the forms and processes of relations among categories of phenomena and the themes and units of meaning relevant to these relations (Shields, 2008). This stance makes the qualitative researcher more open to emergent phenomena than the quantitative researcher whose work is driven by hypotheses determined *a priori* (Shields, 2008). Moreover, research undertaken from an intersectionality perspective originates from a point of view which includes an agenda for positive social change through advancing research, practice, and policy that disrupts structures of inequality, but requires data to support it (Duran et al., 2020; Mason, 2010; Shields, 2008). This approach reflects a belief that science can be beneficial to society and that it is our obligation to study those problems and issues that bear on real people's lived experience (Shields, 2008). Indeed, qualitative methods are ideal when exploring nascent areas of research and unearthing individuals' perspectives and experiences (Creswell, 2014). My study design, data collection and analysis are informed by the feminist theoretical orientation of intersectionality and SRA, which is consistent with a constructivist epistemology, which both emphasise analysing data by examining the experiences of those who are being studied.

**Grounded Theory Methodology**

Introduced to the research community in the 1960s, grounded theory is "the discovery of theory from data" (Glaser and Strauss, 1967:1). Based on the philosophy of social constructionism, it is an inductive enquiry that explains social processes in complex real-world contexts (Creswell, 2006; Malterud, 2001). Using a grounded theory methodology as line of enquiry calls the researchers to ask participants open ended questions, check understanding and prompt further description to elicit their perspectives and experiences (Urquhart, 2013). Accordingly, the researcher is not supposed to force or shaped data to fit any preconceived ideas, but should remain theoretically sensitive and open minded, and identify significant theoretical concepts as they emerge from the data (Urquhart, 2013). Data is usually analysed using a constant comparative process, which entails taking information from data collection and comparing it to emerging categories (Charmaz, 2006). Initially coding uses participants' words, and then identifies patterns, social processes and emerging substantive theories or concepts (Urquhart, 2013). Grounded theory was therefore a suitable research methodology for this qualitative research study.

## 3.3 Study setting

My research study was nested within the context of the DELTAS Africa HRCS initiative. This was a five-year programme that ran from 2015- 2020 and funded by Wellcome Trust and UKAID, through DFID. The initiative was coordinated by the African Academy of Sciences' Alliance for Accelerating Excellence in Science in Africa, and the New Partnership for Africa's Development (NEPAD) Agency,[1] and implemented by a network of eleven African-led health research capacity strengthening programmes, commonly referred to as DELTAS ARC. The DELTAS ARC offered collaborative research training programmes in various health-related scientific disciplines, ranging from biomedical and social sciences, spanning 54 lead and partner institutions (research organisations and universities) across SSA, in partnership with Northern academic institutions. In doing so, it facilitated career development of postgraduate science students (Masters and Doctorate), who I refer to in this study as junior researchers, and scientific research professionals (post-doctoral fellows and mid-level researchers), who pursued research work/studies at institutions in their home - or other African-countries. Training offered was designed to provide individuals at all career stages with the academic support and research facilities that they need to develop into world-class researchers.

The eleven DELTAS ARC were as follows:

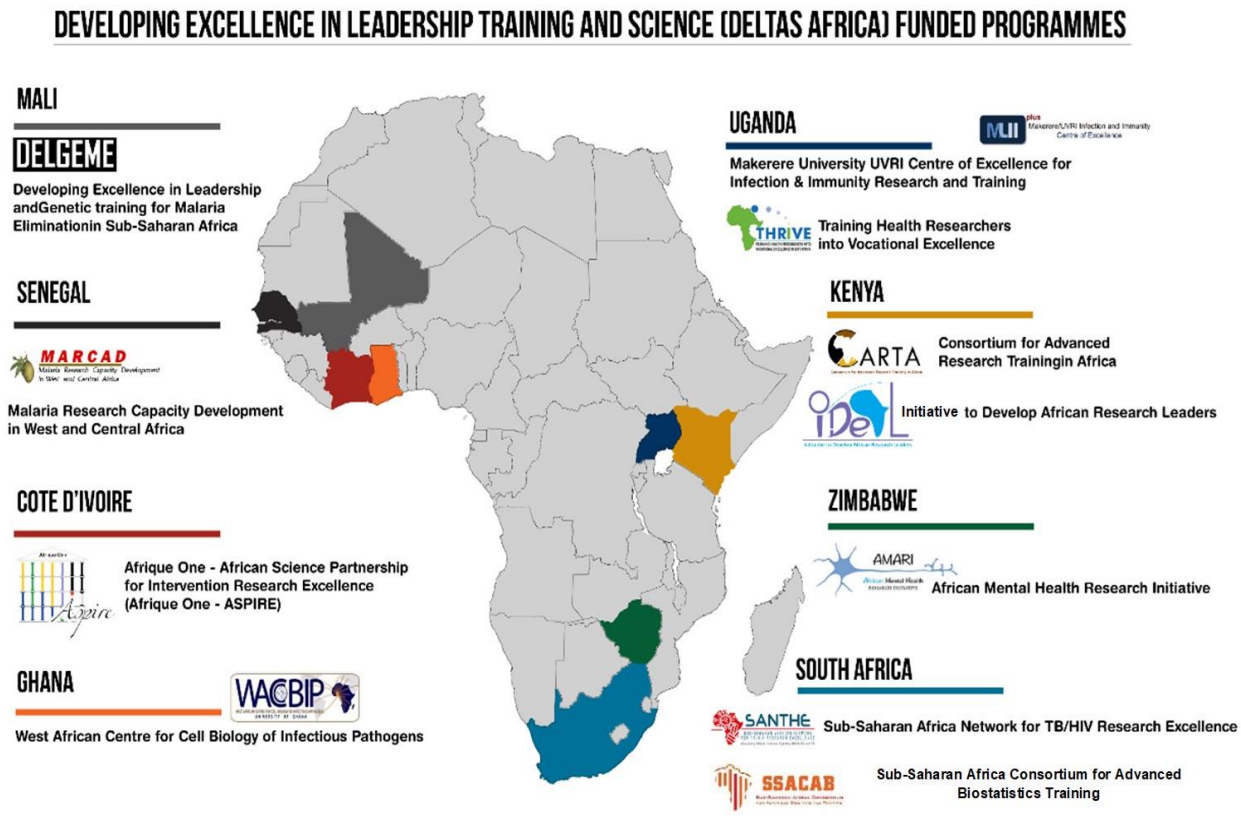
1) Developing Excellence in Leadership and Genetic Training for Malaria Elimination in Sub-Saharan Africa (DELGEME), based at the University of Science, Techniques and Technologies in Bamako, Mali.
2) West African Centre for Cell Biology of Infectious Pathogens (WACCBIP), based at the University of Ghana in Ghana.
3) Malaria Research Capacity Development in West and Central Africa (MACARD), based at the Université Cheikh Anta Diop (UCAD) & Malaria Research Capacity Development in West and Central Africa, in Senegal.
4) African Science Partnership for Intervention Research Excellence (Afrique One-ASPIRE), based at Centre Suisse de Recherches Scientifiques (CSRS) in Côte d'Ivoire.
5) Consortium for Advanced Research Training in Africa+ (CARTA+), led by African Population and Health Research Centre (APHRC) based in Kenya.
6) Initiative to Develop African Research Leaders (IDeAL), a capacity building initiative of KEMRI Wellcome Trust Research Programme (KWTRP) in Kenya.

[1] https://www.aasciences.africa/sites/default/files/Publications/DELTAS%20Africa%20factsheet_2018_0.pdf site accessed on 6th January 2020.

7) Training Health Researchers into Vocational Excellence in East Africa -2 (THRiVE-2), based at Makerere University College of Health Sciences in Uganda.
8) Makerere University and UVRI (MUII-plus), stationed at Makerere University and the Uganda Virus Research Institute (UVRI) in Uganda.
9) African Mental Health Research Initiative (AMARI), based at the University of Zimbabwe in Zimbabwe.
10) Sub-Saharan Africa Consortium for Advanced Bio-statistical Training (SSACAB), based at the Wits School of Public Health - University of the Witwatersrand in South Africa.
11) Sub-Saharan African Network for TB/HIV Research Excellence (SANTHE), based at the KwaZulu-Natal Research Institute for Tuberculosis and HIV (K-RITH) of KwaZulu-Natal University in South Africa (All available at https://aasciences.ac.ke/aas/en/academy/academy-pages/deltas-africa-grantees/ accessed on 17th March 2021 ).

All these eleven DELTAS ARC are geographically spread and operational in sub-Saharan Africa as presented in map below:

*Figure 3.3: Map showing the location of the DELTAS Africa funded Research Consortia*




*Source: [https://aasciences.ac.ke/aesa/programmes/deltas/](https://aasciences.ac.ke/aesa/programmes/deltas/) accessed on 17 March 2021*

## 3.4 Research design

In line with my constructivist epistemology, feminist standpoint theory and intersectional approach, I employed an exploratory qualitative cross-sectional study design, to allow participants to give voice to their own identities and experiences (Cole, 2009). In-depth interviews (IDIs) mainly focus on the individual personal perspective and understanding of the phenomena under investigations and provides an opportunity of giving personal opinions, history, and experiences in discussing sensitive issues (Lewis, 2003). Accordingly, I used in-depth interviews (IDIs) as the main method of data collection with DELTAS supported trainees and research scientists. This was aimed at exploring qualitative narratives about their lived experiences with their science careers as well as experiences with their current institutional environment in shaping their career progression, and how their multiple social identities may have influenced these. Patton (2002) describes key informants as persons who are particularly knowledgeable about the inquiry setting and whose insights can help gain an understanding of the subject under study.

To corroborate information from the IDIs, and also provide additional information on enabling strategies/actions and policy processes, I conducted Key informant interviews (KIIs) with respective consortia research leaders/directors, programme managers/coordinators, monitoring and evaluation officers, and supervisors (co-investigators).

## 3.5 Study Population

My study population comprised of all women and men research fellows and scientists who were affiliated with or working within the selected DELTAS ARC. The unit of analysis is individual women and men research fellows and scientists who were integrated within selected DELTAS ARC. Wellcome Trust categorises research scientists[2] as follows:

- Junior researcher - this refers to a student at Masters and Doctoral degree level.
- Early career stage researcher - which means starting a career in as a post-doctoral researcher/fellow.
- Intermediate/middle level researcher – this refers to a stage where one is consolidating his/her research career, and can lead on research projects and is establishing a research team.
- Senior level researcher – you are an experienced researcher responsible for the strategic direction of your research programme(s) and team(s).

Accordingly, a similar approach was used by DELTAS Africa Initiative which categorised its research fellows as masters' students and doctoral students jointly referred to as junior research fellows, post-doctoral fellows/early career researchers, mid-level and senior researchers. I utilised this approach in my presentation of the results.

## 3.6 Sampling Procedure

The intention of this study is to explore the barriers and enablers to intersectional gender equitable scientific career pathways within the DELTAS-funded African research institutions, requires undertaking interviews with a diverse group of participants in multiple purposively selected DELTAS ARC. I adopted the principles of maximum variation sampling. This allowed me to discover patterns for core elements or dimensions that hold across a diverse sample, as well as unique or distinctive variations (Patton, 2002). Purposive sampling is generally used in qualitative research as it is known to provide rich and

[2] https://wellcome.ac.uk/funding/masters-fellowships-public-health-and-tropical-medicine Accessed on 16th March 2020

knowledgeable information, by allowing the researcher to select participants based on specific criteria (Patton, 2002). I used a two-tiered purposive sampling strategy for selection of: 1) consortia and 2) participants within the sampled consortia.

Step one involved purposive sampling of three DELTAS ARC. I have withheld the identity of these consortia for confidentiality purposes (as detailed in section 3.9). I selected them on the basis of: regional representation in SSA (Eastern Africa, Southern Africa, and West and Central Africa); representation of consortia that are located in English and French speaking countries; presence of fellows of diverse nationalities recruited from different African countries; presence of fellows at various career stages from Masters (Msc), doctoral (PhD), post-doctoral research fellowship (PDF) and mid-career research (MCR) scientists. Other inclusion criteria for selection of ARCs included: consortium willingness to participate in this study; and consortium with almost equal representation of female and male DELTAS fellows as students and staff as of the year 2016. Therefore, to inform my purposive sampling of DELTAS ARC, I carried out a review and secondary analysis of 2016 programmatic annual reports of the eleven DELTAS ARC from AESA. The results (which are confidential) showed that nearly all the consortia (9/11) had almost equal representation of female and male and fellows at all levels of research support. Notably, there was only one research consortium that did not recruit fellows from different African Countries other than from the country in which it was located. Regarding the level of research support across the science career pathway by DELTAS ARC, only two consortia recruited research fellows along the whole scientific career pipeline from undergraduate interns up to intermediate scientist level. Regarding consortia representation on the basis of language, all the East Africa and Southern Africa consortia had fellows recruited from Anglophone speaking countries of sub-Saharan Africa. The West Africa research consortia did have fellows recruited from both Anglophone and Francophone countries, for which I purposively selected one that had higher number of Francophone speaking research fellows.

For step two, I sought heterogeneity within each of the purposively sampled DELTAS ARC by using gender as a primary selection criterion for in-depth interview (IDI) study participants. Other multiple social identities were sought along axes of career stage, scientific discipline, duration in the programme/institution, and nationality. All these are considered important when purposively sampling for diversity. A list containing such information was provided by the research directors of the sampled DELTAS ARC, which aided in purposive selection of study participants. Once selected, the inclusion criteria for participants in the category of DELTAS sponsored junior scientists (Masters and PhD Fellows) included

those who: had served at least one year in the institution by the time of recruitment into the study; and were willing to participate in the study. On the other hand, the inclusion criteria for participants in the category of DELTAS supported early and mid-career level scientists (referred to as staff) included those who: had served at least one to two years at the selected consortium/host institution; and were willing to participate in the study. For key informants, I selected them based on their role and knowledge about the functioning and operation of their respective DELTAS ARC.

### 3.6.1 Procedure followed in accessing the DELTAS ARC and study participants

To begin with, I wrote a letter to AESA, the overall institution that was in charge of coordinating the DELTAS Africa Initiative across the participating research consortia, seeking permission to conduct the research within the three selected research consortia (See Appendix B for AESA's approval letter for this research study). Thereafter, I sought another request to AESA to introduce me to the respective research leaders of selected consortia of study focus as well as informing them about the importance of this study. Going through AESA was purely for administration purposes, as it did not have any involvement or influence on the research design, data collection or analysis. Following the response from the research leaders of the respective targeted consortia, I took up the communication by sending them an email, outlining the proposed research project, as well as requesting them whether they were interested and willing to participate in this study. Following their positive response, I shared with them the proposed methodology via email, and gave them at least two weeks for their full consideration before asking their permission to access participants. I informed them that I was the one responsible for selecting and contacting the potential study participants and not AESA, and their decision to participate was at their individual discretion. I requested from the respective consortia research leaders a list of DELTAS supported research fellows or files containing such information pertaining to the two categories of potential study participants. Prior to gaining access to participants' contact details, I requested the respective consortia research leaders asking them to communicate to all fellows supported through the DELTAS initiative, by introducing me as well as seeking their approval as to whether or not personal information relating to them including name(s), gender, research position/rank, location, email address(es) could be shared with me, who I would later contact them by requesting for their participation in the study. They were informed that sharing their contact details did not necessarily mean that they had to participate in the study, and were given one week to respond to this request. However, for those who did not wish to have their contact details passed on to me, they were asked to let the consortia leader know, and without giving any reasons whatsoever. I then sent via email a brief

questionnaire accompanied by an information consent sheet to the research leaders requesting them to forward it to the potential study population within their institutions that are part of the consortia for completion. I gave them at least two weeks before making a follow-up on the same. The questionnaire was aimed at gathering descriptive information such as: sex of the respondent, age, sponsor/project funder, place of work/institution of affiliation, position within the university/affiliated research institutions, number of years within the institution, citizenship, physical disability, language minority (not fluent with the required official language of current institution), ethnic/racial/religious minority, disciplinary field of research focus (i.e. social or biomedical sciences), childcare responsibility /parenthood, marital status among others. The information obtained from analysis of data gathered through electronic administration of the brief questionnaire (See Appendix C - Screening questionnaire for potential study participants) was aimed to guide in the selection and purposive sampling of the case study participants using a maximum variation sampling approach as already outlined above. Thereafter, I planned to contact participants who met the inclusion criteria via email and telephone for scheduling of in-depth interviews. As it is often a peculiar challenge with online surveys, administering the online questionnaire for sampling purposes was not effective as the response rate was very low. I therefore opted to rely on the files received pertaining available socio-demographic characteristics of their fellows, which I used for purposive sampling. I then contacted the potential fellows via email, attached the informed consent form, and requested them to participate in the study. I administered the questionnaire before commencement of interviews.

## 3.7 Sample size and characteristics of study participants

The recommended size of purposive samples can be established inductively and sampling should continue until “theoretical saturation” occurs (Guest et al., 2006). Grounded theory methodology calls for the researcher to acknowledge when data saturation has occurred, or when there are no new emerging concepts or categories coming from the interview data (Birks and Mills, 2011; Urquhart, 2013). Notably, approximately thirty to fifty participants are recommended for grounded theory studies (Guest et al., 2006). Ultimately, I conducted 58 IDIs (32 female and 26 male) with trainees/research fellows at various career stages; and 20 KIIs (4 female and 16 male) with consortia research leaders/directors, programme managers/coordinators, monitoring and evaluation officers, and supervisors (co-investigators) across the three purposively selected DELTAS ARC as presented in Table 3.7 below:

*Table 3.7: Sample size of IDIs and KIIs conducted across the three purposively sampled DELTAS Consortia*

| Consortia | | E. Africa | S. Africa | W&C. Africa | TOTAL |
|---|---|---|---|---|---|
| **Gender** | ***Female IDIs*** | 18 | 8 | 5 | 32 |
| | ***Male IDIs*** | 12 | 9 | 6 | 26 |
| **Total No. of IDIs** | | **30** | **17** | **11** | **58** |
| **Total No. of KIIs** | | **6 (4 Male; 2 Female)** | **9 (7 Male; 2 Female)** | **5 (All male)** | **20** |

### 3.7.1 Characteristics of the IDI sample

The IDI study participants were nationals of thirteen SSA countries across Eastern (Uganda, Kenya, Rwanda, Somali), Southern (Zambia, Botswana and South Africa), and West and Central Africa (Senegal, Ghana, Nigeria, Benin, Mali and Cameroon). They represented three consortia composed of eleven partnering institutions for which seven were research institutes and four were African public universities. The majority identified English as their everyday language of scientific communication (52/58) while the rest reported French. Overall, most study participants identified themselves as biomedical scientists (45/58) while the rest were social scientists (13/58). Regardless of gender, most study participants were from less educated family backgrounds (46/58), where no parents or siblings had attended university. Regarding religious affiliation, most participants identified themselves as Christians (44/58). This was followed by those who identified as Muslims (7/58), with the remainder (7/58) reporting that they did not subscribe to any religion. More female than male participants had young children and the women at early career stages were more likely to have young children than men. Table 3.7.1 summarises the general socio-demographic characteristics of the IDI study participants.

*Table 3.7.1: Socio-demographic characteristics of the IDI study participants (n=58)*

| Gender | Other characteristics | | Total (n=58) | MSc (n=14) | PhD (n=19) | PDF (n=18) | MCR (n=7) |
|---|---|---|---|---|---|---|---|
| **Women (n=32)** | **Age Range** | 25-29 | 9 | 7 | 2 | - | - |
| | | 30-34 | 12 | 2 | 9 | 1 | - |
| | | 35-39 | 5 | - | - | 2 | 3 |
| | | 40-44 | 4 | - | 1 | 2 | 1 |
| | | 45-49 | 2 | - | - | 1 | 1 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **Marital status** | Unmarried* | 16 | 7 | 4 | 3 | 2 |
| | | Married | 16 | 2 | 8 | 3 | 3 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **With children <5 years** | Unmarried (16) | 4/16 | 0/7 | 0/4 | 2/3 | 2/2 |
| | | Married (16) | 12/16 | 2/2 | 6/8 | 3/3 | 1/3 |
| | | **Total (32)** | **16/32** | **2/9** | **6/12** | **5/6** | **3/5** |
| | **Family educational Background**** | Highly educated | 8 | 2 | 2 | 1 | 3 |
| | | Less educated | 24 | 7 | 10 | 5 | 2 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| **Men (n=26)** | **Age Range** | 25-29 | 4 | 3 | 1 | - | - |
| | | 30-34 | 8 | 2 | 3 | 3 | - |
| | | 35-39 | 9 | - | 3 | 5 | 1 |
| | | 40-44 | 2 | - | - | 2 | - |
| | | 45-49 | 3 | - | - | 2 | 1 |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **Marital status** | Unmarried* | **11** | **5** | **4** | **1** | **1** |
| | | Married | **15** | **-** | **3** | **11** | **1** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **With children <5 years** | Unmarried (11) | 0/11 | 0/5 | 0/4 | 0/1 | 0/1 |
| | | Married (15) | 11/15 | 0 | 1/3 | 10/11 | 0/1 |
| | | **Total (26)** | **11/26** | **0/5** | **1/7** | **10/12** | **0/2** |
| | **Family educational Background**** | Highly educated | **4** | **1** | **1** | **2** | **0** |
| | | Less educated | **22** | **4** | **6** | **10** | **2** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |

*Legends: *The label 'unmarried' includes those who identified themselves as single (never married), divorced or separated. I grouped them together for purposes of protecting participants' anonymity and confidentiality particularly for the latter two identities. ** I based this on the parental and sibling's level of education, with those who had attended university considered as highly educated.*

Among married female and male participants in the majority of relationships (24/31), only one partner, the study participant, was in a scientific career.[3] For the remainder of married study participants (7/31), both partners were in scientific research professional careers, which I have referred to as dual scientific career couples, and the majority of these participants were women (5/7). Notably, both female and male participants in dual scientific career unions were at PhD (4) and PDF (3) career stage, and nearly all of them (6/7) had under five-year-old children.

## 3.8 Data collection

I visited the purposively selected DELTAS ARC where I conducted most IDIs (n=47/58) and KIIs (15/20) in-person at the respective consortia secretariat and during the consortia annual scientific meetings. However, given the geographical spread of partner institutions for which some of the study participants were affiliated with, I conducted the remaining interviews (11/58 IDIs, and 5/20 KIIs) via skype and telephone. I conducted the interviews between May and December 2018, all in English. Despite making provision for a bilingual research assistant who was fluent in writing and speaking English and French to help in conducting some interviews in French, all the Francophone study participants expressed that they were comfortable conversing in English Language as opposed to using a translator.

The setting of an interview can influence participants' engagement in the interview process and their description of their life-worlds (Kvale and Brinkmann, 2009). I considered that participants would feel more comfortable being interviewed in an environment and at a time of their choosing and that allowing participants this choice would facilitate collection of richer data. I therefore encouraged participants to nominate an interview location and time that best suited them. As per individual participants' requests, the in-person interviews were held at a location that was most convenient for them, including coffee shops, meeting rooms, or researcher's offices. The time that interviews occurred also varied according to participant preferences.

For the study participants scheduled for Skype and telephone interviews, I requested them in advance to find a quiet place or room where they could hold a private conversation without disturbance. To initiate and guide the interviews I created a set of open-ended questions for different cadre of participants (as described in section 3.6) which I use to guide the interviews (See Appendix D – Interview

[3] In this study, I define such partnership as non-dual career couples.

guides). The interview guide helps to structure the course of the interview and contains the topics to be covered (Kvale and Brinkmann, 2009). The questions I developed were in response to knowledge gaps that I identified after completing the literature review for this study. I recorded all interviews using a digital dictaphone, alongside note taking. On average, the IDIs lasted 90 minutes while KIIs took 75 minutes.

## 3.9 Data processing and analysis

### 3.9.1 Quantitative data analysis

I analysed quantitative data on participants' personal identities descriptively using Statistical Package for Social Sciences version 25. I presented these findings in a tabular format (as per Table 3.7.1). This was helpful for profiling the study participants.

### 3.9.2 Qualitative data analysis

I analysed the qualitative data for this study inductively based on grounded theory approach. Grounded theory is a systematic methodology in social sciences involving the discovery of theory through the analysis of data (Glaser and Strauss, 1967). According to Creswell (2014), the purpose of grounded theory is to develop a theory for an action or process that is "grounded" in the viewpoints of the participants. The approach exists within the interpretive tradition with a focus on learning about the experiences within hidden networks, situations, relationships, and making visible hidden hierarchies of power (Creswell, 2014). The emphasis of this approach is placed on views, values, beliefs, feelings, and ideologies of individuals.

#### *3.9.2.1 Procedure for qualitative data analysis*

All audio data were transcribed verbatim by an experienced qualitative research assistant. Transcription begun after the first few interviews were recorded and continued throughout the data collection exercise. I verified the transcripts by comparing the audio files and scripts with the field notes. Once this process was complete, I employed member-checking to ensure the trustworthiness of these data (Creswell, 2014). I sent a copy of the transcripts to all individual study participants for member-checking to ensure participants' views were appropriately captured. This process also allowed the participants to identify content they preferred to be removed from the analysis e.g. individual characteristics and statements that they felt might easily identify them. Following the member checking process, most of the IDI participants asked to have the identities of their ARC and affiliated institution, number of children, country of origin, and disciplinary field of study withheld for confidentiality purposes. In addition, they suggested that findings be presented as views and experiences of a selection of

participating DELTAS Africa research fellows as a whole, rather than being attributed to specific consortia as 'case studies'. In protecting participant anonymity and confidentiality, I have replaced all identifiers with pseudonyms. However, given the necessity of an intersectional gender analysis, other identities such as age (provided in range), marital status, and presence of dependents are anonymously presented where necessary.

Rubin and Rubin (2011) recommends two phases be utilised for interview analysis. Transcripts are transcribed, read several times by the researcher; then coded into themes and categories that relate to the research question. In doing so, a software could be used as it allows the researcher to quickly regroup interview data, enhancing ability to link concepts and themes, refine them, and locate evidence (Rubin and Rubin, 2011). Following receipt of feedback from the study participants on member-checking, I familiarised myself with transcripts by reading and re-reading them several times, then developed a coding framework (see Appendix E). Thereafter, I coded the transcripts in a computer assisted qualitative data analysis software, QSR International's NVivo 11. This aided in the data management and analysis process. The coding process was informed by Urquhart's (2013) coding terminology, who terms the three coding phases as: open, selective, and theoretical as follows:

i. **Open Coding** - Open or initial coding is the phase when each line of transcribed interview text is coded line by line (Urquhart, 2013). As its name reflects, line-by-line coding is a critical part of grounded theory methods where coding each line of the transcribed interviews by using a few words to describe the data (Birks and Mills, 2011; Charmaz, 2006). This method of coding was helpful in gaining in-depth focus on every interview, enabling me to identify new emerging concepts from the data itself. Coding line by line in open coding typically results in many codes (Urquhart, 2013).

ii. **Selective coding** – It begins to occur when there are no new open codes, or when codes relate only to the core categories that begin to emerge (Urquhart, 2013). In general, it is used to identify core categories, patterns and relationships emerging through an on-going cyclic process of comparing data with data (Birks and Mills, 2011; Urquhart, 2013). Sometimes a single selective code becomes a prominent theme, or a theoretical code (Birks and Mills, 2011; Urquhart, 2013). In selective coding, the researcher strives to find categories emerging, but will hopefully not have as many selective codes as open codes. I used this approach to identify core emergent categories.

iii. **Theoretical Coding** – It occurs when the codes and categories that emerged during open coding and selective coding are compared to find constructs, connections, and explain relationships to generate theory or new concepts (Urquhart, 2013). Given coding is an iterative process, new codes should be constantly compared to existing data to determine if new categories emerge and whether these new categories are densifying. However, Birks and Mills (2011) argued that theoretical coding can also begin during open coding, if the initial data starts to reveal concepts that begin to signal potential theories or explanations of phenomenon.

Thereafter, I analysed the data inductively based on emergent themes, utilising a grounded theory approach, employing constant comparative analysis (Charmaz, 2006; Glaser and Strauss, 1967), whilst aligning the themes to the Liani and colleagues (2020) integrated conceptual framework developed as part of the literature review in Chapter two. Specifically, I kept comparing data from the interviews for each of the participants for emergent patterns informed by gender and other multiple social identities/axis of identity, and linked them to various components of the conceptual framework. I have presented participants views using verbatim quotes.

## 3.10 Quality assurance across thesis

### 3.10.1 Trustworthiness of the data

Trustworthiness is a term used in qualitative research to establish whether data collected and analysed during the research process is credible, transferable, dependable and confirmable (Lincoln and Guba, 1985). Credibility refers to the truthfulness, which relates to internal validity that determines whether the findings are reliable as it relates to the study. Transferability refers to showing that the findings are consistent and can be used in other contexts. Dependability is a concept used to refer to consistency and duplication of the research. While confirmability refers to the degree of neutrality in the study regarding the researcher's bias. I utilised several techniques to ensure that findings are trustworthy as follows:

**a. Credibility**

I utilised a variety of measures throughout this study to establish credibility. Member checking and peer examination should be utilised to ensure accuracy and to enhance credibility (Creswell, 2014; Lincoln and Guba, 1985). In this study, this was achieved through sending a copy of the transcripts to all individual study participants for member-checking to ensure participants' views were appropriately captured as detailed in sub-section 3.9.2.1 above. I also spent ample time with study participants to check for distortions during the data collection process. The significant number of open-ended questions enabled

me to effectively comprehend the nature of the participants' assertions. I also held regular peer debriefing sessions with my supervisors to discuss the conceptual basis used, and to broaden the perspectives of the study, coding framework and process, interpretation and presentation of the analysed data. Moreover, following the tradition of naturalistic inquiry, I coded the data based upon replicable themes and concepts that emerged from the data. I have included the participants' perspectives by using verbatim phrases from interviews to illustrate the themes presented in the findings (Chapters four, five and six). Triangulation is a method used to judge the validity and accuracy of data by comparing differing points of view (Creswell, 2014), thus helpful in minimising the threat of researcher bias. During data analysis, I used the conceptual framework (as provided in Chapter two), and adopted the constant comparison approach to triangulate my analysed the data.

**b. Transferability**

According to Lincoln and Guba, (1985), transferability relies on providing a description of the content and context of the inquiry that is detailed enough to make a judgment about transferability. I have aimed to address this in the design of my thesis by providing a detailed description of the study sites. The literature review and conceptual framework developed from the data also serves to draw out the themes from a global perspective. Lincoln and Guba (1985) pointed out that the burden of transferability lies on the initial researcher to provide the data to make the judgment. To help ensure transferability in this study, I triangulated the data gathered from the IDIs using KIIs to provide corroborating evidence.

**c. Dependability**

Dependability shows that the findings are consistent and could be repeated (Lincoln and Guba, 1985). I have aimed to address this by writing a clear and detailed account of the research process, including data collection and analysis procedures, and the procedures followed in recruitment of study participants.

**d. Confirmability**

The research study and conclusions drawn from the data can always be shaped by the researcher's personal experiences. As Malterud (2001) points out, "A researcher's background and position can affect what they choose to investigate, the angle of investigation, the methods judged most adequate for the study purpose, the findings considered most appropriate, and the framing and communication of conclusions" (pp. 483-484). The confirmability of the findings has been reflected through my

presentations of key research findings to DELTAS AGMs, conferences, seminars, symposium, producing annual learning reports for, and sharing confidential feedback reports to the respective DELTAS ARC, among others as provided in the timeline of my thesis time journey (See Appendix F). This was useful for feedback provision that further guided my interpretation and presentation of the findings.

### 3.10.2 Reflexivity and researcher's positionality

In qualitative research, reflexivity is very important to ensuring trustworthiness as it improves transparency of the principal researcher's unintentional influence on the collection, analysis and interpretation of the study data (Malterud, 2001). Reflexive practices such as "bracketing" may help the researcher to acknowledge his or her own vested interests, personal experience, cultural factors, assumptions, and hunches that could influence how he or she views the study's data (Fischer, 2009:583). On the other hand, positionality has been operationalised as reflexivity, an activity in which a researcher identifies, examines, and owns their backgrounds, perspectives, experiences, and biases in an effort to strengthen research quality, which are all integral to the research process (Charmaz, 2006; Patton, 2002; Secules et al., 2021). Positionality captures a dichotomy of outsider and insider doctrines of research, whereby the outsider doctrine values detached observations from 'neutral' researchers not belonging to the group under study, while the insider doctrine values researchers studying a group to which they belong and the ability to authentically engage members of that group (Merriam et al., 2001; Secules et al., 2021). Even though positionality is determined by where one stands in relation to 'the other' – research participants or 'the researched', discussions of insider/outsider status have acknowledged that the boundaries between these two positions are not all that clearly delineated, as there is slippage and fluidity between these two states, in which positions can shift (Merriam et al., 2001). More importantly, the identity of the researcher with regard to dimensions such as education, gender, race, social status relative to those interviewed, or other societal structures and institutions may inevitably shape the kind of data generated in association with insider or outsider status (Green and Thorogood, 2009; Merriam et al., 2001). In the ensuing section, I provide some examples of my own outsider/insider positionality and the reflexive approach taken throughout the study.

I brought both an insiders' and outsiders' stance to this research. My thesis was completed in collaboration with the DELTAS Africa LRP, which worked alongside the DELTAS Africa HRCS initiative to document learnings about how they were fostering and enhancing equitable career pathways of

researchers. Towards the beginning of my thesis journey, July 2017, I was able to attend the first DELTAS Africa Annual Grantees Meeting (AGM) in Ghana where all consortia and partners institutions attended. This was an early opportunity to introduce myself, present my research proposal (oral and poster presentation), meet, and build rapport with DELTAS fellows and consortia research directors and management team. However, by virtue of my affiliation to DELTAS LRP as a PhD research fellow mandated to lead the thematic research strand on equitable career pathways, this placed me in a different position for which I was considered an outsider. I was aware of subconscious ways in which participants assumed that I was part of AAS AESA team, conducting an evaluation of the DELTAS programme, which some DELTAS fellows at that forum were reluctant to participate in this study, as they perceived me as an outside evaluator. I constantly reminded them that this was a learning research study that was contributing towards my PhD research work. In addition, my position as an outsider was based on the fact that I was neither affiliated to any of the DELTAS ARC nor previously worked with participating institutions that were part of the purposively selected DELTAS consortia.

Indeed, during my visit for data collection to all the three purposively sampled DELTAS consortia, I held a one-hour seminar presentation about my proposed research study – findings from the literature review, aims of the study and the methodology to be adopted, prior to doing interviews. At the beginning of each seminar, I shared information about my biography pertaining to my current role/position and institutional affiliation, academic and professional background, prior work experience in gender research. During the question-and-answer session following completion of my presentation, I felt my position as an 'outsider' with study participants begun to shift, as the DELTAS fellows and consortia management team members became more critical of the challenges they experienced and were willing to suggest ideas of how narrow the gender inequity gap in scientific research career progression. Moreover, I believe that my attendance to all the DELTAS AGMs over the four-year period and constant informal conversations with the DELTAS Africa community greatly influenced the shifting of my positionality from an outsider towards being seen as an insider.

It has commonly been assumed that being an insider means easy access, the ability to ask more meaningful questions and read non-verbal cues, and most importantly, be able to project a more truthful, authentic understanding of the culture under study (Merriam et al., 2001). However, this is necessarily not always the case (Secules et al., 2021). Given that I had met most participants informally at the DELTAS AGMs and during their attendance to my seminars, they had come to consider me as one

of their own. They came to the interviews with some knowledge of my personal and professional background as a result of previous interactions. Awareness of my positionality as an insider played out in different ways throughout this research. For instance, during the interviews, I could ask some participants about particular life and career experiences they may not have initially mentioned i.e. whether they were married and had children and how such identity shaped their career progression. At the end of the interview, some women and men participants posed the same question to me by asking: How old are you? Are you married? Do you have children? My honest response was that I am unmarried African female doctoral researcher in my mid-thirties without children.

Some participants, particularly the men, were curious to know why I was still unmarried at such an age, for which I informed them that was my own personal decision to first establish my career before getting married and bearing children. This was informed by my own observation of how women struggle with juggling between family and postgraduate studies, most of who end up not graduating. I also have witnessed some of my female friends forfeiting fellowship opportunities because of family commitments. I felt personal resonance with what the participants were narrating on some of the reasons as to why most women do not progress in their careers at the same pace with men. Consequently, while some participants asserted that perhaps that is why I am finding it interesting to research on this topic, others, particularly men, noted that maybe I am doing this study to find resolve to my career progression and personal life. I consistently reflected about such sentiments as I attempted to understand and interpret my participants' challenges to scientific career progression based on their lived experiences. For instance, when I reflect on my own research career experiences, the main presentation of self that I think has motivated me in this research study, has been my empathy for those junior and early career women researchers who are married with young children, and whom I recognise as different from me but equally as human as I, wondering how they manage to juggle between career and family.

On the other hand, insiders have been accused of being inherently biased with data collection and interpretations of the findings (Merriam et al., 2001). In this study, my knowledge, experience, values and beliefs are 'bracketed' as much as possible to ensure they did not create a bias during the research process (Fischer, 2009). I approached this study with both sensitivity and a strong desire to uplift the voices and experiential realities of African women and men scientific researchers by using participants' excerpts in an effort to support interpretations of the data and to make visible how multiple identities

shapes inequities in their career progression. I am a social research scientist, with disciplinary training background in Anthropology and Gender studies, with extensive work experience in conducting gender research using qualitative methods. As such, I regularly interrogated my interpretations to be reflective, addressed potential assumptions and biases through keenly listening to participants experiences, and attempted to ensure consistency in adopting the social constructivism epistemological stance, drawing upon feminist research perspectives and grounded theory approach. Based on the above reflections, I acknowledge that I was more of an insider than outsider. As Merriam and colleagues (2001) puts it, sometimes the boundaries between these two positions are not all that clearly delineated, as there is slippage and fluidity between these two states, in which positions can shift.

To minimise researcher's bias, the study triangulated inputs from multiple sources including my supervisors which ensured that data collection and analysis did not reflect the bias of myself as the principal researcher. Throughout the course of the four- and half-year period, I produced annual learning reports (available at https://bit.ly/3doNCqh), which were fed back to DELTAS Africa Consortia through AESA. Moreover, courtesy of the DELTAS LRP Fellowship Programme, I was a member of the LSTM gender and health group, a key working group with particular strength with gender integration and analysis in qualitative research. I had an opportunity to present my work to this working group at different stages of my PhD journey – proposal, literature review findings, preliminary empirical findings, and my thesis structure - from which I gained useful feedback on how to undertake intersectional gender analysis for my research study. This served as a community of practice for peer checking and knowledge exchange. I have also disseminated my findings to other subject related fora (As summarised in Appendix F). During these dissemination presentations, I encouraged subject matter experts to challenge findings and recommendations as well as asking for clarity or ideas as to what issues could be interrogated further. Delivering these presentations aided in the triangulation of data sources and study

findings. This has supported the trustworthiness of my study findings as well as encouraging critical reflection on the practicability of my recommendations.

## 3.11 Ethical Considerations

The study received required approvals from the Liverpool School of Tropical Medicine Research Ethics Committee (Protocol ID: 17-075 – See Appendix G) and the Strathmore University Institutional Ethics Review Committee (Protocol ID: SU-IRB 072/18 – See Appendix H). Collaboration and administrative approval were also sought from AESA (see the approval in Appendix B).

**Obtaining Informed Consent**

Prior to conducting face to face, telephone or Skype interviews, I sent a written informed consent and participant information sheets (See Appendix I) to potential participants via email to read in advance, outlining the research project, aims of the study and related risks and benefits, and acknowledging participant's rights to refuse to participate or withdraw from the study at any time. I also explained this information orally during the scheduled day of the interview. I encouraged participants to exercise their right of voluntarism in deciding whether or not to participate in the study, and asked them if they had any questions or concerns, which they addressed before providing a written informed consent. I sought permission from all potential study participants to have the interviews digitally recorded and hand-written notes taken as well, which they also accepted. For telephone and Skype interviews, I sought both verbal and written consent from the study participants, whom I asked to acknowledge receipt of the email by confirming that they have received the study information sheet, have read and understood it and have agreed to participate in the study through providing details stated in the 'Research participant' section (as provided in certificate of consent section of the information sheet) as a proof of written consent to participate in the study. All participants gave written informed consent prior to the interviews. All interviews conducted in person, by telephone or via skype were audio-recorded using a digital dictaphone, alongside note taking.

**Privacy and Confidentiality**

To ensure privacy of participants during in-person interviews, I made efforts to conduct the data collection in a place or room that was private and comfortable for the participants. To ensure that I did not disrupt their duties and breach confidentiality, the participants suggested a time and location that was most convenient to them, including coffee shops, meeting rooms, and researcher's offices. For the

study participants scheduled for Skype and telephone interviews, I requested them in advance to find a quiet place or room where they could hold a private conversation without disturbance. I informed that Skype calls are usually encrypted, thus the conversation would not easily be hacked. In addition, I cautioned them there is potential for loss of confidentiality if a third party enters the room during a Skype/telephone conversation. I advised them to immediately alert me to pause the interview by hanging up the call or have it rescheduled for another day at a time of their convenience just in case this happens. Overall, I encouraged all participants not to speak about/share insights from the study to their colleagues. All audio data were transcribed verbatim by an experienced qualitative research assistant who signed a non-disclosure form on maintaining anonymity and confidentiality (See Appendix J) prior to transcribing the interviews. In reporting the findings, I have ensured that no personal identifiers are revealed as I have replaced them with pseudonyms.

### Data storage

The electronic versions of transcripts and audio recordings were saved in password protected computer files and flash drive, which are only accessible to the research assistant and me, as the principal investigator. I have safely stored all paper documents such as informed consent sheets and field notes in a locked cabinet, and the key to the filing cabinet is under my custody as the researcher. I will destroy all the data after five years from the date of interview/discussion. Specifically, I will shred information gathered on paper documents while soft copy data in computer hard disk and memory sticks will permanently be destroyed using the eraser software, which is a file shredder program that is used to remove sensitive data from hard drive by overwriting it several times.

### Good clinical practice training

As the principal researcher, I availed myself for the “Good Clinical Practice” training organised by LSTM to refresh my knowledge on the set of internationally recognised ethical and scientific quality requirement for designing, conducting, recording, and reporting studies that involve human subjects. The relevant content of this training was respected throughout all the stages of the research.

# Chapter 4: Results – Familial and socio-cultural drivers of intersectional gender inequities in scientific career progression

## 4.1 Chapter Overview

This chapter aims to answer the first research question: How does familial and socio-cultural factors shape inequities in scientific career progression, and their disadvantages in relation to their multiple social identities, along the scientific career pathway in selected DELTAS institutions? It outlines the rationale for, and methodological approach to undertaking the empirical research. It utilises the conceptual framework developed within the literature review in chapter two to frame the results and discussion sections. Finally, it provides implications for policy and practice, highlights the study limitations and conclusions. This paper has been accepted for publication in the Global Health Research and Policy Journal subject to minor changes which I have addressed, and resubmitted. As this paper draws multiple elements of this thesis together, there is some overlap in this chapter and chapters two, six and seven.

**An intersectional gender analysis of familial and socio-cultural drivers of inequitable scientific career progression of researchers in sub-Saharan Africa**

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**Author Contributions:**

**ML:** Conceptualisation, Project administration, Study design, Data collection, Data Analysis and interpretation, Writing – original draft preparation, review and editing the manuscript.

**IN:** Guidance and support with conceptualisation and study design, Validation of data analysis process and feedback provision on data interpretation, Writing – review and editing, PhD Supervision

**JP:** Guidance and support with study design, Writing - review and editing, Funding acquisition.

**RT:** Guidance and support with conceptualisation and study design, Validation of data analysis process and feedback provision on data interpretation, Writing – review and editing, PhD Supervision, Funding acquisition.

## 4.2 Abstract

***Background:*** This study sought to illuminate familial and socio-cultural drivers that contribute to intersectional gender inequities in scientific career progression in Sub-Saharan Africa (SSA) by drawing on lived experiences of women and men researchers. The findings are drawn from a wider research study that was aimed at gaining an in-depth understanding of the barriers and enablers of gender equitable scientific career progression for researchers in SSA. This was nested within the context of 'Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) – a health-based scientific research capacity strengthening initiative.

***Methods:*** The study adopted an exploratory qualitative cross-sectional study design. In-depth interviews were conducted with fifty-eight (32 Female and 26 Male) trainees/research fellows at various career stages, supported and/or affiliated to three purposively selected African Research Consortia. The interviews were conducted between May and December 2018 in English. The data was analysed inductively based on emergent themes.

***Results:*** Four themes were identified. First: characterisation of the normative career pathway and progression requirements. Second: social power relations of gender within the family and wider society. Third: researchers' experiences of navigating between the 'two different lives' – family and career, and the resultant implications for their career progression and personal well-being. Fourth, potential strategies utilised by women for navigating the 'two different lives' and their impacts.

***Conclusions:*** This study offers important policy and practice measures and approaches for fostering equitable scientific research career progression for women and men within research capacity strengthening initiatives in SSA. These includes the need for: reforms in institutional human resources policies and systems; a more fundamental re-think of the normative scientific career structure to create equitable opportunities, improving diversity and well-being of both female and male researchers; additional support and potential adjustments to expectations for language minorities in science; and embracing gender transformative approaches in science.

## 4.3 Background

Women's under-representation in scientific careers, and especially in senior positions is a well-known and persistent global problem (Mavriplis et al., 2010; The Royal Society, 2011; Thege et al., 2014). A commonly shared explanation is that women experience conflict balancing scientific work and familial responsibilities (i.e. Beaudry and Prozesky, 2017; Beoku-Betts, 2004; Mabokela and Mlambo, 2015; Masanja, 2010; Prozesky, 2006 and 2008; Raburu, 2015; Thege et al., 2014) leaving them with less time for the former (Rathgeber, 2013). Existing literature on gender and science careers in industrialised countries shows that women's slow progression and attrition at each stage of the scientific career ladder is due to career processes that are influenced by multifaceted social forces at individual, familial, and societal levels (Miller and Wai, 2015). Such impediments to women's career progression tend to more pronounced in low and middle income countries (Sarwar and Imran, 2019), although there is also substantial variation across contexts due to religious, socio-cultural, economic and political differences among others. For example, studies from south and South-East Asia have pointed to the influence of religious and socio-cultural norms, values and traditions, which allocate gender roles to men as family breadwinners and women as caregivers (Fazal et al., 2019; Sarwar and Imran, 2019). Such gendered division of labour has been identified as promoting notions of 'ideal' women as a dutiful wives, mothers and homemakers, who are expected to take more family responsibilities than men (Nguyen, 2013), constraining their opportunities in the workplace (Fazal et al., 2019). In majority Islamic contexts in particular, restrictions on women's mobility and participation in employment, including the association of women working as a threat to family honour have been identified as limiting women's career opportunities and progression (Fazal et al., 2019; Malik and Courtney, 2011).

Extant literature from SSA indicates that family obligations affect women differently to men, as women spend on average more time caring for children and the elderly (Thege et al., 2014). Nonetheless, the distinct factor for African women research scientists is they are more likely to be married with families in comparison to their European or North American counterparts at the same stage in their careers (Josephine Beoku-Betts, 2004). Indeed, in most African societies, men are privileged as they are not expected to contribute to domestic labour and childcare, resulting to women's constraint of juggling marriage and family life while pursuing a scientific career (Josephine Beoku-Betts, 2004). However, in SSA, there is a dearth of concrete information on the causes of women's under-representation in scientific research workforce particularly at higher levels (Okeke et al., 2017) compared to the wealth of information that exists in the global north (Campion and Shrum, 2004; Morley et al., 2006). In addition, SSA still suffers from a paucity of empirical studies about how gender intersects with other individual multiple social identities to produce inequities in career progression outcomes for both women and men research scientists, as most of the available studies have focused only on women as a homogenous group (Liani et al., 2020). This presents a knowledge gap about the career experiences of women and men scientists in the SSA (Mabokela and Mlambo, 2015; Morley, 2005).

In this paper we illuminate familial and socio-cultural drivers that contribute to intersectional gender inequities in scientific career progression in SSA by drawing on lived experiences of women and men researchers. The data presented is part of a wider research study set within the context of 'Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) – a health-based scientific research capacity strengthening initiative. This is a five-year (2015-2020) initiative whose vision is to train and develop the next generation of internationally competitive African scientific health researchers and research leaders while fostering career pathways (Kay, 2015). The ultimate goal of this study was to produce evidence from a holistic, gender comparative and intersectional perspective that can be used to develop strategies to promote career equity for internationally competitive African scientific researchers.

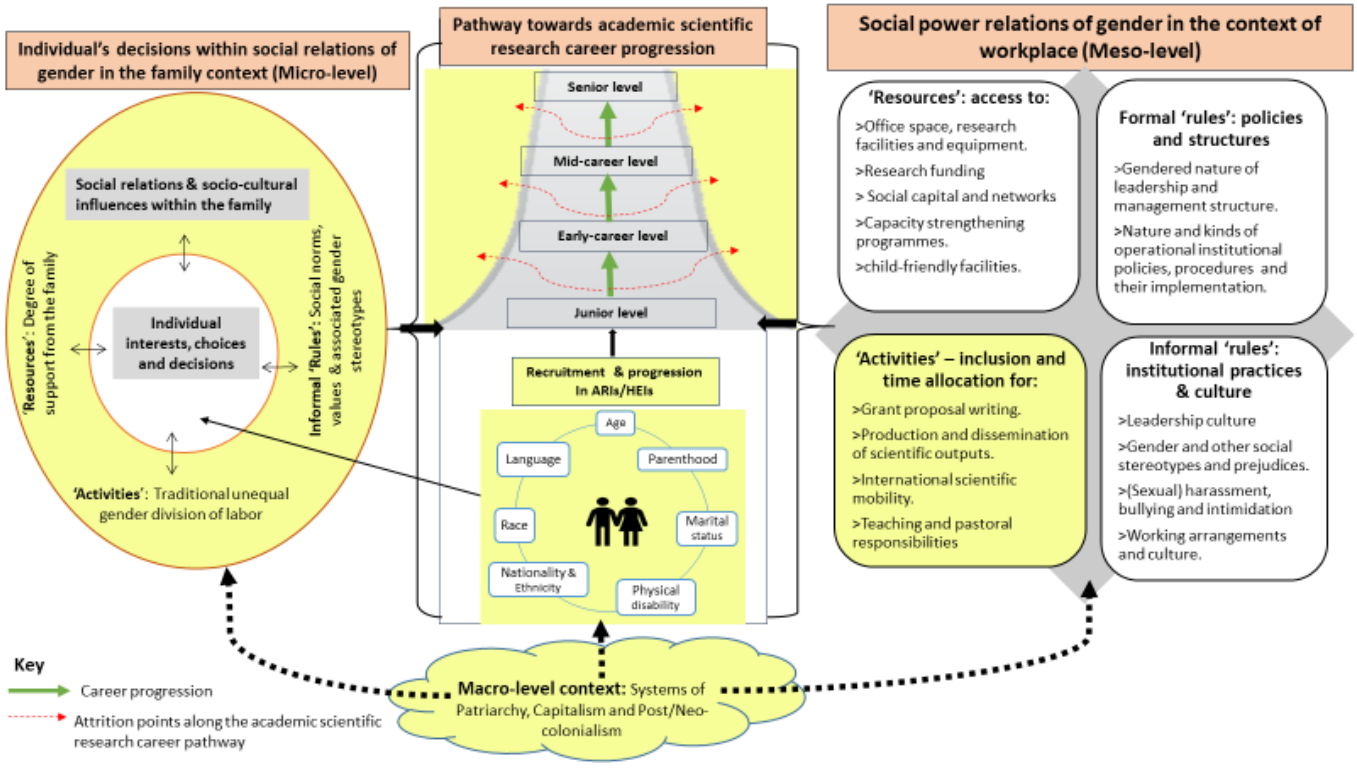
## 4.4 Methods

### 4.4.1 Theoretical and conceptual framing

The empirical research for this study was informed by three theories and models: Systems of Career Influences Model (Magrane et al., 2012); the Social Relations Approach (Kabeer, 1994; Kabeer and Subrahmanian, 1996; March et al., 1999); and Intersectionality theory (Crenshaw, 1991; Hancock, 2007).

These three theoretical and conceptual models were drawn together to form an integrated conceptual framework (Liani et al., 2020) (see Chapter two) which was developed based on existing evidence around the current research problem within the context of SSA as presented in Figure 4.4.1 below.

*Figure 4.4.1: An integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in SSA*




The Systems of Career Influences Model (Magrane et al., 2012) provides the central core of the framework, focusing on the interplay between socio-cultural influences within the family and organizational factors in shaping career advancement of women. Kabeer's Social Relations Approach (Kabeer, 1994) provides key dimensions for an institutional gender analysis – within the family and workplace, expressed as 'rules' (formal and informal), 'resources' and 'activities', which are all permeated by 'power'. The intersectionality lens (Crenshaw, 1991; Hancock, 2007) is then explicitly added to highlight the multiple social identities and related power of these individuals according to aspects such as age, professional cadre, marital status, ethnicity, language minority, (dis)ability, and parenthood.

We used this integrated conceptual framework as a lens for understanding how gendered social relations and processes within the institution of the family interact with societal norms, values and expectations in shaping career progression opportunities of women and men in their day-to-day

scientific research 'activities'. We have taken gender as a key entry point into analysing the positionality and experiences of individual researchers, who according to an intersectionality perspective, may further be identified as (dis)advantaged based on other multiple intersecting social categories. Individuals may either get 'stuck' at a relatively junior level or opt out of the scientific career path. In this paper, as indicated in the components of the framework highlighted in yellow, we focus on how participation in scientific research activities (right box-lower level), is influenced by the social relations of gender within the family context - micro-level system (left box) - which determines progression along the pathway towards academic scientific career ladder for women and men scientific researchers in SSA, who have multiple social identities (middle box). We also indicate how such processes are reinforced by the macro-level systems of patriarchy, capitalism, and neo/colonialism in producing and reproducing inequities. The remaining constituents of the framework are explored in another paper focused on the gendered nature of the social power relations of the workplace (Liani et al., forthcoming).

### 4.4.2 Study design and setting

We adopted an exploratory qualitative cross-sectional study design. The research was conducted within the context of the DELTAS Africa initiative. The initiative is coordinated by the African Academy of Sciences' Alliance for Accelerating Excellence in Science in Africa,[4] and implemented by a network of eleven African-led health research capacity strengthening programmes, commonly referred to as DELTAS Africa Research Consortia (DELTAS ARC). The DELTAS ARC offers collaborative research training programmes in various scientific disciplines spanning 54 lead and partner institutions (research organizations and universities) across SSA, in partnership with Northern academic institutions. In doing so, it facilitates career development of postgraduate science students (Masters and Doctorate), who are referred to in this study as junior researchers, and scientific research professionals (post-doctoral fellows and mid-level researchers), who pursue research work/studies at institutions in their home- or other African-countries.

### 4.4.3 Study population and sampling strategy

The study population comprised of all women and men research fellows and scientists who were affiliated with or working within the purposively selected DELTAS ARC. The unit of analysis is individual

[4] https://www.aasciences.africa/sites/default/files/Publications/DELTAS%20Africa%20factsheet_2018_0.pdf site accessed on 6th January 2020.

women and men research fellows and scientists who were integrated within selected DELTAS ARC. The findings could be generalisable to similar populations elsewhere, although this should be done with caution in unrelated contexts or settings.

We adopted the principles of maximum variation sampling. This allowed us to discover patterns for core elements or dimensions that hold across a diverse sample, as well as unique or distinctive variations (Patton, 2002). We used a two-tiered purposive sampling strategy for selection of: 1) consortia and 2) participants within the sampled consortia. Step one involved purposive sampling of three DELTAS ARC. These were selected on the basis of: regional representation in SSA (Eastern, Southern, and West and Central Africa); representation of consortia that are located in English and French speaking countries; presence of fellows of diverse nationalities recruited from different African countries; and presence of fellows at various career stages including Masters (MSc), doctoral (PhD), post-doctoral research fellows (PDF) and mid-career research (MCR) scientists.

For step two, we sought heterogeneity within each of the purposively sampled DELTAS ARC by using gender as a primary selection criterion for in-depth interview (IDI) study participants. Other dimensions of multiple social identities were sought along axes of career stage, scientific discipline, duration in the programme/institution, and nationality. A list containing such information was provided by the research directors of the sampled ARC, which aided in purposive selection of study participants.

### 4.4.4 Data collection methods

Data was collected using in-depth interviews with trainees/research fellows at various career stages supported by and/or affiliated to the DELTAS ARC. Interviews aimed at exploring qualitative narratives about their lived experiences with undertaking scientific research activities and the familial and societal expectations and relations shaping their career progression. We collected additional information about personal identities such as age, marital status, presence of children, nature of partnership (dual or non-dual career couple), through administering a brief questionnaire before commencing of IDIs. During the interviews, we asked the participants to reflect on how such identities shaped their everyday experiences with their scientific career taken.

In total, 58 participants were interviewed, of whom 32 were female and 26 were male, across the three selected ARC. Most interviews (n=47/58) were conducted in-person by the lead author (ML), a social science doctoral candidate with extensive experience in conducting qualitative interviews, at consortia secretariat or annual scientific meetings. The remainder were conducted via skype and telephone. Interviews were conducted between May and December 2018, all in English. Despite making provision for assistance to conduct some interviews in French, all the Francophone study participants expressed that they were comfortable conversing in English. All interviews were audio-recorded using a digital dictaphone, alongside note taking. On average, the interviews lasted 90 minutes.

### 4.4.5 Data Processing and Analysis

Quantitative data on participants' personal identities was analysed descriptively using Statistical Package for Social Sciences version 25. All audio data were transcribed verbatim by an experienced qualitative research assistant. The transcripts were verified by comparing the audio files and scripts with the field notes. Once this process was complete, transcripts were sent to respective study participants for member-checking to ensure their views were appropriately captured. This process also allowed the participants to identify content they preferred to be anonymised e.g. individual characteristics and statements that could identify them.

Following member checking, the majority of participants asked to have the identities of their ARC and affiliated institution, number of children, country of origin, disciplinary field of study withheld for confidentiality purposes. In addition, they suggested that findings be presented as views and experiences of participating DELTAS Africa research fellows as a whole. All anonymised identifiers have been simplified accordingly. However, to enable presentation of an intersectional gender analysis, other identities such as age (provided in range), marital status, nature of partnership, and presence of dependents are anonymously presented where necessary. ML organised and coded the data in QSR International's NVivo 11 qualitative data management software, and analysed these inductively based on emergent themes, whilst aligning the themes to the developed integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in SSA (Liani et al., 2020). ML utilised a grounded theory approach, employing constant comparative analysis (Charmaz, 2006; Glaser and Strauss, 1967). All illustrative quotes have been carefully reviewed for their potential to reveal individuals' identity.

## 4.5 Results

This section presents findings on characteristics of the study participants, as well as the four interrelated themes that were identified. Specifically, the themes illustrate how women's and men's participation in scientific research activities is shaped by interactions between familial and socio-cultural drivers, and the structure of normative career pathways. In this process, gender intersects with other aspects of identities, leading to differing working experiences and inequities in career progression.

### 4.5.1 Characteristics of the sample

The study participants were nationals of thirteen SSA countries across Eastern (Uganda, Kenya, Rwanda, Somali), Southern (Zambia, Botswana and South Africa), and West and Central Africa (Senegal, Ghana, Nigeria, Benin, Mali and Cameroon). The majority identified English as their everyday language of scientific communication (52/58) while the rest reported French. Regardless of gender, most study participants were from less educated family backgrounds (46/58), where no parents or siblings had attended university. More female than male participants had young children and the women at early career stages were more likely to have young children than men. Table 4.5.1 summarises the general socio-demographic characteristics of the study participants.

*Table 4.5.1: Socio-demographic characteristics of the study participants (n=58)*

| Gender | | Other characteristics | Total (n=58) | Msc (n=14) | PhD (n=19) | PDF (n=18) | MCR (n=7) |
|---|---|---|---|---|---|---|---|
| **Women (n=32)** | **Age Range** | 25-29 | 9 | 7 | 2 | - | - |
| | | 30-34 | 12 | 2 | 9 | 1 | - |
| | | 35-39 | 5 | - | - | 2 | 3 |
| | | 40-44 | 4 | - | 1 | 2 | 1 |
| | | 45-49 | 2 | - | - | 1 | 1 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **Marital status** | Unmarried* | 16 | 7 | 4 | 3 | 2 |
| | | Married | 16 | 2 | 8 | 3 | 3 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **With children <5 years** | Unmarried (16) | 4/16 | 0/7 | 0/4 | 2/3 | 2/2 |
| | | Married (16) | 12/16 | 2/2 | 6/8 | 3/3 | 1/3 |
| | | **Total (32)** | **16/32** | **2/9** | **6/12** | **5/6** | **3/5** |
| | **Family educational Background**** | High education | 8 | 2 | 2 | 1 | 3 |
| | | Low education | 24 | 7 | 10 | 5 | 2 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| **Men (n=26)** | **Age Range** | 25-29 | 4 | 3 | 1 | - | - |
| | | 30-34 | 8 | 2 | 3 | 3 | - |
| | | 35-39 | 9 | - | 3 | 5 | 1 |
| | | 40-44 | 2 | - | - | 2 | - |
| | | 45-49 | 3 | - | - | 2 | 1 |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **Marital status** | Unmarried* | **11** | **5** | **4** | **1** | **1** |
| | | Married | **15** | **-** | **3** | **11** | **1** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **With children <5 years** | Unmarried (11) | 0/11 | 0/5 | 0/4 | 0/1 | 0/1 |
| | | Married (15) | 11/15 | 0 | 1/3 | 10/11 | 0/1 |
| | | **Total (26)** | **11/26** | **0/5** | **1/7** | **10/12** | **0/2** |
| | **Family educational Background**** | High education | **4** | **1** | **1** | **2** | **0** |
| | | Low education | **22** | **4** | **6** | **10** | **2** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |

**Legends**

* 'Unmarried' includes those identifying as single (never married), divorced, or separated, all grouped together to increase anonymity and confidentiality.

** High education = parent or sibling has university-level education, otherwise classified as low education.

A further analysis of the type of partnership as it relates to scientific research professional career for all married female and male participants showed that for the majority of relationships (24/31), only one partner, the study participant, was in a such a profession.[5] For the remainder of married study participants (7/31), both partners were in scientific research professional careers, referred to as dual scientific career couples, and the majority of these participants were women (5/7). Notably, both female and male participants in dual scientific career unions were at PhD (4) and PDF (3) career stage, and nearly all of them (6/7) had under five-year-old children.

### 4.5.2 Normative career pathway and progression requirements

Overall, study participants consistently described a scientific research career as beginning with a postgraduate degree, followed by post-doctoral research experience, mainly through working in a research group on a grant led by a senior researcher. Thereafter, researchers are expected to obtain their own independent research grant to establish a research group and demonstrate leadership through running and managing it. Progression from one scientific career stage to the next calls for significant 'time' commitments, outside of core working hours, requiring:

> *"...Long working hours with a lot of lab and fieldwork, grant proposal writing, production of scientific outputs…[and] …international scientific mobility that requires being ready to pack and go at any time" (IDI, Male, #14, MCR).*

The latter aspect of availability for short-term travel to spend research time in another context, was perceived as instrumental for enabling career progression.[6] This was through gaining scientific research skills, enhancing visibility through presentation in scientific fora and developing and fostering the professional networking and research collaborations that are key to obtaining research grants.

### 4.5.3 Social power relations of gender within the family and wider society

Participants' narratives elucidated the ways that social power relations of gender shaped their struggle in meeting the career progression requirements; specifically, the unequal gender division of labour within the family, and informal 'rules' of gendered social norms, values and stereotypes in society.

[5] In this study, we define such partnership as non-dual career couples.
[6] Short-term study or placements were most common in the DELTAS ARC

#### *4.5.3.1 Unequal gender division of labour within the family*

Scientific research career progression requirements were reported as more challenging for women compared to men. Most female and male participants consistently identified competing expectations of career and family responsibilities as a factor impeding research productivity, and agreed that this is particularly the case for women. A common notion was that 'in Africa', women's key role is to perform domestic chores and meet marital and family obligations while men are expected to be 'breadwinners' as exemplified in the quote below:

> *"Women especially in Africa are at a more disadvantaged point because a woman is central in the family obligations especially when children are young. Men are expected to go out there toiling to get money for the family as breadwinners"* (IDI, Female, #01, PhD).

Fulfilment of such gendered responsibilities entails normative symbolic requirements of constant 'availability' and visible prioritisation of family and marriage. For women, this included an ideal of always being at home to fulfil domestic responsibilities such as caring roles for children, and other family members such as siblings and elderly parents, as well as participation in family events. For men, it involved being at home to participate and sometimes preside over customary family obligations, and safeguard their families and marriages, in addition to fulfilling their breadwinning roles as household heads.

#### *4.5.3.2 Informal 'rules': gendered social norms and values of marriage and childbearing*

The influence of informal 'rules' characterised by gendered social norms and values, and socially ascribed gender roles, responsibilities, and expectations was common in most female and some male participant narratives at all career stages. This was mediated by other aspects of individual identity such as age, marital status, parental status, religion, positional hierarchy in the family, and social norms around birth order, which presented differential career advancement challenges.

A common struggle for some unmarried female researchers at all career stages was conformity to societal values which stress the centrality of marriage and motherhood for women. Some experienced pressure from their parents, extended family members and religious leaders to get married and have children, at a time when their peers were establishing their science career. The timing of this depended on the contextually specific societal expected age at marriage for women and men. Most participants asserted that in some social contexts with strong religious beliefs and values around marriage, women were expected to either get married in their early, mid or late twenties, regardless of education, and

start bearing children not later than three years into marriage. In contrast, men were required to marry either in their mid-to-late twenties or early thirties. Some unmarried women who defied such societal expectations occasionally received cautionary statements such as "*your eggs will die"* (IDI, Female, #09, MSc) or "*I am getting old…I need to see your child before I die"* (IDI, Female, #07, MSc). Such emotional pressure was mainly raised by participants whose parents were becoming much older, or who were raised by their grandparents, who would beg them to fulfil their wishes. In addition, some parents conspired with religious leaders who would scorn and admonish their daughter for prioritising a career over marriage.

It also emerged that in some families, female siblings are expected to get married according to birth order. One Christian participant noted, based on experience and observation, that in her home context,[7] a woman with younger siblings who prioritises career establishment over marriage becomes seen as a 'nuisance' to her parents and extended family members who would keep nagging her to *"open the marriage doors for the rest of the siblings*" (IDI, Female, #32, MCR, married). She also felt internal pressure to conform to such expectations based on her religious beliefs. Similarly, a Muslim male participant emphasised that based on his cultural and religious beliefs, "*women and men can only get blessings in life once they are married… It is something you can't run away from as it's a rite of passage"* (IDI, Male, #16, MSc, unmarried).

Some unmarried male researchers also reported experiences of shame and ridicule from parents, siblings, and peers in home communities, who could not understand why "*you are only prioritising getting degrees over marriage and establishing family"* (IDI, Male, #20, PhD). They faced occasional demeaning statements such as "*life seems to be slow for you*" (IDI, Male, #08, PhD) and "*you will die in school"* (IDI, Male, #19, PhD).

Overall, most participants explained family members and broader society including friends, had limited understanding of the requirements and importance of scientific work and are thus not sympathetic to the dilemmas facing them in establishing their careers. Notably, most scientific researchers who participated in this study (46/58) identified themselves as the first highly educated generation in their family and the first to pursue such a career.

[7] Identity of the ethnic community and country withheld for purposes of confidentiality as requested by the study participant.

### 4.5.4 Navigating 'two different lives'

This theme focuses on how gender and other identities shape researchers' everyday experiences of navigating the 'two different lives' of career and family, and the resultant implications for their career progression and personal well-being.

#### *4.5.4.1 Time pressure and sense of 'work-life' imbalance related to scientific writing*

***Time pressure particularly disadvantages women in career progression:*** Although scientific writing and publication was considered essential for upward career mobility, making time for this 'activity' was perceived as 'difficult' by everyone. However, most participants (both female and male) expressed that it is particularly challenging for women given the unequal gender division of labour within the family, which renders women - regardless of marital or parental status - 'time poor':

> "*Even getting time to sit and write just becomes so difficult...So it is not easy. I just feel we [women] are 'time poor'…we struggle to write and manage other major family responsibilities [elderly care] … of course moving to the next level for scientists, it is always about publishing" (IDI, Female, #27, PDF, unmarried).*

Men were perceived as 'privileged' with the opportunity of staying in the office for longer working hours compared to women who have to leave earlier to fulfil family responsibilities:

> *"I have to pull my weight just as much as the male counterpart who sits next to me can pull their weight… these guys [men] stay in the office until 9pm and for me I have to leave at 3pm to pick children from school…help them with homework…cook dinner and ensure they are in bed by 8pm…then I continue working maybe until 11pm and wake up by 5am to repeat it all over again… I am trying to manage 'two different lives' which is a struggle for me" (IDI, Female, #26, PDF, married, under 5-year-old children).*

The above participant further expressed that a married woman staying in the office till late means the family suffers and society will judge her as a woman who failed to manage her home. This places women at a disadvantage in terms of their opportunities to allocate and spend the 'extra time' required to meet institutional requirements for career progression. Some men also commented on the impact of this on women's career progression opportunities; for example: *"I always wonder how women make it in science beside managing their childbearing and family responsibilities" (IDI, Male, #05, PDF, married, under 5-year-old-children).*

***Time pressure impacts differently on women and men***: Most female researchers, at all career levels irrespective of their marital and parental status, reported that 'there is no work-life balance in science careers; which often meant long hours working both at home and at work. Some asserted that for women to achieve career progression, they have to work much harder compared to men at fulfilling their dual responsibilities. Concerns about continued poor 'work-life balance' leads junior and early career female researchers, to question whether to stay in a scientific research career:

> *"Time is a big one…For me being able to balance between your family and work is a big challenge…that has been going through my mind lately. I definitely like science, but I am beginning to question myself of whether or not I want to stay in science if it continues to be the way it is" (IDI, Female, #18, MSc, unmarried)*.

Most men perceived themselves as better off compared to women in terms of time pressure. Some male researchers also shared concerns about 'poor work-life balance', particularly at doctoral and post-doctoral career stages. However, their explanations revolved around the long-hours working culture of science which puts a toll on their 'time' allocation for social activities and personal life. Thus, they might have an advantage in career progression, but at a personal cost. For this reason, some already felt they were unlikely to continue with such a career path:

> "*The reality is that I don't seem to have the 'right' work-life balance… it's difficult. I am [at work] at night and on weekends…it takes up a lot of 'time' …[and] has had a toll on my social life … you have to keep off a number of things… Actually, I feel like I need to change … to find the kind of work that gives me the flexibility for personal time … I can't continue working this way for the coming years" (IDI, Male, #10, PhD, unmarried).*

***Additional time demands for language minority research scientists:*** A unique challenge elucidated by participants who identified themselves as language minorities, was the additional time requirements to read and write in English. Participants from Francophone countries explained that, *"As Francophone fellows, we have no choice but rather you must put in effort to learn English, which is a universal language of scientific communication"* (IDI, Male, #04, PDF). Many of them saw this as a challenge that they were determined to meet to 'prove themselves' equally as good research scientists as the Anglophones. However, preparing and delivering scientific outputs and presentations in English requires additional time allocation:

> *"We still need more 'time' for us to write in English…most of the time we write first in French then we translate into English …[then] share the text with the people from English speaking countries to correct every text…[also]when making [a] presentation, you need first to prepare your talk, … present it to them...*

*[so that] they correct it before the meeting. The whole process takes much 'time'…that is my greatest challenge" (IDI, Male, #01, Francophone PDF).*

Female Francophone researchers are thus doubly disadvantaged by the additional time burden of writing in English as well as their domestic responsibilities:

*"The language barrier is a very big problem for us…writing becomes a bit more difficult when you have kids, [as] you have more duties, and you have to share your 'time' in between family and writing. So of course, it impacts to the 'time' you have to dedicate to grant writing or publication writing…So it takes a long 'time' for us" (IDI, Female, #04, Francophone PDF).*

#### *4.5.4.2 Pressures around participation in scientific mobility-oriented 'activities'*

The expectations of geographic mobility oriented 'activities' required to progress in a scientific career emerged as a specific dimension that differentially affects women and men in ways that are gendered and intersect with other aspects of their identities. All participants narrated that the DELTAS Africa initiative offered them travel grants for attending and presenting at conferences as well as undertaking exchange programmes through visiting research collaborators in the global North. Such visits vary in duration across different consortia and career stage, but tend to last between three to six months. However, even though such opportunities were equally presented to them, some women and men researchers experienced barriers to uptake, which were shaped by their marital and parental status, nature of partnership, and positional hierarchy in the family.

***Women's experiences***: Some women researchers with young children, whether they were married or not, explained that their ability to take up these opportunities was limited by their socially prescribed childbearing and care responsibilities. They tended to be selective of which travels to pursue and to shy away from those that required staying away for a longer period in favour of fulfilling their caring responsibilities. One participant contrasted this with her male colleagues' ability to take up all the opportunities available:

*"For us women, you can't force it to happen, but rather choose which event to attend while men can decide to go for all events" (IDI, Female, #25, PDF, married, under 5-year-old children).*

Another explained that childbearing had 'slowed down' her career for this reason:

*"This is a woman's life, so it is challenging for every woman who has children. There are occasions where I have failed attending conferences or travelling abroad for an important training…either I was pregnant, or I had a very young breastfeeding baby...so it can slow down some steps in establishing your career niche" (IDI, Female, #05, PDF, married, under 5-year-old children).*

Male participants agreed with this; for example:

> *"For a woman, if you have children who are less than one-year-old, it is not easy to go [abroad] for three months. Perhaps you have to go with your children if it is possible…I think that is the good thing that we [the programme] can do" (IDI, Male, #03, PDF, married, under 5-year-old-children).*

Notably, despite their reliance on employing house-helps for childcare while at work, most mothers were apprehensive of leaving their children under their care while on travel for fear of child abuse.

This problem was not only perceived as that of physically taking care of children but also a more normative symbolic importance of always being 'available' and having a primary focus on mothering responsibilities. Whilst both married and unmarried female researchers with young children sought childcare support, which is a vital *'resource'*, from the extended family, they expressed frustration that this was sometimes given grudgingly. In-laws may remind them indirectly of the primacy of their caring duties with statements such as: *"remember you have duties, don't abandon them" (*IDI, Female, #27, PDF). Some highlighted that even if childcare support during travel is provided by the programme, sometimes the in-laws and extended family members would question "*why you leave the family behind and often fail to participate in the family events*" (IDI, Female, #22, PhD, married, under 5-year-old-child). This participant narrated that continuous failure to do so could result in marital discord and break-up, leading to emotional suffering, a view that was consistently shared by other married female participants. One participant narrated her own experience of this:

> *"So, it became stressful …my partner [non-dual career couple] could not understand why you are not 'available'…you are always on travels… He thinks you are going beyond what he understood you as a woman. …. Yeah, 'relationships' went through the roof! That one [laughs], I mean it is very hard for us women" (IDI, Female, #31, MCR).*

Similarly, while making reference to the normative symbolic requirements of constant 'availability' in most socio-cultural contexts in Africa, a male participant explained that:

> *"In our African culture in general, women are not allowed to travel all the time. For men it's normal as they are breadwinners and thus obliged to travel and fend for their families …not the contrary. …The society doesn't have a problem with men travelling compared to women because they see you are working and trying to provide for your family…it is essential…They [men] are barely questioned when they stay away from home for long*" (IDI, Male, #02, PDF).

***Men's experiences***: Notwithstanding the stereotypical normative assumption that men are breadwinners, some married men researchers feared and declined to undertake the long-term travels expected in exchange programmes. They perceived this a as a compromise due to the normative expectations of always being 'available' at home with the rest of immediate family members specific to their situation. For instance, a participant feared being criticised by his nuclear and extended family for "*moving out too much…. [as] they have heard stories of people [men in the community] who when they go out [abroad], some of their marriages come to an end*" (IDI, Male, #10, PhD, married, under 5-year old-children). This was based on the perception that such men are likely to establish another family abroad. He further explained that such concerns led to a lag in acquiring the necessary scientific skills required to enable him to carry out his research work.

In another instance, a married male researcher, who had additional responsibilities as a *de facto* household head of his extended family following his father's death, recounted how the normative symbolic importance of constant 'availability' for the family inhibits his participation in scientific mobility. He narrated that by virtue of being the only son from his nuclear family he bears the customary responsibility to preside over important family social events such as marriage ceremonies and death of a family member; in his absence such matters get postponed, which makes him feel he is a nuisance to his family. He expressed that taking time off work for these responsibilities are can also be interpreted by supervisors as showing a lack of commitment to work. He expressed that sometimes men like himself "suffer in silence" over these dilemmas, explaining: "*Sometimes, we don't say certain things!*" (IDI, Male, #23, other identities withheld). Consequently, "*such customary family obligations [which] dictates that as a man you need to be home taking care of such issues…can weigh down on your career as they come with a lot of stress… [which can] pull you back a lot [from progressing]*" (IDI, Male, #23, other identities withheld). Thus, some male researchers experience either negative effects on their career progression or their personal well-being due to navigating these competing pressures.

***Scientific mobility challenges exacerbated for dual scientific career couples:*** Participants who were married to another scientist with young children cited scientific mobility as their greatest challenge to progression, particularly when their travel dates coincide. They had to make decisions about who should travel, with some explaining that they followed a rotational travel plan as "*there is no proper formula for resolving the child-care puzzle when that happens*" (IDI, Male, #25, PDF). In this situation, female participants in such unions shared their personal frustrations about not only limiting their own travel,

but also bearing the brunt of childcare responsibilities alone when their partner travels, affecting their career progression:

> "*I bear the brunt of everyday care of dropping and picking them (children) from school and caring for them once they get home, which is affecting my progress with doctoral studies…sometimes you have to put those travels on hold…you would want your partner to be supporting such endeavours but unfortunately you are just alone (because of geographical separation)*" (IDI, Female, #14, PhD, dual scientific career couple, under 5-year-old children).

The above participant expressed thoughts of quitting scientific research in pursuit of clinical practice. Other female researchers in such a marital union explained that the problem extended beyond the practical problem of childcare to the normative expectation of their availability and responsibility: *"If both of you are out, whatever happens to the children in Africa, the woman is definitely blamed…so most women like myself don't bother taking them up"* (IDI, Female, #11, PhD, dual scientific career couple).

### 4.5.5 Potential strategies utilised by women for navigating the 'two different lives'

Both female and male participants observed that the timing of the performance and establishment of one's scientific research career, mainly happens while in their 30s, the period during which most women researchers experience the highest level of career interruptions because of childbearing and rearing responsibilities. This puts them at a disadvantage in terms of achieving the milestones within a normative career path as compared to men:

> *"Sometimes depending on the age, it becomes very difficult for women to build their careers…women who are generally my age [mid 30s] have young families…This is the point at which they now feel they can establish their career which creates a huge conflict [and] poses a challenge for them as they have to either take a break from research or their career progression to bring up their family"* (IDI, Male, #26, PDF, married, under 5-year-old children).

In the context of the challenges described above, many women researchers made different and conscious trade-offs between their 'time' commitments for family and scientific research activities. In narrating this, and their considerations in making these trade-offs, they used several key metaphors such as the *'biological clock and career clock'*, the '*glass ball and rubber ball*', and the concept of '*sacrifice*'. Male researchers did not speak about such strategies.

The metaphor of the 'biological vs career clock' pitted the idea of a 'ticking' 'biological clock' – a limited window for fertility – against a 'career clock', which denoted a steady focus of establishing oneself career-wise, expressing the sense of time pressure. The time pressure of the career clock was described by both female and male participants as increasing with seniority, as expressed by a female participant as follows:

> *"As you move up, it becomes harder and harder demanding much time, energy and attention. […] the family life is one of the major competing interest, and unfortunately the burden always lies with the woman… You are constantly split between managing these two things …That is why there are a lot more girls doing PhDs and then when it reaches post doc all of them will tell you, I can't take the pressure of science" (IDI, Female, #29, MCR).*

Women attempting to 'chase' both 'biological and career clock' complained of '*mental slowness*' and constant fatigue which they felt contributed to slowing down their career advancement compared to their male counterparts.

Others articulated that in life, women are presented with two balls: a '*glass ball'* and a *'rubber ball'*. The *'glass ball'* denoted the normative expectation to get married and establish a family, which when dropped, is difficult to recover as it will be broken completely. The '*rubber ball'* denoted the career itself, which when dropped, will keep bouncing - that is you can always have it back - expressing the idea that one's personal life is more fragile than a career and needs to be protected where one is unable to effectively 'juggle' the two balls.

Many female participants narrated a sense of making '*sacrifices',* either of their career progression in favour of their personal and family life or vice versa. One woman expressed this as follows: "*as a woman you cannot throw your children and husband on the street because of career progression"* (IDI, Female, #12, PhD). This participant, who was in a dual scientific career marital union, narrated how she had taken a career break from science by taking up an administrative job for close to ten years which enabled her to raise her children. She later resumed her science career (catching back the '*rubber ball'*) by taking up a DELTAS research fellowship. She emphasised that achieving certain milestones by a certain age as is normative in scientific career path can be difficult especially when age is used as a criterion for selection as well as good publication and grant record. She expressed that this amounts to a form of discrimination, along with employers being unwilling to make allowances for such career breaks in recruitment. Consequently, she observed that such women can end up getting 'stuck' in lower-level

scientific research positions or opt out of this career either part way through to senior level or in early stages of the 'pathway'. Those women who narrated prioritising their 'career clock' explained that their relationships have suffered. For example:

> "*Our relationship just ended like that…he thought I am busy chasing this career by not thinking about settling down for marriage…he gave up with me. I have been suffering in silence since then [for the past 2.5 years] … it is difficult…I really don't want to speak about it at length, it is hard"* (IDI, Female, #06, PDF, unmarried).

Some junior and early career women researchers who were already married or were planning to get married and establish families expressed that they had very few examples of women in senior scientific positions who are also in successful marriages. Their perception, that most senior women had to 'sacrifice' their marriages to enable them progress in their careers, negatively impacted their potential ambitions for career progression in scientific research. Overall, most women, especially at junior and early career stages, regardless of their marital and parental status, viewed an academic scientific research career as 'a huge battle'. This seemed unappealing in view of the 'sacrifices' they felt they would need to make for these careers:

> "*It's a 'huge battle' for women which creates difficulties for them to just make a decision on whether to progress to next level in their science career or not… So, you are going to worry about the impact that that decision is going to have to the rest of your family*" (IDI, Female, #13, PhD, married, under 5-year-old child).

Some were already considering alternative career pathways, including: academic teaching roles and pursuing research consultancies on the side; research and grant management; or developmental non-governmental organizations. They perceived such opportunities as likely to enable them to achieve a better work-life balance. In the same vein, a male participant argued that even though the overall DELTAS programme has almost achieved gender parity in recruiting female and male researchers, women face greater barriers to progression as *"…it's a steeper hill for women to climb on …which requires much 'sacrifice'"* (IDI, Male, #09, PhD).

## 4.6 Discussion

This study has contributed towards illuminating the underlying familial and socio-cultural drivers of intersectional gender inequities, and how they interact in shaping experiences and career progression of researchers as they engage in their day-to-day scientific research 'activities'. Our findings show that advancement in scientific research careers require extensive 'time' commitment, a crucial 'resource', to meet normative requirements of long working hours with occasional scientific mobility. Such

requirements interact with gender divisions of labour and normative societal expectations at family level, in ways that differ for women and men and are further shaped by other aspects of their identities. The unequal gender division of labour in the family often reduces women's opportunities to compete with men in terms of time availability to commit to scientific research. This creates dilemmas around whether to 'sacrifice' career or family or negative impacts on well-being through efforts to pursue both. These pressures are particularly acute for women due to the expectations to establish both careers and families during the same period. All participants agreed that this systematically disadvantages women in career progression, contributing towards their underrepresentation and attrition from scientific research careers. Francophone women and men in SSA experience further disadvantage due to the additional time burden of 'translating' between French and English. However, the normative gender roles as family heads also create pressures and dilemmas for some men. For instance, the expectation of them as 'breadwinners' has a negative impact on their well-being and opportunities for 'work-life balance', including contributions to their family lives. Neither are opportunities are equal between men, with Francophone speakers facing clear disadvantage.

The normative scientific career progression described by participants is structured around the idea of spending 'extra time' at work, which does not reflect social realities for most women and some men in SSA. Such expectations embody the prevailing western capitalist scientific system of long hours-culture through which the 'ideal scientist' is defined as an individual with unlimited time commitment to science throughout their entire working life (European Union, 2012). As reflected in our findings, capitalism interacts with patriarchy to create an inherent bias against female scientists with caring and other domestic responsibilities, who are disproportionately penalised and pushed out of the system (European Union, 2012; Ovseiko et al., 2016). This is particularly due to the bottleneck created by conflicting time requirements during reproductive years (Mavriplis et al., 2010). However, this intersection between patriarchy and capitalist extraction of value in scientific labour also reduces men's opportunities to contribute to and benefit from family life as well as pursue other creative interests (Mavriplis et al., 2010).

In line with a number of other researchers in SSA (Beoku-Betts, 2004; Halpaap et al., 2017; Masanja, 2010; Prozesky, 2008; Raburu, 2015), this study found that women's socially ascribed caring responsibilities and expectations of marriage within the 'rules' of the family as an institution are strongly reinforced by familial and wider societal pressure (Raburu, 2015). Our findings support others which

have shown that some women interrupt their careers to adhere to social norms of marriage and establishing family, lest they be ostracized and blamed for neglecting them (Kiamba, 2008; Masanja, 2010; Prozesky, 2008; Raburu, 2015). To this we have added the new insight that birth order can exacerbate the pressure to marry at a particular time for some women. Further, we found that a generational educational gap compounds this problem for many women and some men as many participants in this study were the first in their family to pursue a scientific career path, reducing familial understanding of its particular pressures.

We also recognise that employing web technology could help alleviate some of the difficulties experienced by some women and men researchers who face constraints to participate in scientific-mobility oriented activities. Teleconferencing and webinars could enable researchers at all career stages to present aspects of their work to others, as well as attend online trainings without requiring to travel great distances (Bell et al., 2016). Miller and colleagues (2006) quantitatively examined the impact of the internet on the research careers of female scientists in SSA and South Asia, who found that the introduction of the internet is widely expected to diminish professional women's constraints with physical mobility, thus could aid in reducing gender differentials resulting from this. Such a shift may potentially be accelerated by increases in online conferencing driven by the COVID-19 pandemic, but this has yet to be evidenced.

This study also presents new insights on the challenges related to marital and parental status by indicating that these are not just practical challenges around provision of childcare but also symbolic ones around normative 'availability' and expectations of women to prioritise families rather than careers. In a recent study, Khisa and colleagues have highlighted the positive outcome of supporting women's practical gender needs around childbearing and caring through financially supporting husbands to travel with their spouse to provide childcare during short and long-term travel (Khisa et al., 2019). The authors contend that such efforts are beginning to pay off through men/fathers playing a more active role in childcare even on return. Consequently such an initiative may support shifting the patriarchal gendered institution of family to be more accommodating to women to successfully pursue careers in science research (Khisa et al., 2019). However, how this might play out for dual and non-dual scientific career couples remains unexplored.

An intersectional perspective has shown that language minority status also emerged as an additional layer of disadvantage, further amplifying the 'time' pressure for Francophone women and men researchers in meeting the expectations of scientific research 'activities'. However, women Francophone speakers with caring responsibilities emerged as particularly disadvantaged. Various scholars have observed that as a pre-requisite for career progression, it is increasingly becoming a requirement for researchers to publish their work in English language journals (Hyland, 2016; Martín et al., 2014). This is to enable them gain visibility to the wider audience and international recognition, which is a struggle for many non-Anglophone speaking scientists. We argue that placing emphasis on English as a standard language for scientific research communication is a form of neo-colonialism that minimises the presentation of scientific research from other languages. This inadvertently limits wide dissemination of research results by researchers from such disadvantaged language minority populations (Minja et al., 2011), thus reducing their research productivity as well as visibility and research collaborations.

By going beyond a 'women-only' perspective, which has been the trend in most studies (Liani et al., 2020) towards consideration of men's experiences, this study provides new insights on the challenges faced by some men. These are produced by the intersection of institutional scientific career norms and their gender identities, particularly where their positional hierarchy in the family creates additional family responsibilities due to customary values and expectations that require their frequent 'availability' at home. We further established that the particular challenges faced by dual career couples with young children regarding scientific mobility. This has been observed in European settings (Murray, 2015), but not to date in the SSA literature. Our findings concur with existing studies suggesting that among such couples, the female partner is more likely to forfeit travel 'activities' (Murray, 2015) with negative implications for her career, due to lack of childcare availability. However, the challenges faced by men suggest that the gendered assumptions of constant availability underlying the scientific career model may be inimical to personal and social well-being for both sexes (European Union, 2012). Therefore, unless inequalities in the opportunity of individuals to meet expectations of unlimited time availability to devote to scientific research are considered a structural problem rather than an individual problem, they are likely to persist.

This study provides new insights on how women make decisions about whether to spend additional time on work, particularly during the time period of intense demands of young families. This has consequences for their career progression, their individual well-being and their social relationships.

Most women feel this acutely as a dilemma between managing 'two different lives', and use various metaphors to discuss the strategies utilised and the 'trade-offs' involved. The 'biological clock' and 'career clock' metaphor was also used by participants in another qualitative study in SSA (Raburu, 2015). The 'glass and rubber balls' metaphor has not been identified in previous studies in SSA but emerged as a common figure of speech from a qualitative study conducted amongst women from eight Arab Middle Eastern countries[8] (Afiouni and Karam, 2014). These metaphors, and the narratives of our participants emphasise the high social costs to women of pursuing scientific careers, including divorce and separation or opting not to marry, in line with some studies in Europe (European Union, 2012; Vilnius, 2007). This was underscored in our study by early career female participants pointing to the lack of positive role models who had succeeded in their careers without 'sacrificing' marriage and family. Those women in our study who attempted to meet both familial and career expectations reported exhaustion. Some of our participants narrated emotional suffering that was rarely expressed in their daily lives. Thus, all these strategies have consequences for either women's well-being or their lower representation in scientific careers, especially in more senior positions.

Our study also found that even though men generally did not talk about dilemmas about managing the 'two different lives', some did express a sense of the social cost to their well-being and social relationships of spending the 'extra' time at work. They experienced a sense of work-life imbalance that was detrimental to their well-being, with some indicating their likelihood of opting out of scientific research career, citing a lack of time for leisure. It is note-worthy that female researchers did not even refer to perceived needs for leisure, which likely reflects gendered norms and expectations, especially for women with caring responsibilities. Some scholars have argued for a fundamental rethinking of current scientific research and family systems for the benefit of all (Murgia and Poggio, 2019). Whilst such a rethink may particularly benefit women in terms of well-being (including the opportunity for leisure time) and career progression, our study suggests that such a rethink would also offer benefits to male researchers' well-being, contributing to the retention of male scientists.

The empirical findings of this study generally support the conceptual framework posited based on existing literature and relevant models of career progression and social relations (Liani et al., 2020) [see Chapter two] and has contributed new insights about how intersecting aspects of individual identities

[8] These countries included: Egypt, Jordan, Saudi Arabia, Kuwait, Lebanon, Oman, Palestine, and Qatar.

create particular pathways in specific contexts. This analysis has provided new insights into often-overlooked types of identities such as dual career couple and individual's positional hierarchy in the family, in shaping inequities in career progression.

### 4.6.1 Policy and practice implications

The results of this study indicate that fostering equitable scientific research career progression for women and men in SSA requires understanding, recognising and taking actions to address familial and societal drivers of intersectional gender inequities in order to reduce career disadvantage and improve well-being of researchers. A gender-transformative approach is required, that goes beyond steps to ameliorate the impact of unequal gendered power relations to transforming them (Kagesten and Chandra-Mouli, 2020). This will require sustained action both within and beyond scientific research institutions and funders. However, concrete policy and practice measures and approaches that can be taken by employers and funders include:

First, reforms in institutional human resources policies and systems to provide researchers with more practical support to parenting such as childcare and parental leave, including for men. This may help women to navigate the 'two different lives' and also to shifting norms so that this work is less seen as the sole responsibility of women (Khisa et al., 2019; Prozesky and Mouton, 2019). Removing age-related expectations from hiring/promotions policies is also important. In addition, promoting workplace practices and incentives for healthy work-life balance for all, for instance through active discouragement of overworking, should be considered.

Second, there is a need for a more fundamental re-think of the normative scientific career structure to create equitable opportunities, improve diversity and also the well-being of both female and male employees. The science leaders and grant awarding bodies have a role to play in redefining the adoption in SSA of a western scientific research system that prioritises research productivity, which does not account for the social realities of African researchers. Attention should be paid to developing a more locally appropriate and achievable approach to measuring 'excellence' for individuals, in line with existing debates at the level of national scientific research funding systems (Chataway et al., 2019). This may include considering research achievements in the context of research opportunities for individuals (e.g. over a full time working equivalent period) (Global Research Council, 2016). Additionally, there is need for greater flexibility in setting age limits as a criterion for eligibility for fellowship and other

research appointments. Tackling the expectation of long working hours is also required. This is a cultural change but will also need a revised expectation of productivity within given working hours. Support is required from SSA governments as local funders and in setting expectations with external funders.

Third, additional support and potential adjustments to expectations for language minorities in science across SSA, including but not limited to Francophone speakers, is also required to create equality of opportunity. This could be achieved through enhanced institutional collaborations between Anglophone and Francophone researchers to help strengthen researcher English language skills. However, re-shaping local scientific eco-systems may also require attention to the role of publications and grant submissions in languages beyond English. External research funders should also consider granting additional time or support for submission to non-English language speakers.

### 4.6.2 Study limitations

Findings from this study should be considered in light of the following limitations. First while the integrated conceptual framework highlights the intersection of gender and physical disability, we were not able to identify researchers who identified as disabled within the sampled consortia and the overall DELTAS Africa initiative. Efforts to identify and recruit such individuals from the wider host and participating institutions in selected consortia were prevented by the need for country-level ethical clearances for each institution. This was not possible within the time constraints of the study. Second, participant concerns about anonymity and confidentiality prevented the presentation of nuanced comparisons with regard to nationality and ethnicity. Third, we acknowledge the underrepresentation of female PDFs in our sample. This was not by study design: despite significant follow up efforts, we experienced lower take up of interview offers by female PDFs. Despite these limitations, we contend that this study provides useful information upon which to understand the issues and begin to address the gendered familial and socio-cultural drivers of challenges facing research scientists in SSA.

## 4.7 Conclusions

The findings presented in this paper reflects the experiences of women and men scientific researchers at various career stages characterised by multiple social identities in three purposively sampled consortia within the DELTAS Africa Research capacity strengthening initiative. This study is the first of its kind to demonstrate how intersectional gender analysis through use of qualitative research methods may advance novel ways of understanding the differential hidden familial and socio-cultural challenges that

contributes to inequitable scientific career progression. Specifically, we have shown the importance of considering multiple social identities such as age, marital status, parental status, presence of dependants, positional hierarchy within family, nature of partnership (dual and non-dual career couple) and patriarchy and capitalism as systems of power, oppression and privilege in shaping inequities in career progression. It is important to take into consideration the fluidity of individual social identities, which contributes to slow progression and the loss of researchers along the scientific research pathway at different career stages when their identities change. A fundamental re-think of the normative scientific career structure in SSA is required to create equitable opportunities, increase diversity and improve the well-being of both female and male scientific researchers.

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### 4.7.3 Ethics approval and consent to participate

The study received required approvals from the Liverpool School of Tropical Medicine Research Ethics Committee (Protocol ID: 17-075) and the Strathmore University Institutional Ethics Review Committee (Protocol ID: SU-IRB 072/18). Participants were provided with an information sheet that explained the aims of the study and related risks and benefits. All participants gave written informed consent. For participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms.

# Chapter 5: Results – Institutional level drivers of gender inequitable scientific career progression

## 5.1 Chapter Overview

This chapter aims to answer the second research question: How does the institutional environments, including 'informal rules' in intersectional power hierarchies, values, policies, and their implementation shape inequities in scientific career progression for women and men, and their disadvantages in relation to their multiple social identities in selected DELTAS institutions? It outlines the rationale for, and methodological approach to undertaking the empirical research. It utilises the conceptual framework developed within the literature review in chapter two to frame the results and discussion sections. Finally, it provides implications for policy and practice, highlights the study limitations and conclusions. It has been submitted for peer review to the Health Research Policy and Systems Journal. As this paper draws multiple elements of this thesis together, there is some overlap in this chapter and chapters six and seven.

**Institutional level drivers of gender inequitable scientific career progression in Sub-Saharan Africa**

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**Author Contributions:**

**ML:** Conceptualisation, Project administration, Study design, Data collection, Data Analysis and interpretation, Writing – original draft preparation, review and editing the manuscript.

**IN:** Guidance and support with conceptualisation and study design, Validation of data analysis process and feedback provision on data interpretation, Writing – review and editing, PhD Supervision.

**JP:** Guidance and support with study design, Writing - review and editing, Funding acquisition.

**RT:** Guidance and support with conceptualisation and study design, Validation of data analysis process and feedback provision on data interpretation, Writing – review and editing, PhD Supervision, Funding acquisition.

## 5.2 Abstract

***Background:*** This study sought to find out how institutional environments, including values, policies, and their implementation shape inequities in scientific career progression for women and men, and their disadvantages in relation to their multiple social identities in Sub-Saharan Africa (SSA). The findings are drawn from a wider research study that was aimed at gaining an in-depth understanding of the barriers and enablers of gender equitable scientific career progression for researchers in SSA. This was nested within the context of 'Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) – a health-based scientific research capacity strengthening initiative.

***Methods:*** The study adopted an exploratory qualitative cross-sectional study design. In-depth interviews (IDIs) with trainees/research fellows at various career stages supported and/or affiliated to three purposively selected DELTAS Africa Research Consortia was the main method of data collection. In addition, key informant interviews (KIIs) with consortia research leaders/directors, co-investigators, and the consortia management team were also conducted to corroborate information gathered from the IDIs, and also to provide additional insights on the drivers of intersectional gender inequitable career progression. In total, fifty-eight IDIs (32 female and 26 male) and twenty KIIs (4 female and 16 male) were conducted. The interviews were carried out between May and December 2018 in English. The data was analysed inductively based on emergent themes.

***Results:*** Three interrelated themes were identified. First: characterisation of the institutional environment as highly complex and competitive, pertaining to progression opportunities and funding structure. Second: Inequitable access to support systems within institutions. Third: Informal rules: Everyday experiences of negative practices and culture at workplace - characterised by negative stereotypical attitudes; gender biases; sexual harassment, bullying and intimidation.

***Conclusions:*** We contend that understanding and addressing the social power relations at the meso-institutional environment and macro level contexts could benefit career progression of both women and men researchers through improving working culture and practices, resource allocation and better rules and policies thus fostering positive avenues for systemic and structural policy changes.

## 5.3 Background

Health research capacity strengthening (HRCS) initiatives have been identified as critical drivers for creating a large number of well-trained health researchers and institutions in low-and middle-income countries, including sub-Saharan Africa (SSA) (Minja et al., 2011). This have seen substantial investments from various donor agencies (Vasquez et al., 2013), with a shift of focus from international to local leadership of training programs in SSA (Daniels et al., 2015). A key mandate for many of these international HRCS programs has been to develop and facilitate academic scientific research career pathways, with anticipation that the established local investigators will train and mentor future cadres of investigators and research leaders (Daniels et al., 2015). Indeed, recent developments by funding bodies have led to a renewed interest in understanding the gender equity concerns in career progression of fellowship recipients and their retention in academic scientific career paths (Vallentin, n.d.; Wellcome Trust, 2015). Despite the existence of several HRCS programs in SSA, we have not come across a study that provides in-depth explanations on existence of such concerns along the scientific career pathways for researchers who are beneficiaries of such programs within their institutions. A promising research capacity strengthening initiative requires a gender equity lens, since compared to men, women researchers are often disadvantaged in pursuing scientific research careers and accessing senior leadership positions (Halpaap et al., 2017; Ovseiko et al., 2016).

Scholars have argued that gendered power relations affect women's everyday experiences once they enter the academic scientific workforce; they may be subjected to sexual harassment, exclusion from career development opportunities, prejudices concerning their academic abilities and intellectual

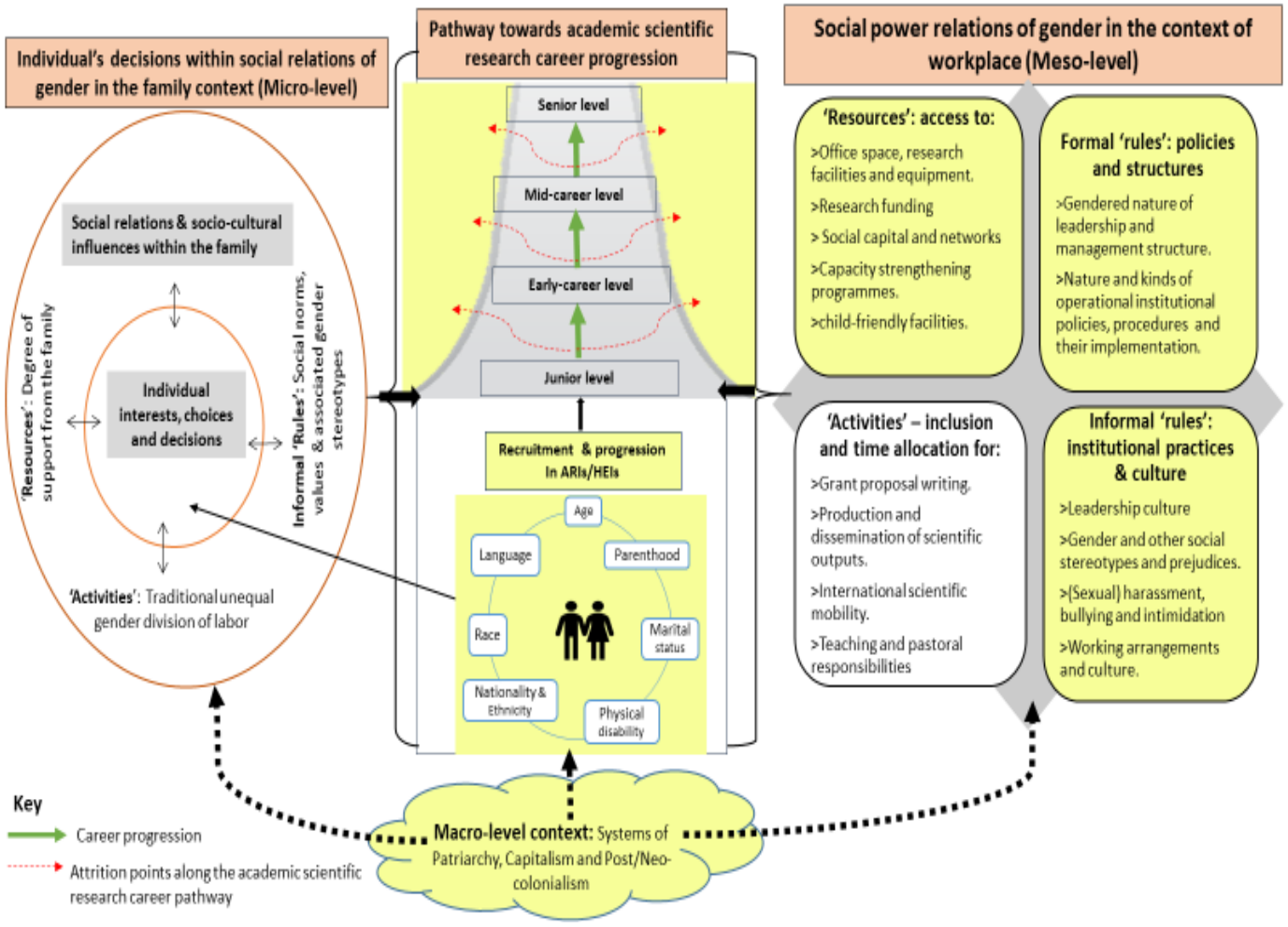
authority, and unconscious biases among others (Morley, 2005). Therefore, to inform action for institutional change, it is important to gain insights into their experiences to understand the underlying institutional-level drivers and processes that produce gender inequities in science careers in the context of African academic and scientific institutions (Liani et al., 2020). In doing so, there is an increasing recognition of the need to go beyond the binary notion of gender, towards embracing an intersectional approach to gender analysis, which is critical to understanding the way different social stratifiers and power structures produce inequities in career progression for both female and male research scientists (Liani et al., 2020).

It is against this backdrop that we sought to explore the institutional level drivers of gender inequitable scientific career progression as experienced by women and men researchers, and their disadvantages in relation to their multiple social identities in SSA. The data presented is part of a wider qualitative research study set within the context of 'Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) – a health-based scientific research capacity strengthening initiative. The details of this five-year (2015-2020) programme have been presented in another paper (Liani et al., 2021a).

## 5.4 Theoretical and conceptual framing

The empirical research for this study was informed by three theories and models: Systems of Career Influences Model (Magrane et al., 2012); the Social Relations Approach (Kabeer, 1994; Kabeer & Subrahmanian, 1996; March et al., 1999); and Intersectionality theory (Crenshaw, 1991; Hancock, 2007) – also see (Liani et al., 2020). These three theoretical and conceptual models were drawn together to form an integrated conceptual framework (Liani et al., 2020) which was developed based on existing evidence around the current research problem within the context of SSA as presented in Figure 5.4 below.

*Figure 5.4: An integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in HEIs in SSA*




The Systems of Career Influences Model (Magrane et al., 2012) provides the central core of the framework, which focuses on the interplay between socio-cultural influences within the family and organisational factors in shaping career advancement of women at different career stages. Kabeer's framework on the Social Relations Approach (Kabeer, 1994) provides key dimensions for an institutional gender analysis – within the family and workplace, expressed as 'rules' (formal and informal), 'resources' and 'activities', which are all permeated by 'power'. 'People' are located as individuals at the centre of the family and as entrants into the career pathway. The intersectionality lens (Crenshaw, 1991; Hancock, 2007) is then explicitly added to highlight the multiple social identities and related power of these individuals according to aspects such as age, professional cadre, marital status, ethnicity/race, and parenthood.

We used this integrated conceptual framework as a lens for understanding the everyday experiences of individual researchers' who are characterised by multiple social identities with their science careers as it relates to institutional environment, policies, and practices as well as access to the necessary research infrastructure or 'resources' (Liani et al., 2020). We have taken gender as a key entry point into analysing the positionality and experiences of individual researchers, who according to an intersectionality perspective, may further be identified as (dis)advantaged based on other multiple intersecting social categories. Such individual may either get stuck or opt out of the scientific career path. Specifically, as indicated in the components of the framework highlighted in yellow, we focus on how social power relations of gender in the context of workplace – meso level (right box), exacerbated by macro-level systems of power (word bubble), shapes everyday experiences of women and men scientific researchers in SSA characterised by multiple social identities (middle box) to progress along the pathway towards academic scientific career ladder.

## 5.5 Methods

### 5.5.1 Study design and setting

An exploratory qualitative cross-sectional study design was adopted. The research was conducted within the context of the DELTAS Africa initiative. The programme is coordinated by the African Academy of Sciences' Alliance for Accelerating Excellence in Science in Africa,[9] and implemented by a network of eleven African-led health research programmes, commonly referred to as DELTAS Africa Research Consortia (DELTAS ARC). The DELTAS ARC offers collaborative research training programmes in various scientific disciplines, ranging from biomedical and social sciences, spanning 54 lead and partner institutions (research organisations and universities) across SSA, in partnership with Northern academic institutions. In doing so, it facilitates career development of postgraduate science students (Masters and Doctorate), which are both referred to in this study as junior researchers, and scientific research professionals (post-doctoral fellows and mid-level researchers), who pursue research work/studies at institutions in their home - or other African-countries.

[9] https://www.aasciences.africa/sites/default/files/Publications/DELTAS%20Africa%20factsheet_2018_0.pdf site accessed on 6th January 2020.

This study adopted a two-tiered purposive sampling strategy for selection of consortia and participants within the sampled consortia. This was based on the principles of maximum variation sampling, which allowed us to discover patterns for core elements or dimensions that hold across our diverse sample, as well as unique or distinctive variations (Patton, 2002). The first step involved purposive sampling of three DELTAS ARC. These were selected on the basis of: regional representation in SSA (Eastern Africa, Southern Africa, and West and Central Africa); representation of consortia that are located in English and French speaking countries; presence of fellows of diverse nationalities recruited from different African countries; and consortia with presence of fellows at various career stages from Masters (Msc), doctoral (PhD), post-doctoral research fellowship (PDF) and mid-career research (MCR) scientists.

In each of the purposively sampled DELTAS ARC, we sought heterogeneity by using gender as a primary selection criterion for in-depth interview (IDI) study participants. Other multiple social identities were sought along axes of career stage, scientific discipline, duration in the programme/institution, and nationality. A list containing such information was provided by the research directors of the sampled DELTAS ARC, which aided in purposive selection of study participants. We collected additional information about personal identities such as age, marital status, presence of children through administering a brief questionnaire before commencement of IDIs. During the interviews, we asked the participants to reflect on how such identities shaped their everyday experiences of their science careers as it relates to institutional environment, policies, and practices. Key informants were selected based on their role and knowledge about the functioning and operation of their respective DELTAS ARC.

### 5.5.2 Data collection methods

The in-depth interviews (IDIs) with trainees/research fellows at various career stages supported and/or affiliated to the DELTAS ARC was the main method of data collection. This was aimed at exploring qualitative narratives about everyday lived experiences on how institutional environments, including values, policies, and their implementation shape inequities in scientific career progression for women and men researchers in SSA characterised with multiple social identities. Key informant interviews (KIIs) with consortia research leaders/directors, programme managers/coordinators, monitoring and evaluation officers, and supervisors (co-investigators) were also conducted. These was aimed to corroborate information from the IDIs and to provide additional information on the drivers of intersectional gender inequitable career progression. In total, 58 IDIs (32 female and 26 male) and 20 KIIs (4 female and 16 male) were conducted across the three purposively selected DELTAS ARC. Most IDIs (n=47/58) and KIIs (15/20)

were conducted in-person by the lead author (ML), a social science doctoral candidate with extensive experience in conducting interviews in qualitative research, at the respective consortia secretariat or annual scientific meeting. The remainder were conducted via skype and telephone. The interviews were conducted between May and December 2018, all in English. Despite making provision for a bilingual research assistant who was fluent in writing and speaking English and French to help in conducting some interviews in French, all the Francophone study participants expressed that they were comfortable conversing in English Language as opposed to using a translator. All interviews were audio-recorded using a digital dictaphone, alongside note taking. On average, the IDIs lasted 90 minutes while KIIs took 75 minutes.

### 5.5.3 Characteristics of the IDI sample

The IDI study participants were nationals of thirteen SSA countries across Eastern (Uganda, Kenya, Rwanda, Somali), Southern (Zambia, Botswana and South Africa), and West and Central Africa (Senegal, Ghana, Nigeria, Benin, Mali and Cameroon). They represented three consortia composed of eleven partnering institutions for which seven were research institutes and four were African public universities. The majority identified English as their everyday language of scientific communication (52/58) while the rest reported French. Regardless of gender, only few participants (9/58), particularly at PDF and MCR, held faculty positions mainly as lecturers and assistant professors. Overall, the majority of study participants identified themselves as biomedical scientists (45/58) while the rest were social scientists (13/58). Regardless of gender, most study participants were from less educated family backgrounds (46/58), where no parents or siblings had attended university. More female than male participants had young children and the women at early career stages were more likely to have young children than men. Table 5.5.3 summarises the general socio-demographic characteristics of the IDI study participants.

*Table 5.5.3: Socio-demographic characteristics of the IDI study participants (n=58)*

| Gender | | Other characteristics | Total (n=58) | MSc (n=14) | PhD (n=19) | PDF (n=18) | MCR (n=7) |
|---|---|---|---|---|---|---|---|
| **Women (n=32)** | **Age Range** | 25-29 | 9 | 7 | 2 | - | - |
| | | 30-34 | 12 | 2 | 9 | 1 | - |
| | | 35-39 | 5 | - | - | 2 | 3 |
| | | 40-44 | 4 | - | 1 | 2 | 1 |
| | | 45-49 | 2 | - | - | 1 | 1 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **Marital status** | Unmarried* | 16 | 7 | 4 | 3 | 2 |
| | | Married | 16 | 2 | 8 | 3 | 3 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **With children <5 years** | Unmarried (16) | 4/16 | 0/7 | 0/4 | 2/3 | 2/2 |
| | | Married (16) | 12/16 | 2/2 | 6/8 | 3/3 | 1/3 |
| | | **Total (32)** | **16/32** | **2/9** | **6/12** | **5/6** | **3/5** |
| | **Family educational Background**** | Highly educated | 8 | 2 | 2 | 1 | 3 |
| | | Less educated | 24 | 7 | 10 | 5 | 2 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| **Men (n=26)** | **Age Range** | 25-29 | 4 | 3 | 1 | - | - |
| | | 30-34 | 8 | 2 | 3 | 3 | - |
| | | 35-39 | 9 | - | 3 | 5 | 1 |
| | | 40-44 | 2 | - | - | 2 | - |
| | | 45-49 | 3 | - | - | 2 | 1 |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **Marital status** | Unmarried* | **11** | **5** | **4** | **1** | **1** |
| | | Married | **15** | **-** | **3** | **11** | **1** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **With children <5 years** | Unmarried (11) | 0/11 | 0/5 | 0/4 | 0/1 | 0/1 |
| | | Married (15) | 11/15 | 0 | 1/3 | 10/11 | 0/1 |
| | | **Total (26)** | **11/26** | **0/5** | **1/7** | **10/12** | **0/2** |
| | **Family educational Background**** | Highly educated | **4** | **1** | **1** | **2** | **0** |
| | | Less educated | **22** | **4** | **6** | **10** | **2** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |

**Legends**

*The label 'unmarried' includes those who identified themselves as single (never married), divorced or separated. We grouped them together for purposes of protecting participants' anonymity and confidentiality particularly for the latter two identities.

** We based this on the parental and sibling's level of education, with those who had attended university considered as highly educated.

### *5.5.4 Data Management and Analysis*

All audio data were transcribed verbatim by an experienced qualitative research assistant. The transcripts were verified by comparing the audio files and scripts with the field notes. Once this process was complete, transcripts were sent to all individual study participants for member-checking to ensure participants' views were appropriately captured. This process also allowed the participants to identify content they preferred to be removed from the analysis e.g. individual characteristics and statements that they felt might easily identify them.

Following the member checking process, most of the IDI participants asked to have the identities of their ARC and affiliated institution, number of children, country of origin, disciplinary field of study withheld for confidentiality purposes. In addition, they suggested that findings be presented as views and experiences of participating DELTAS Africa research fellows as a whole. In protecting participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms. However, given the necessity of an intersectional gender analysis, other identities such as age (provided in range), marital status, and presence of dependents are anonymously presented where necessary. Thereafter, the data were organised and coded in QSR International's NVivo 11 qualitative data management software, and analysed inductively based on emergent themes, and the relationships between them as presented in a conceptual framework reflected in the results and discussion section. We utilised a grounded theory approach, employing constant comparative analysis (Charmaz, 2006; Glaser and Strauss, 1967). All illustrative quotes have been carefully reviewed for their potential to reveal individual identities.

## 5.6 Results

Three interrelated themes were identified. They illustrate how women's and men's everyday lived experiences with their workplace environment are shaped by institutional power relations underpinned by macro-level forces of patriarchy, capitalism and neo-colonialism. This leads to a highly complex and competitive environment characterised by limited access to the necessary research resources; dissatisfaction with operational policies and power structures (formal rules); as well as institutional practices and culture (informal rules). In this process, gender intersects with other aspects of identity, leading to differing work experiences and inequities in career progression.

### 5.6.1 Complex and competitive institutional environment: Progression opportunities and funding structure

The participants' narratives about their everyday experiences within the institutional environment revealed how global and national political economies, shaped by neo-colonialism, influence institutional funding models. At the funding, national and institutional levels, positional hierarchies within institutions are reinforced by racism, ageism, nepotism, and patriarchy shaping the way this funding environment is experienced. All these axes of inequity intersected with institutional policies, practices and culture creating a highly complex, competitive, and insecure working environment characterised by limited career progression opportunities and uncertainties with research funding. Consequently, scientific research was consistently perceived by most female and male participants at all career stages as a 'very scary career' characterised by short-term research contracts, culminating in job insecurity and financial instability. This further exacerbates inequities at the micro-level of family creating difficulties for women and men in fulfilling their normative gender roles, producing differential implications and outcomes for researchers' career progression and personal well-being as presented in different paper (Liani et al., in press).

#### *5.6.1.1. Uncertainties with research funding and the resultant implications*

Most female and male participants at all career stages narrated that research funding was essential for scientific career progression. Some participants, particularly at early and mid-level career stage, attributed the research funding uncertainty they experienced to racial inequities in international grant allocation and stiff competition. They perceived racial discrimination by international funding agencies in grant funding for African applicants, commenting that it is hard to win a research grant as a lone African applicant without a White collaborator/co-applicant:

> *"The fellowships are very competitive…most African researchers and applicants here feel like we actually don't get funded because we are Africans…there is always some barrier towards being awarded a fellowship or a grant if you are only African applicants. But at least if there is a European or White co-applicant, then the application seems to be successful" (IDI, Female, #28, MCR).*

In the same vein, another participant noted that on several occasions he had heard his colleagues mention that: "*If your supervisors are all Blacks, then you wouldn't easily progress in your career because there is a notion that even if we apply, we are unlikely to get the funding"* (IDI, Male, #22, PDF). Such concerns were corroborated by a key informant who reported that: *"Most senior fellowships are still skewed towards whites…this is an issue that I have observed for close to fifteen years I've been here*

*(research institution) … for whatever reason [funding agencies] say that they have difficulties attracting African fellows*" (KII, Male, #08).

Participants also expressed concerns about the merit criteria for application for research funding, which are sometimes conditional on holding a faculty position, which they felt places many African researchers at a disadvantage. Notably, most participants in this study were affiliated to research institutions, the majority of who did not have faculty positions. For example:

> *"Here is Africa, most research scientists like us who work in research institutes do not hold faculty positions in universities…so if the funder puts a condition where you need to be a faculty staff somewhere as part of the requirement for a grant application, sometimes this discourages you from applying…you feel you are not good enough…they already have the condition that disqualifies you from applying or even if you apply, you are likely to be unsuccessful" (IDI, Male, #11, PDF).*

Consequently, the competitive nature of the grant application and allocation process, coupled with scarcity of resources created anxiety for most participants about continuing on this career path. Indeed, most researchers at different career stages, whether female or male, and irrespective of their marital and parental status expressed concerns about the likelihood of ongoing short-term employment contracts and few prospects for permanent appointments. This creates job insecurity and financial instability, making progression in scientific research career path unappealing:

> *"'It's a very scary career'…You are always thinking about if this contract runs out, where am I going to next? Will I go to another research institution? Will I get another research project that I will work on? …that uncertainty and the fact that I am a married man with a family to feed and you are always given short-term contracts with no job security is something that can really distract you from staying in this career path" (IDI, Male, #23, PDF, married, under five-year-old children).*

However, these common fears had clear gendered dimensions. For example, anxiety about financial insecurity was considered by most male participants as their most pressing challenge particularly given their societal expectations to fulfil the breadwinning responsibilities for their families. Notably, most of them identified themselves as coming from low socio-economic family backgrounds, whose extended family members were financially dependent on them for support with living costs, as well as paying school fees for their younger siblings. Moreover, female participants who were single parents with no additional family income, also perceived this as extremely challenging:

> *"For me, the main challenge has mainly been financial impact. I don't think I will be writing grants for the rest of my life because the possibility of sailing through is slim…that is not the direction I want to go with my science. This is all complicated…for a single mother like myself, you must figure out how your child will survive…perhaps if I was married, it would be easier as you would have complimentary family income… I am contemplating to move into entrepreneur or in an NGO that implements projects, if things get tough" (IDI, Female, #25, PDF, unmarried, under five-year-old child).*

Overall, in his reflections about this problem of funding uncertainty and job insecurity, a junior research fellow highlighted that his mentor always advises him that: *"Science is not for the faint hearted…if you are looking for financial stability, then you shouldn't be in sciences"* (IDI, Male, #09, PhD).

#### *5.6.1.2 The 'hustle' for career progression opportunities*

Related to uncertainty with research funding were concerns about the limited career progression opportunities in science in Africa, which most female and male participants felt was a 'hustle' due to its highly competitive culture. From the perspective of career progression within research institutes, a participant noted that: *"If you don't have a grant, you can't be guaranteed a working space in the lab within a research institution"* (IDI, Male, #14, MCR). In addition, most participants were also concerned about the dearth of strong research institutes in Africa, which makes it difficult to enhance career progression of all trained fellows. This problem was also attributed to the limited investment in research by most African governments, denoting how macro level forces of political economy at national level shapes inequities, which may limit researchers' progression in such a career path.

> "*The government in many African countries aren't ready to invest into research… So that again for me is a limitation. If you want to continue in this career path especially on this continent, how feasible is that going to be? If we are not going to have access to funding like the one we are currently having through DELTAS, it is difficult to envision career progression based in what actually happens in our African context" (IDI, Male, #08, PhD)*.

The lack of core funding for research by the African governments culminates in a dearth of progression opportunities resulting in an undefined research career pathway, particularly in African universities as most faculty members primarily focus on teaching, while they conduct research 'on the side'. Indeed, through their detailed description of the situation in most SSA universities, most participants attributed the dearth of opportunities for early career researchers to transition into faculty positions to the lack of a structured approach to career progression and succession planning. This results in ad hoc recruitment

process, limited and infrequent vacancies at some departments. The fact that most African Universities barely recruit junior faculty staff makes progression difficult for early career researchers who desire to take an academic scientific career path, but are left 'hustling' as illustrated using the quote below:

> *"In our department, the last time they recruited for junior staff was in 1990's. It was in 2017 that they had one vacancy for professor of entomology… I would like to have a position in the university, but it is not easy to have junior faculty positions advertised…This is a very big problem here and in Africa in general…If you finish your PhD and post-doctoral fellowship, you don't have somewhere to go…you keep 'hustling'! There are no opportunities" (IDI, Female, #04, PDF).*

This problem was shaped and reinforced by other axes of power such as tribalism, nepotism and aging workforce remaining in post. For example, most participants observed that tribalism and nepotism was mainly practiced by senior university management staff, who influence the recruitment of their relatives and those whom they are ethnically affiliated to for junior faculty positions. On the other hand, discrimination based on age revolved around professors holding onto their positions despite being aged, which was reinforced by institutional policies that do not enforce the retirement age, hindering entry of junior researchers into the academic career pipeline. As one participant noted: *"It is not easy to get an academic position unless a professor dies"* (IDI, Male, #13, MCR). The pervasiveness of age-related hierarchies and reluctance to breach these on merit criteria perpetuated further inequities in provision of faculty positions for junior and early career researchers. Such experiences and observations were alluded to by a key informant who noted that most African universities operate on an 'old deadwood' model of lifetime jobs to professors. This creates difficulties with hiring young academic scientists who are ambitious of driving the research field forward as was illustrated using the following quote:

> *"Universities in Africa operate on an 'old deadwood' model where once you are in your job, you never leave. You can just stay in it forever irrespective of how effective you are…there is no oversight on how to ensure quality and rigorous progressive science…Therefore, some institutions stagnate to hire emerging academics because there is just all this 'old deadwood' with no space or money for young scientists who are ambitious to drive science forward*" (KII, Male, #14).

The lack of career guidance on possible career pathways within and outside academic scientific research by the DELTAS Africa initiative, as reported by most female and male doctoral research fellows compounds this issue. A participant noted: "*There are 'a lot of hanging things on next steps'…it is not clear what the path is for us when we finish…there is no career advice on where to go next… you are left to plan on your own" (IDI, Male, #20, PhD)*. To them, career progression to the next level "*could be*

*depended on how merciful your supervisor would be by offering you a position one you finish*" (IDI, Female, #14, PhD). Another participant further stated that:

> "*I don't think people [research leaders] have spent time sitting down to offer us communication and career advice on what do you do next after PhD completion… It would be nice for someone to come and talk to you about what are the various career options"* (IDI, Female, #20, PhD).

Consequently, *"If there is no clear pathway in science for fellows, it is likely for them to move elsewhere [out of science]"* (IDI, Male, #11, PDF). Moreover, the risk of brain drain for excellent trained African scientists to the global North is likely to occur as illustrated using the following quote:

> *"We don't have a good career path here in Africa…there is no tenure, there is no job for life, there is no pension, you are just entirely 'hustling'. And so, if they go to the Europeans or Americans, they will give you tenure, lectureship or something better which is much more attractive…then they begin to see a clear trajectory which doesn't maybe exist in their home countries... that is a massive problem for retention of African research scientists" (KII, Male, #19).*

### 5.6.2: Inequitable access to support systems within institutions

This theme elucidates participants' narratives on the ways that social power relations of gender shaped their everyday lived experiences at workplace in accessing relevant resources and how informal rules of institutional practices and culture exacerbated inequities in career progression.

#### *5.6.2.1 Insufficient social resources - mentoring and dearth of female role models*

One of the mandates of the DELTAS Africa initiative is to provide mentorship to research fellows as a mechanism for enhancing career progression in science, which most participants underscored as '*crucial during the early career stages'* (IDI, Male, #06, MSc). Important roles of mentors were expressed as providing advice on how to progress in one's career, keeping an eye on mentees' social wellbeing, and supporting with linkages to the right professional networks and research collaborators. However, some female and male participants perceived that they had received insufficient mentoring across the science career trajectory. This was a common problem experienced by both women and men, with a range of facets.

A common generic issue that emerged, particularly from two study sites/consortia, was that not all fellows were assigned mentors. This was partly due to a lack of structured mentorship programme in place to facilitate the process. Where mentors were assigned, some mentees narrated that they barely

met with them, not even virtually, since the mentors were extremely busy. The affected participants complained that they were allocated mentors without involvement in their selection, leading to a mismatch due to personality or other differences and a consequent lack of one-on-one relationship.

From a gendered perspective, some female participants reported that it was commonly assumed that supervisors and thesis advisory committee members, the majority of who were male, could also simultaneously serve as '*natural*' and '*automatic*' (IDI, Female, #03, PhD) mentors. This presented additional problems since when faced with personal (e.g. failed and broken relationships, difficulties with work-life balance) and work-related problems (e.g. abusive supervision, sexual harassment) that impact on their careers, they did not feel comfortable sharing these with male mentors. Some expressed the need for female mentors for provision of psycho-social support, emphasising that *"sometimes you need to have someone who understands you, who is married and easy to relate with" (IDI, Female, #14, PhD, married, under 5-year-old-children)*. In particular, most junior and early career female research fellows without children frequently expressed the need for support and guidance on how to manage the common dilemma expressed by female researchers about how to progress in science alongside the anticipated pressures of childbearing and childrearing responsibilities for women. For example: "*What if I get pregnant! How will I progress in science?" (IDI, Female, #22, PhD, unmarried)*. Some women with children also expressed the need for mentorship on managing critical career transition points whilst they have dual responsibilities for young children, for example:

> *"Transitioning from post-doctoral research fellowship to a principal investigator is very difficult…to me, this is a career stage where you need someone to genuinely encourage you, mentor you, give you the right kind of support on how to deal with family and research career" (IDI, Female, #27, PDF, married, under 5-year-old children).*

Overall, most key informants stated that they encouraged both female and male fellows to find informal mentors for themselves who could support them with career progression, although most women had an additional challenge finding female mentors due to fewer senior female research scientists.

Role models were also recognised as important to aspiration and strategic direction in research careers. In this study, most male participants considered either their male supervisors, mentors, or the DELTAS consortium leaders as their role models in scientific careers. In contrast, most female researchers, especially at junior and early career stage expressed that they barely had female role models in science.

Instead, they commonly pointed to their DELTAS consortium research leaders, and to some extent supervisors and mentors, most of who were male. When prompted to reflect on the lack of female role models amongst those they identified, they frequently expressed that they had very few examples of women in senior scientific positions who were also in successful marriages, since it seems most of them had to 'sacrifice' their marriages to enable them progress in their careers:

> *"But I don't see any successful, powerful and huge women as science directors that are still in their marriage and who have maintained a successful family life! ...It seems someone has to 'sacrifice' something! Something must fall apart one way or the other…realistically speaking, I think my family would definitely suffer if I became more ambitious in science… for me that would be the hindrance, I would say" (IDI, Female, #11, PhD, married, under five-year-old child).*

Many junior and early female researchers who were already married or were planning to get married and establish families expressed that such observations led them to doubt whether they could follow careers in scientific research. Growing up within an African patriarchal context, with a strong linkage between marriage and childbearing for women, those who had 'sacrificed' such expectations for their career progression were labelled by some female researchers as poor role models or mentors.

#### *5.6.2.2 Inflexibility of formal rules around working policies and culture*

There was consensus amongst key informants that formal flexible working policies within their institution do not exist, although research fellows were perceived as 'usually' able to make informal arrangements with their supervisors on provision of flexi-time. However, some informants admitted that:

> "*The culture and practice of flexible working arrangement is more for the senior level researchers, from postdoctoral research fellows moving upwards…this can be extremely difficult for postgraduate research fellows*" (KII, Male, #05).

A common issue raised by most female and male research fellows at all career stages was their dissatisfaction with the way in which flexible working opportunities may depend on one's position in the institutional hierarchy. This was acknowledged as a particularly acute problem for women by both women and men:

"*The reality is that flexibility mainly depends on the level at which one is located at the science professional cadre. A woman who is not in senior position wouldn't be comfortable to keep requesting the supervisor for flexi-time, as not all supervisors are the same at granting such opportunities*" (IDI, Female, #31, MCR).

Considering that women bear the brunt of reproductive responsibilities in their everyday lives compared to men, the lack of formal provision of flexible working hour policy or procedure within the institutions was seen by some women as "*gender discriminatory issues …through unconscious biases from the leadership with no conscious considerations on how it could impact on career pathways"* (IDI, Female, #05, PDF, married, under 5-year-old children). A male participant also noted that "*keeping women in science careers, and who have reproductive duties to fulfil without provision of formal flexible working arrangement is just a dream"* (IDI, Male, #12, PDF, married, under 5-year-old children). He further placed emphasis on this issue as particularly challenging for women, asserting that provision of flexible working opportunities by institutions would also enable men to take on and assist women with reproductive and caring responsibilities.

#### *5.6.2.3 Lack of institutional support for women researchers with nursing needs*

The absence of mother and baby-friendly lactation rooms at workplace presented difficulties for women researchers with nursing needs, which they expressed as indicative of the gender insensitivity of the workplace environment. Some female participants with young children lamented that: *"If you don't have a personal office or a car and happen to be a nursing mother, it is hard to find a conducive place to express and store breastmilk while at work" (IDI, Female, #25, PDF).* When caught in such a situation, a common option for them was to use bathrooms for breastmilk expression as well as storing the milk in a common fridge, which to them was unhygienic. Even where an individual manager was sympathetic, the physical environment was unconducive. In one consortium, a male supervisor (interviewed as a key informant) explained that he improvised by allowing his supervisee to use his office for nursing, but since his office was glass walled, he had to cover the walls with papers to enable privacy. Overall, this finding was corroborated by most key informants who admitted that provision of adequate and well-equipped lactation rooms within their institutions was lacking.

### 5.6.3 Informal rules: Everyday experiences of negative practices and culture at workplace

Some female participants across all career stages in the sampled consortia narrated their experience of an uncomfortable workplace environment characterised by negative stereotypical attitudes; gender biases; sexual harassment, bullying and intimidation. They felt that this environment impeded their career progression within the institution, and/or could even lead to attrition from a scientific career. Such concerns were barely experienced by the male participants, most of whom acknowledged that such issues were mainly experienced by women.

#### *5.6.3.1 Negative stereotypical attitudes at work towards 'career women' and social scientists*

This was an issue that was mainly raised and experienced by some junior and early career female researchers. For example, a participant complained about some female and male colleagues at her workplace who occasionally questioned her as to why she is still unmarried, implying that she was prioritising her career over marriage, which made her feel uncomfortable:

> *"It is more individual colleagues who will make the workplace sometimes uncomfortable because they think at your age you should be married, you should have children…so sometimes you know they won't say it directly but the message that is coming across is like you are prioritising your career over other things"* (IDI, Female, #*27, PDF, unmarried).*

Sometimes formal meetings by female networks at the workplace were negatively perceived by male colleagues as gossip time:

> "*When we are having meetings with my friends at work, they [male colleagues] would think that all that we do as women is to gossip. And then when we start winning project proposals, then they are like, 'you people when you have projects and proposals you only invite your friends!'. My friends are all ladies. And when we are winning proposals, they are like you just gossip!*" (IDI, Female, #06, PDF).

***Gendered disciplinary stereotyping for social scientists:*** Most participants who identified as social scientists perceived themselves as under-appreciated minorities within their respective (largely biomedical research focused) institutions:

> *"There isn't really an appreciation by biomedical scientists of what social science brings to the table…it is still overlooked as of less interest in the science agenda… [But then] you get their request to help them have a paragraph in their proposal that needs some qualitative research work. They are like ooh, 'can you please write this paragraph for me?'…And when it is funded, it's focus is to complement the other*

*sciences… it is like an afterthought...the assisting part of research. It is like it can't stand by itself. So that remains a big problem for us which keeps making me feel bad" (IDI, Female, #26, PDF, social scientist).*

Accounts of gender stereotyping of the disciplinary field of social sciences, which was viewed as mainly dominated by women were also prominent. For example, a female social scientist admitted that she had occasionally heard sentiments conflating social science methodologies and female gossip, such as "*what have you women been discussing, and not what have you social scientists been discussing*" (IDI, Female, #26, PDF, social scientist).

#### *5.6.3.2 'Hot' and 'hidden': Gender biases at workplace*

Existence of gender biases within the workplace, mainly against female scientists was reported by some female and male participants. This was characterised as a "*problem that is 'hot' [very common], 'hidden', entrenched within the system and which is difficult to see and tell that it exists*" (IDI, Male, #25, PDF). A range of manifestations were described, including preferential treatment by some principal investigators (PIs) towards hiring male researchers; and some male scientific managers cautioning female scientists to avoid pregnancy within the lifecycle of a research project. For example:

*"Sometimes you experience bad attitude of some managers because some will be like, they don't encourage pregnancy. They are like, why are you getting pregnant, and you are a student? …They are male senior scientific staff. They are like you are supposed to be concentrating on your work, nothing else! So, when you get such comments, you are like okay, so I shouldn't do this? I should put it on hold, finish, then I should go and do this other thing" (IDI, Female, #23, PhD, married, no child).*

In the same vein, an early career male researcher asserted that he had observed gender discrimination in hiring where some male PIs exhibited unconscious gender biases against provision of job opportunities to young female researchers even when they turn out to be the best candidates. He further noted that when having informal conversations with such PIs, they usually argue that "*women are likely to go on maternity leave, which is useless to have them, even though they performed better at interviews*" (IDI, Male, #02, PDF). Similarly, a female research scientist from a different DELTAS ARC noted that: *"I heard a comment where somebody [PI] said that, 'I prefer hiring research assistants that are male because they don't have to deal with things like pregnancies"* (IDI, Female, #32, MCR). Such attitudes result in feelings of guilt among junior female researchers, and some perceiving a need to 'pause' their science career to have children or focusing on teaching instead of research.

#### *5.6.3.3 Sexual harassment, bullying and intimidation*

***Sexual harassment:*** This was experienced by some female researchers mainly at junior and early career stages, most of who identified themselves as unmarried. However, when encouraged to elaborate further, most of them highlighted that they were uncomfortable speaking about it while still on the fellowship programme. As one participant said: "*Personally I have sexually been harassed on several occasions…I really don't want to talk about it…maybe after I am done and out of this place* [clicks - indicating how unbearable this problem was for her]" (IDI, Female, #21, PhD, unmarried). A few opened up to share their experiences of sexual harassment by some male senior research scientists within their institutions. This took the form of physical sexual advances and sexual coercion, where a career progression opportunity was offered conditional on sexual activity.

When asked about whether they had a chance to report it to the relevant authorities, most were unaware of any sexual harassment policy for the institution in which they were affiliated to, noting that they had never been given an induction or even a handbook with such information. Additionally, they highlighted the lack of clear institutional procedures for how to report and effectively address such issues both at institutional and consortium level. Consequently, the affected participants feared that reporting or even speaking out would jeopardise their prospects of career progression within the same institution and elsewhere given that most institutions are interlinked through research collaborations. Moreover, they also feared a lack of confidentiality in handling the matter, citing they might later be victimised. For example:

> "*There is no proper approach on how to handle and report it… I don't want to go to the director that I am reporting my supervisor, that I wouldn't do! Unfortunately, we are human beings, and you will meet over a cup of coffee and someone whom you reported the matter to might mention that and perhaps my name mentioned too. If it gets to my supervisor again, it will make things worse …continuing to work and grow here or even in other related research institutions can become difficult…so I think that is my major point of concern" (IDI, Female, #17, MSc, unmarried).*

Whilst most key informants reported the existence of policies and reporting procedures on harassment and discrimination, most participants within the same institutions were unaware of them. When asked whether any incidence/s of sexual harassment had ever been reported by research fellows within their institutions, most key informants said there had never been such a case. However, one informant expressed the view that: "*In every institution where there are men and women, you will always get*

*sexual harassment…it is all about 'power' and as a show of strength mostly coming from male lecturers who end up sexually harassing most of the female doctoral fellows that they supervise"* (KII, Male, #20). He further emphasised that even where policies exist, fellows may be sceptical about the chances of them being implemented, due to the influence of social power relations which privilege perpetrators:

> "*Even though there is a disciplinary council with professors who sit on the panel, it is very difficult to dismiss a lecturer as almost all cases end up being withdrawn…most perpetrators usually have political connections or inclinations with the [university and ministry of higher education] administration"* (KII, Male, #20).

Participants who experienced harassment expressed how uncomfortable they felt in the institutions; some considered opting out of the fellowship programme, while others noted that they would not like to take up any future career progression opportunities at their current institution or programme.

***Bullying and intimidation****:* This was experienced by some female fellows at various career stages. They asserted that this was mainly perpetrated by both female and male supervisors and senior research scientists towards junior, early career and mid-level female scientists suggesting that workplace hierarchies were the most significant power relation at play. Notably, the kind of bullying experienced was often "*more subtle and silent, which is hard to report as there is no dictionary definition to it*" (IDI, Female, #03, PhD). For instance, a female mid-career researcher attributed her own experience of bullying to senior scientists feeling threatened by her rapid career progression into their areas of expertise. This is indicative of the highly competitive nature of scientific culture in which researchers are expected to 'fight' for their place, against those above them in the hierarchy as well as their peers. She further reflected on how women are often socialised to be more oriented towards 'cordial relationships' and therefore less prepared to 'fight' which may lead to them 'opting out':

> *"I felt bullied. The bullying is very subtle because it is very low.… If you are an upcoming scientist trying to break through to senior level, stepping into a research area similar to that of your senior scientists makes them uncomfortable… there is a tendency sometimes to be bullied… I am encountering it right now. … It is more of power imbalances … you have to think of the checks and balances here. Obviously, the junior scientist doesn't want to offend this one here because of mentorship and all that. You want a 'cordial relationship'… [but] it is a battle which I don't want to fight here! I just can't 'fight'! ...You decide this is not for me… for a man, they can 'fight' over such issues without caring…they will say what they will say. For most women like me, we are very careful about what we say and that doesn't work very well. Women*

*don't 'fight' good. And so, when you are encountering a situation where you have to 'fight', most women would just rather abandon the idea or just quit" (IDI, Female, #29, MCR).*

She further observed that bullying behaviours by seniors are one of the reasons why early and mid-career level researchers opt out of the scientific research career path.

Other bullying and intimidatory behaviours included: yelling at junior fellows in public spaces within the institutions as mainly reported by female fellows; making demeaning statements to fellows and asking for a higher number of publications from junior fellows than required, which delays their graduation. For instance, a participant stated:

"*I am literally terrified every time I am going to talk to him. He is going to tell me, 'I am so stupid' or if he doesn't use the word 'stupid', he says, 'you are superficial, you are not thinking deeply'… It is so frustrating. Most of the time after talking to him, I can't tell if I have made progress or not… sometimes I sit and cry because it is too much" (IDI, Female, #02, other identifiers withheld).*

Such behaviours were perceived as drivers of poor mental health. For example, a junior female researcher narrated how she had suffered from depression in silence for which she sought treatment on her own.

*"Very demeaning statements were said to me [by the supervisor] … I was getting drained day by day psychologically and emotionally … I had certain constant headaches and the doctors diagnosed depression…For three months, I wasn't myself! …I was always getting medication without their [programme management team] knowledge. From the time I was suffering, I was just trying hard still to fight it… It was very difficult" (IDI, Female, #01, other identifiers withheld).*

She further noted that even though the programme had earlier assigned her a female mentor, she never disclosed to her how she was suffering in silence as she did not have a personal rapport with her. Overall, such experiences could demotivate them from aspiring to advance their careers within the same institution or even lead to attrition of fellows from the programme and the specific institutions. Notably, none of the male participants reported experiences of bullying and intimidation.

#### *5.6.3.4 Implications of women's under-representation in scientific leadership and decision-making*

Most female participants noted that direct and indirect discrimination, sexual harassment, bullying and gender stereotyping result in fewer women progressing to scientific leadership and decision-making positions. Consequently, the lack of women in such positions acts as a barrier to changing institutional cultures, formal and informal rules:

> *"So, within our African institutions, it's quite clear that there is a big problem. You will find the major executive and leadership positions are mainly held by men… they are not that much sensitive on issues about gender equality…people feel uncomfortable to reach out to them. Perhaps if we change the leadership towards including women, maybe this problem [sexual harassment] will be minimal" (IDI, Female, #32, MCR).*

In addition, a male participant reiterated that such inequities are exacerbated by a lack of deliberate action towards increasing female representation in leadership:

> *"There is no deliberate action to have the gender balance for the heads of departments …its mainly constituted by men. So, if we have more men head of departments than we do have women, we lose a lot of women to grow up into leadership. So, you find that fewer women qualify for leadership positions than men… So, what we need to do, is to encourage greater female representation at the departmental heads" (IDI, Male, #13, MCR).*

Women participants attributed their under-representation in leadership and decision-making committees to a range of issues, including incompatibility of women's gender roles with the nature of science careers; 'excuses' given by male leaders that women don't apply for such positions; institutional sexism & bullying; and stereotypic perceptions that women are not strong enough to lead an institution.

Most key informants stated that in their research consortia positions within the management and decision-making committees were skewed towards more men than women. Notably, the PIs of the three consortia that participated in this study were all male, and only two out of the eleven DELTAS RCS initiative was led by female PIs. The informants further noted that "*the steering committee was mainly made of the PIs of the African partnering institutions and Northern research collaborators, most of who were male*" (KII, Male, #15). The reason provided for this skewed gendered representation was that "*the main consideration for PIs and co-PIs was based on their expertise as opposed to gender*" (KII, Female, #02), as well as historic imbalances. They also noted that funding agencies also play a role in perpetuating gender inequities at leadership level, since they barely appoint female leaders for

executive and management positions; for example, citing Wellcome Trust funded research institutes in Africa are mainly male-headed.

## 5.7 Discussion

This study provides insights on the way in which institutional level drivers and processes around access to resources, as well as formal and informal rules manifested through policies and everyday practices and culture at workplace, intersects with macro-level systems of power to produce differential gender inequities in scientific career progression of researchers. We have analysed how the challenges of limited career progression opportunities, and research funding uncertainties are shaped by oppressive macro-level forces of power at the wider national and global context, making the institutional environment highly complex and competitive for researchers. Whilst this was considered a salient issue affecting both female and male researchers, we have identified differential gendered impacts. We also found that women researchers at all career stages work in an unconducive environment characterised by negative stereotypical attitudes towards 'career women', gender biases, bullying and intimidation, and sexual harassment. Such negative behaviours and practices at workplace are inherent in institutional formal and informal rules which interact with the culture to deter their career advancement. In addition, we found gendered inequities in access to social resources such as psycho-social mentoring and female role models; as well as lack of provision of physical resources pertaining to mother and baby-friendly nursing facilities which disadvantages women researchers. The inflexibility of working policies and culture, which are engrained within the formal rules and informal arrangements compounds the latter issue, which not only affects women, but also perpetuates gender inequities by failing to support men who would like to shoulder caring responsibilities. Indeed, women attributed their underrepresentation in scientific leadership and decision-making roles to these experiences, which they felt disadvantaged them in career progression. Social scientists also felt marginalised and disadvantaged in ways that intersected with gender stereotyping.

Although mentoring is acknowledged as a key to successful and satisfying careers, studies have shown that there is a shortage of formal mentoring programs (Frei et al., 2010). Our findings raise questions regarding the nature of mentoring that is offered within the DELTAS Africa initiative, which although apparently equally accessible to women and men, is in fact 'gender blind' in that it caters less to needs expressed by women for psycho-social support in what they often experience as a hostile environment. This indicates the need to rethink mentorship schemes through embracing a structured approach, which

is also cognisant of both career and psycho-social needs of women and men researchers. It has been argued that women benefit more from having senior male career mentors as they typically tend to have more power and influence compared to women, thus making them more effective for the career advancement of mentees (Mukhebi et al., 2017). On the flip side, there are advantages of women scientists being paired with female mentors to offer psychosocial support, as they better understand the barriers women scientists encounter in their careers, and the relationship is often more relaxed (Mukhebi et al., 2017). We therefore contend that women researchers may need two types of mentors to help enhance equitable progression in their careers.

Even though women are encouraged to identify their own informal mentors, other studies have found that that compared to men, women have fewer contacts outside their own institutions who could serve in such roles (Rathgeber, 2013). Indeed, with fewer women in senior scientific and leadership positions, other studies have found that male researchers are more likely than females to have role models, and career and psycho-social mentors who are able and willing to promote their career interests (Liani et al., 2020; Mabokela and Mawila, 2004; Raburu, 2015). Relatively few examples of women scientific leaders exist, and even fewer who have managed to effectively balance work and family demands, leading to a lack of female role models in science who can model such balance for women seeking successful careers in this field (Jean et al., 2015). In line with other studies, the overall picture is of a prevailing scientific culture that provides inadequate direction and psycho-social mentoring for women, eroding their self-confidence, especially for junior researchers, who feel that they cannot afford to make it to senior scientific and leadership positions (Etzkowitz et al., 2000; Mathad et al, 2019; Vallentin, n.d.).

Our findings align with other studies in SSA (Liani et al., 2020; Mabokela and Mlambo, 2015; Mama, 2006; Onsongo, 2006; Raburu, 2015), which have shown that the inflexibility of formal rules around working policies and culture, and a lack of resource allocation for women researchers with nursing needs disadvantages women with reproductive responsibilities. Vilnius argues that that combining family and career is viewed as a “private affair” for women which culminates in a lack of family favorable environment in scientific institutions (Vilnius, 2007). This implies for a need to develop and foster an inclusive conducive institutional work environment that is sensitive to gender, and diversity needs through formulation of clear policies and practices, and proper implementation. For instance, creating working models that support women and men with family responsibilities through provision of lactation

areas, and on-site childcare centres would enable them to balance their careers, family and personal wellbeing, thus overcoming barriers to equitable progression.

Our findings that unfriendly work environments characterised by a spectrum of behaviours and practices shaped by gender dynamics at the (meso) institutional level, such as bullying and discrimination, sexual harassment, gender stereotypes and biases, and inflexible working hours, disadvantage women, align with other SSA literature (Assié-Lumumba, 2006; Johnson, 2014; Liani et al., 2020; Mama and Barnes, 2007; Morley, 2005; Onsongo, 2007). Women's narratives in our study concur with the work of other scholars who contend that not only is sexual harassment a recurrent problem for women in research institutions in Africa, but raising attention to it is still perceived a dangerous act for women, who may therefore opt not to report it (Mathad et al, 2019; Morley, 2005; Rathgeber, 2013). Such women suffer because of a lack of a safe and unbiased reporting system for seeking help, as well as fear of negative repercussions, jeopardising their academic standing, and fear of not being believed (Mathad et al., 2019). This may result in poor mental health (Fine and Sojo, 2019; Jagsi et al., 2019), as well as discouraging women from career progression. Notably, the fact that men did not report about experiencing bullying and intimidation, may indicate that perhaps it was harder for them to speak about it, or rather they had a different understanding of what bullying and intimidating behaviors' entails.

We found that women were discouraged from getting pregnant within the life cycle of a funded project, which constitutes both direct and indirect gender discrimination in that individual women perceived a 'choice' between childbearing and a scientific career, and gender biases against female candidates was also reinforced. Our previous paper from this study found that women's career progression opportunities were acutely influenced by simultaneous requirements to establish scientific research careers and the peak of childbearing and rearing responsibilities (Liani et al., 2021a). Attitudes of decision makers, the majority of who are men, which view child-rearing and research as inherently incompatible contribute towards this disadvantage (Etzkowitz et al., 2000). Other studies have found that such practices are more common in environments where women are underrepresented in positions of power and authority, limiting the promotion of gender-responsive policies that could enhance better institutional culture (Fine and Sojo, 2019; Jagsi et al., 2019; Liani et al., 2020). This implies that institutions should work towards better representation of women in leadership roles.

An intersectional analysis has enabled us to provide new insights into how the disciplinary dominance of biomedicine in global health research acts as another axis of power influencing individual researchers. This creates a clustering of disadvantage as women tend to be more represented in social sciences, which is gendered female and stereotyped as less valuable compared to biomedical sciences. Indeed, the relatively limited funding opportunities for social scientists interacts with the gendering of the discipline to entrench disadvantage particularly for female researchers (Locke et al., 2018; Rathgeber, 2013).

Our findings show that the dearth of career progression opportunities and research funding uncertainties in SSA are shaped by macro-level structural power relations which intersect with formal and informal institutional rules to create differential outcomes along several intersecting power axes. We have argued that the macro-level forces of neo-colonial relationships in funding structures exacerbates the racism in grant allocation as perceived by African scientists. Others have similarly posited that the challenges around funding structures are external to Africa, and are engrained in legacies of colonialism that continue to favour Northern-based researchers as parachute researchers (Kasprowicz et al., 2020). This problem is exacerbated by requiring grant applicants to hold a faculty position, without acknowledging the biases on the basis of ageism, favouritism and nepotism in provision of tenure that are common in higher education institutions in Africa (Beoku-Betts, 2005; Liani et al., 2020; Onsongo, 2006). The criterion favours PIs from Northern academic institutions, who hold permanent faculty positions, and often contract African researchers to conduct research on a short-term basis, continuing extractive approaches that do not build African institutions. Overall, this finding presents implications for research and practice to the research community and funding agencies who need to promote equity in research funding criteria as well as confront structural racism in grant allocation. For instance, funders may need to challenge the prevailing perception that one need to collaborate with a renowned White PI to get funding, when communicating about calls for grant applications.

Dependence on an inequitable Northern grant funding system is entrenched by macro-level forces of political economy characterised by limited investment in research by most African national governments. Despite the fact that most academic researchers working at African universities have a joint mandate to teach and perform research, for many of them, the boundaries between these two fundamental responsibilities are fuzzy (Okeke et al., 2017). With many African governments operating at

huge budget deficits, there is little money allocated for research to faculties in public universities, which are most affected by limited research career progression opportunities (APHRC, 2013). The competition for limited opportunities exerts significant pressure on junior researchers, which interacts with institutional and societal power relations to exacerbate inequities. It is evident from our findings that the psychological and economic insecurity of short-term employment contracts, create the sense of 'a scary' profession for both female and male early career researchers (Vallentin, n.d.). However, the impacts are gendered, both with regard to the responsibility for not only nuclear but extended families assigned to men (and single female parents) and gendered norms and expectations of female social interaction, which favour collaboration over the "rigid model of hyper-competition" that characterizes the "brutally competitive grant culture of scientific research" (Fine and Sojo, 2019). This situation is unlikely to be significantly relieved without expanding the number of sustainable scientific positions for junior and early career researchers in SSA. Indeed, failure to address this problem of limited career progression opportunities can lead to 'brain-drain' of newly-minted African scientific health research workforce (Kasprowicz et al., 2020). The relatively recent expansion of 'soft' scientific research funding to African institutions, and the concomitant increase in HRCS funding appear to have outpaced institutional career progression structures, placing particular pressure on less established researchers.

Notably, the DELTAS Africa initiative through AESA recognises this challenge, and is lobbying with African governments to create viable career pathways for research in universities as well as to invest more of their gross domestic product in research to reduce the reliance on external funding (Kay, 2015). In doing so, we also opine that inasmuch as such initiatives continue to prioritise recruitment and training of individuals, they should also consider if national institutional structures are adequate and willing to support the career progression of the trained research fellows. Moreover, HRCS initiatives need to consider future career systems that are multi-dimensional, and which challenge the ingrained classic linear pipeline model of career progression (European Union, 2012), as a way of recognising contextual realities in SSA. In doing so, there is need to encourage and support researchers to develop new innovative approaches to careers in and out of academia (Wellcome Trust, 2013). They may also need to consider a shift away from individual and institutional capacity strengthening towards creating more enabling institutional environments.

Overall, this study has enabled us to show the relevance of the conceptual framework posited based on review of existing literature (Liani et al., 2020) as clearly supported by the current findings. It has

contributed new insights about how macro level systems of oppression shapes access to resources, which interacts with formal and informal rules and policies to produce and reproduce gender inequities in scientific career progression of researchers as a result of social power relations. The remaining constituents of the framework have been explored elsewhere (Liani et al., 2021a). Notably, in the current study, participants did not refer to gender inequities with resources allocation around office space, research facilities and equipment, as previously reported in other SSA studies (Beoku-Betts, 2005; Campion and Shrum, 2004; Liani et al., 2020). Perhaps this finding be explained by the fact that participants were part of research capacity strengthening initiative that necessitated provision of such resources for the fellows.

### 5.7.1 Study limitations

Findings from this study should be considered in light of the following limitations. First, while the integrated conceptual framework highlights the intersection of gender with language and physical disability, insights about language minorities have been presented in a different paper (Liani et al., 2021a). However, we were not able to identify researchers who identified as disabled within the sampled consortia and the overall DELTAS Africa initiative. Efforts to identify and recruit such individuals from the wider host and participating institutions in selected consortia were prevented by the need for country-level ethical clearances for each institution. This was not possible within the time constraints of the study. In addition, this also meant that we could not embark on document review of the nature and kind of operational institutional level policies, procedures, and their implementation. Second, participant concerns about anonymity and confidentiality prevented the presentation of nuanced comparisons about their affiliated institutions and consortia. Third, we acknowledge the underrepresentation of female PDFs in our sample. This was not by study design: despite significant follow up efforts, we experienced lower take up of interview offers by female PDFs.

Despite these limitations, the findings from this study serve as avenue for understanding the institutional drivers of inequities, which provide DELTAS Africa consortia and similar HRCS initiatives information on the varied intersectional gendered challenges faced by researchers in their pursuit of a scientific career path within their institutional work environments. Detailed participants' recommendations and suggestions on how to address such issues will be presented in a different paper.

## 5.8 Conclusions

This study offers an in-depth analysis of the institutional level drivers and processes that produce gender inequities by illuminating how social and structural power relations shape scientific career progression of researchers who are beneficiaries of a HRCS initiative in SSA. Specifically, the intersectional approach to gender analysis elicited an understanding of how highly competitive and insecure institutional environments are shaped by macro-level forces at national and global levels. Women's and men's differential experiences of this environment are further shaped by institutional power relations, policies, practices and culture, influencing inequities in career progression of women and men researchers. Therefore, understanding and addressing both the social power relations within meso-level institutional environments and at macro level of national and global funding policies is necessary to promote equitable career progression opportunities. HRCS funding initiatives need to pay attention to improving institutional working cultures, practices, and policies, as well as contributing to a more conducive sectoral environment for scientific careers through both advocacy and addressing internal systemic biases.

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The views expressed in this publication are those of the author(s) and not necessarily those of AAS, NEPAD Agency, Wellcome Trust or DFID.

### 5.8.3 Ethics approval and consent to participate

The study received required approvals from the Liverpool School of Tropical Medicine Research Ethics Committee (Protocol ID: 17-075) and the Strathmore University Institutional Ethics Review Committee (Protocol ID: SU-IRB 072/18). Participants were provided with an information sheet that explained the aims of the study and related risks and benefits. All participants gave written informed consent. For participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms.

# Chapter 6: Results – Enablers of gender equitable scientific career progression in Sub-Saharan Africa

## 6.1 Chapter Overview

This is the final results chapter that weaves together findings on enablers to gender equitable scientific research career progression by responding to the last two research questions as follows:

i. What strategies have been used within selected DELTAS institutions to promote gender equitable career progression for women and men, and their disadvantages in relation to their multiple social identities, and what can we learn from them?

ii. What are the participants' desired actions for change towards enhancing equitable career progression for women and men, and their disadvantages in relation to their multiple social identities, to progress along the career ladder in future?

It outlines the rationale for, and methodological approach to undertaking the empirical research. It utilises the conceptual framework developed within the literature review in chapter two to frame the results and discussion sections. Finally, it provides implications for policy and practice, and future research directions, as well as highlights the study limitations and conclusions. It has been submitted for peer review to the AAS Open Research Journal. As this paper draws multiple elements of this thesis together, there is some overlap in this chapter and chapters four, five and seven.

**Enablers of gender equitable scientific career progression in Sub-Saharan Africa: Insights from the DELTAS Africa Initiative**

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**Author Contributions:**

**ML:** Conceptualisation, Project administration, Study design, Data collection, Data Analysis and interpretation, Writing – original draft preparation, review and editing the manuscript.

**IN:** Guidance and support with conceptualisation and study design, Validation of data analysis process and feedback provision on data interpretation, Writing – review and editing, PhD Supervision.

**JP:** Guidance and support with study design, Writing - review and editing, Funding acquisition.

**RT:** Guidance and support with conceptualisation and study design, Validation of data analysis process and feedback provision on data interpretation, Writing – review and editing, PhD Supervision, Funding acquisition.

## 6.2 Abstract

***Background:*** This paper present findings on current strategies utilised within selected Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) consortia to promote gender equitable scientific career progression for researchers, as well as participants' recommendations for change. Findings are drawn from a wider research study nested within this health-based scientific research capacity strengthening initiative that was aimed at gaining an in-depth understanding of the barriers and enablers of gender equitable scientific career progression for researchers in Sub-Saharan Africa.

***Methods:*** We adopted an exploratory qualitative cross-sectional study design. The main method of data collection was in-depth interviews (IDIs) with trainees/research fellows at various career stages affiliated to three purposively selected DELTAS Africa Research Consortia. In addition, key informant interviews (KIIs) with consortia research leaders/directors, co-investigators, and management team were also conducted to corroborate information gathered from the IDIs, and to provide additional insights on the enabling factors/actions and policy processes that were currently in place or proposed to enhance gender equitable career progression. In total, fifty-eight IDIs (32 female and 26 male) and twenty KIIs (4 female and 16 male) were conducted. Interviews were carried out between May and December 2018 in

English. Data were analysed inductively based on emergent themes, and aligned to the developed integrated conceptual framework.

***Results:*** Three overarching themes were identified. First: micro level efforts - individual coping mechanisms and familial level support. Second: Meso level efforts -existing enabling mechanisms at the institutional level. Third: proposed solutions for positive change towards enhancing gender equitable career progression at micro, meso and macro levels.

***Conclusions:*** These findings have implications for future research capacity strengthening programming, including DELTAS Africa II initiative (2021-2025); they provide valuable insights on potential strategies and actions aiming to narrow gender inequities in scientific career progression in the context of sub-Saharan African research institutions.

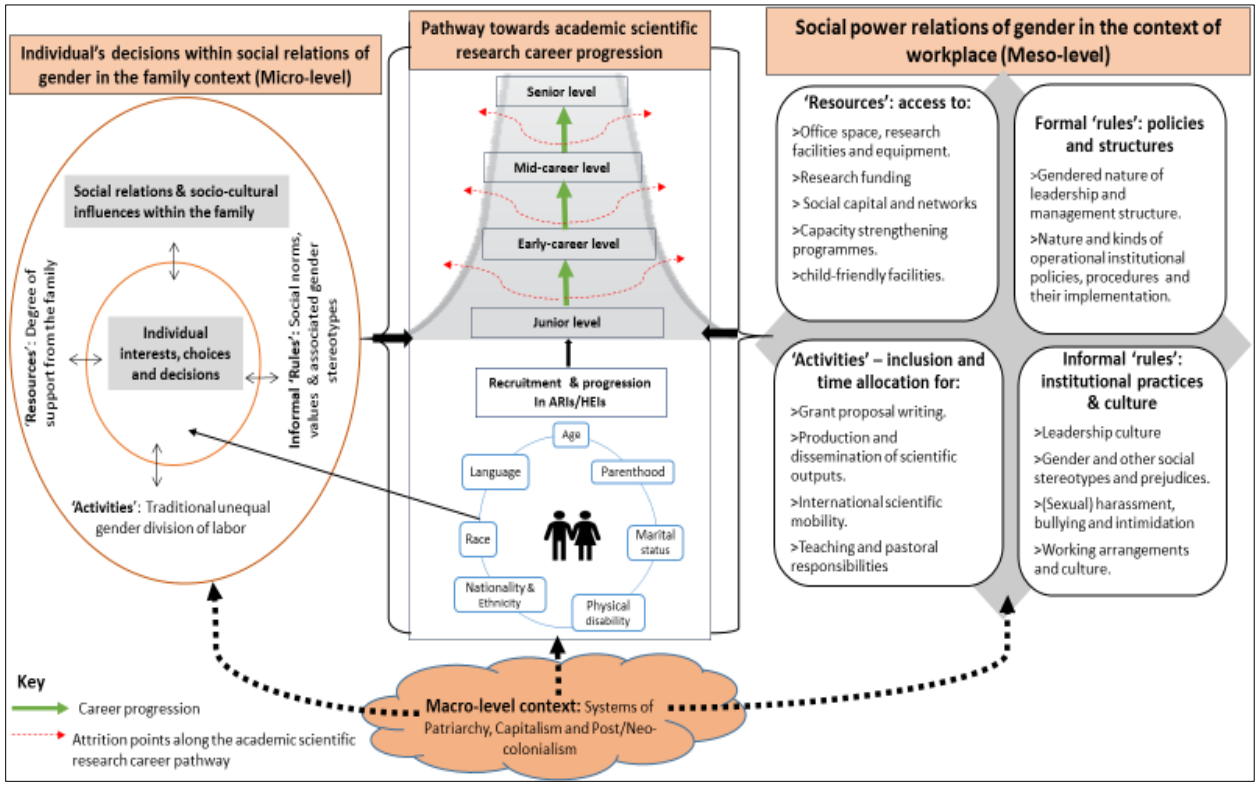
## 6.3 Introduction

Gender inequitable scientific career progression is a global problem (The Royal Society, 2011), which has been extensively investigated in the global north, with existing literature providing little comparative evidence from the global south (Campion and Shrum, 2004). Consequently, most strategies proposed to address this issue are grounded in the socio-cultural context of countries of the global north, which are limited in capturing the nuances of gender and culture of higher education and research institutions in developing countries, and African countries in particular (Mabokela and Mlambo, 2015). Therefore, urgent attention should be paid to conducting research on higher education and research institutions in Africa in order to inform responsive policies and programs that enhance gender equitable career progression (FAWE, 2015). This should provide up-to date evidence on which to develop targeted interventions to address the needs of female and male researchers (FAWE, 2015). A recent review found a dearth of studies trialling interventions to address impediments to equitable scientific and academic career progression of female and male researchers in sub-Saharan Africa (SSA) (Liani et al., 2020).

To address the dearth of empirical research into gender equitable scientific career progression in a SSA context, we undertook a qualitative research study set within the context of 'Developing Excellence in Leadership, Training and Science in Africa' (DELTAS Africa) – a health-based scientific research capacity strengthening initiative – to explore barriers and enablers to gender equitable scientific career progression. The ultimate goal of this qualitative study was to produce evidence from a holistic, gender

comparative and intersectional perspective that could be used to develop strategies to promote career equity for internationally competitive African scientific researchers. In two previous papers, we presented empirical findings highlighting differential drivers of gender inequitable scientific career progression comprising of familial and socio-cultural (Liani et al., 2021a), as well as institutional level drivers (Liani et al., 2021b). Specifically, findings presented previously illuminate how social power relations, gender norms, expectations, roles and responsibilities affect gender equitable scientific career progression across multiple levels – from the individual level, within family, society and institutions. In this third paper, we present and discuss findings on support mechanisms and coping strategies utilised by women and men researchers, existing enabling mechanisms at institutional level for enhancing gender equitable career progression, and participants' own recommendations for positive change in policy and practice. These findings could be used by institutional and consortia research leaders, principal investigators, and funders to inform programme planning for DELTAS II (2021-2025), and related research capacity strengthening programmes, as they provide valuable insights on what strategies and actions they could tap on and implement in narrowing barriers to gender equitable scientific career progression. We frame our findings based on emergent themes from the data whilst aligning them to our integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in SSA (Liani et al., 2020), as a lens for analysing the existing enabling mechanisms at the micro, meso and macro levels, as presented in Figure 6.3 below:

*Figure 6.3: An integrated conceptual framework for understanding intersecting gender inequities in academic scientific research career progression in HEIs in SSA*




## 6.4 Methods

### 6.4.1 Study design and setting

We adopted an exploratory qualitative cross-sectional study design. The research was conducted within the context of the DELTAS Africa initiative, and implemented by a network of eleven African-led health research programmes, commonly referred to as DELTAS Africa Research Consortia (DELTAS ARC). This was a five-year (2015-2020) initiative whose vision was to train and develop the next generation of internationally competitive African health researchers and research leaders while fostering career pathways (Kay, 2015). The DELTAS ARC offered collaborative research training programmes in various health-related scientific disciplines, in a range of biomedical and social sciences, spanning 54 lead and partner institutions (research organisations and universities) across SSA, in partnership with Northern academic institutions. In doing so, it facilitated career development of postgraduate science students (Masters and Doctorate), who are both referred to in this study as junior researchers, and scientific

research professionals (post-doctoral fellows and mid-level researchers), who pursued research work/studies at institutions in their home - or other African-countries.

### 6.4.2 Sampling strategy

We adopted the principles of maximum variation sampling. This allowed us to discover patterns for core elements or dimensions that hold across a diverse sample, as well as unique or distinctive variations (Patton, 2002). We used a two-tiered purposive sampling strategy for selection of: 1) consortia and 2) participants within the sampled consortia. Step one involved purposive sampling of three DELTAS ARC. These were selected on the basis of: regional representation in SSA (Eastern Africa, Southern Africa, and West and Central Africa); representation of consortia that are located in English and French speaking countries; presence of fellows of diverse nationalities recruited from different African countries; and presence of fellows at various career stages from Masters (Msc), doctoral (PhD), post-doctoral research fellowship (PDF) and mid-career research (MCR) scientists.

For step two, we sought heterogeneity within each of the purposively sampled DELTAS ARC by using gender as a primary selection criterion for in-depth interview (IDI) study participants. Other dimensions of multiple social identities were sought along axes of career stage, scientific discipline, duration in the programme/institution, and nationality. A list containing such information was provided by the research directors of the sampled DELTAS ARC, which aided in purposive selection of study participants. Key informants were selected based on their role and knowledge about the functioning and operation of their respective DELTAS ARC.

### 6.4.3 Data collection methods

We conducted 58 IDIs (32 female and 26 male) with trainees/research fellows at various career stages supported and/or affiliated to the DELTAS ARC. We also conducted 20 key informant interviews (KIIs) (4 female and 16 male) with consortia research leaders/directors, programme managers/coordinators, monitoring and evaluation officers, and supervisors (co-investigators) across the three purposively selected DELTAS ARC. The IDIs were aimed at exploring qualitative narratives about the existing enabling strategies and mechanisms used to promote gender equitable scientific career progression for researchers in SSA, as well as suggestions for improvement. KIIs aimed to triangulate information from the IDIs and to provide additional insights on the enabling factors/actions and policy processes that were currently in place or proposed to enhance gender equitable career progression. In total, 58 IDIs (32 female and 26 male) and 20 KIIs (4 female and 16 male) were conducted across the three purposively selected DELTAS ARC.

Most IDIs (n=47/58) and KIIs (15/20) were conducted in-person by the lead author (ML), a social science doctoral candidate with extensive experience in conducting interviews in qualitative research. Interviews were conducted at the respective consortia secretariat or annual scientific meeting. The setting of an interview can influence participants' engagement in the interview process and their description of their life-worlds (Kvale and Brinkmann, 2009). We considered that participants would feel more comfortable being interviewed in an environment and at a time of their choice and that providing them this opportunity would facilitate collection of richer data. ML therefore encouraged participants to nominate an interview location and time that best suited them. As per individual participants' requests, the in-person interviews were held at times and a location that was most convenient for them, including coffee shops, meeting rooms, or researcher's offices. The remaining sixteen interviews (11 IDI, and 5 KIIs) were conducted via skype and telephone. ML requested the respective participants in advance to find a quiet place or room where they could hold a private conversation without disturbance. We created a set of open-ended questions for different cadre of participants that was used to guide the interviews.

The interviews were conducted between May and December 2018, all in English. Despite making provision for a bilingual research assistant who was fluent in writing and speaking English and French to help in conducting some interviews in French, all the Francophone study participants expressed that they were comfortable conversing in English Language as opposed to using a translator. All interviews were audio-recorded using a digital dictaphone, alongside note taking. On average, the IDIs lasted 90 minutes while KIIs took 75 minutes.

### 6.4.4 Characteristics of the IDI sample

The IDI study participants were nationals of thirteen SSA countries across Eastern (Uganda, Kenya, Rwanda, Somali), Southern (Zambia, Botswana and South Africa), and West and Central Africa (Senegal, Ghana, Nigeria, Benin, Mali and Cameroon). They represented three consortia composed of eleven partnering institutions for which seven were research institutes and four were African public universities. The majority identified English as their everyday language of scientific communication (52/58) while the rest reported French. Overall, most study participants identified themselves as biomedical scientists (45/58) while the rest were social scientists (13/58). Regardless of gender, most study participants were from less educated family backgrounds (46/58), where no parents or siblings had attended university. Based on religious affiliation, most participants identified themselves as Christians (44/58). This was followed by those who identified as Muslims (7/58), with the remainder (7/58) reporting that they did not subscribe to any religion. More female than male participants had young children and the women at early career stages were more likely to have young children than men. Table 6.4.4 summarises the general socio-demographic characteristics of the IDI study participants.

*Table 6.4.4: Socio-demographic characteristics of the IDI study participants (n=58)*

| Gender | Other characteristics | | Total (n=58) | MSc (n=14) | PhD (n=19) | PDF (n=18) | MCR (n=7) |
|---|---|---|---|---|---|---|---|
| **Women (n=32)** | **Age Range** | 25-29 | 9 | 7 | 2 | - | - |
| | | 30-34 | 12 | 2 | 9 | 1 | - |
| | | 35-39 | 5 | - | - | 2 | 3 |
| | | 40-44 | 4 | - | 1 | 2 | 1 |
| | | 45-49 | 2 | - | - | 1 | 1 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **Marital status** | Unmarried* | 16 | 7 | 4 | 3 | 2 |
| | | Married | 16 | 2 | 8 | 3 | 3 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| | **With children <5 years** | Unmarried (16) | 4/16 | 0/7 | 0/4 | 2/3 | 2/2 |
| | | Married (16) | 12/16 | 2/2 | 6/8 | 3/3 | 1/3 |
| | | **Total (32)** | **16/32** | **2/9** | **6/12** | **5/6** | **3/5** |
| | **Family educational Background**** | Highly educated | 8 | 2 | 2 | 1 | 3 |
| | | Less educated | 24 | 7 | 10 | 5 | 2 |
| | | **Total** | **32** | **9** | **12** | **6** | **5** |
| **Men (n=26)** | **Age Range** | 25-29 | 4 | 3 | 1 | - | - |
| | | 30-34 | 8 | 2 | 3 | 3 | - |
| | | 35-39 | 9 | - | 3 | 5 | 1 |
| | | 40-44 | 2 | - | - | 2 | - |
| | | 45-49 | 3 | - | - | 2 | 1 |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **Marital status** | Unmarried* | **11** | **5** | **4** | **1** | **1** |
| | | Married | **15** | **-** | **3** | **11** | **1** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |
| | **With children <5 years** | Unmarried (11) | 0/11 | 0/5 | 0/4 | 0/1 | 0/1 |
| | | Married (15) | 11/15 | 0 | 1/3 | 10/11 | 0/1 |
| | | **Total (26)** | **11/26** | **0/5** | **1/7** | **10/12** | **0/2** |
| | **Family educational Background**** | Highly educated | **4** | **1** | **1** | **2** | **0** |
| | | Less educated | **22** | **4** | **6** | **10** | **2** |
| | | **Total** | **26** | **5** | **7** | **12** | **2** |

*Legends: *The label 'unmarried' includes those who identified themselves as single (never married), divorced or separated. I grouped them together for purposes of protecting participants' anonymity and confidentiality particularly for the latter two identities. ** I based this on the parental and sibling's level of education, with those who had attended university considered as highly educated.*

A further analysis of the type of partnership for all married female and male participants showed that for the majority of relationships (24/31), only one partner, the study participant, was pursuing a scientific research career.[10] For the remainder of married study participants (7/31), both partners were pursuing scientific research careers, which we refer to as dual scientific career couples, and the majority of these participants were women (5/7). Notably, both female and male participants in dual scientific career unions were at PhD (4) and PDF (3) career stage, and nearly all of them (6/7) had under five-year-old children.

### 6.4.5 Data management and analysis

All audio data were transcribed verbatim by an experienced qualitative research assistant. The transcripts were verified by comparing the audio files and scripts with the field notes. Once this process was complete, transcripts were sent to all individual study participants for member-checking to ensure participants' views were appropriately captured. This process also allowed the participants to identify content they preferred to be removed from the analysis e.g. individual characteristics and statements that they felt might easily identify them. Following the member checking process, most of the IDI participants asked to have the identities of their ARC and affiliated institution, number of children, country of origin, disciplinary field of study withheld for confidentiality purposes. In addition, they suggested that findings be presented as views and experiences of participating DELTAS Africa research fellows as a whole. In protecting participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms. However, given the necessity of an intersectional gender analysis, other identities such as age (provided in range), marital status, and presence of dependents are anonymously presented where necessary.

Thereafter, ML organised and coded the data in QSR International's NVivo 11 qualitative data management software, and analysed these inductively based on emergent themes, whilst aligning the themes to the developed integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in SSA (Liani et al., 2020). ML utilised a grounded theory approach, employing constant comparative analysis (Charmaz, 2006; Glaser and Strauss, 1967). All illustrative quotes have been carefully reviewed for their potential to reveal individuals' identity.

[10] In this study, we define such partnership as non-dual career couples.

### 6.4.6 Trustworthiness of the data

As a way of minimising individual researcher bias, ML, IN and RT held regular peer debriefing sessions to discuss the coding process, interpretation and presentation of the analysed data. Moreover, based on the tradition of qualitative inquiry, we have amplified the voices and experiential realities of the African women and men scientific researchers by using participants' verbatim phrases from interviews to support our interpretations of the data. The trustworthiness of key messages was further strengthened through dissemination of key research findings by ML, a PhD student, in various fora including the DELTAS Africa Annual Grantees Meetings, conferences, seminars, symposium, and producing annual learning reports for DELTAS ARC. This was useful for feedback provision that further guided data interpretation and presentation of the findings.

### 6.4.7 Ethical considerations

The study received required approvals from the Liverpool School of Tropical Medicine Research Ethics Committee (Protocol ID: 17-075) and the Strathmore University Institutional Ethics Review Committee (Protocol ID: SU-IRB 072/18). Participants were provided with an information sheet that explained the aims of the study and related risks and benefits. All participants gave written informed consent. For participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms.

## 6.5 Results

Three overarching themes pertaining to enabling factors for scientific career progression emerged from the data. These included: 1) individual coping mechanisms and role of familial support at micro levels; 2) existing enabling mechanisms at the meso research institutional level; and 3) proposed solutions for enhancing gender equitable career progression at micro, meso and macro levels.

### 6.5.1 Micro level efforts: Individual coping mechanisms and familial level support

*6.5.1.1 Individual agency, resilience, and importance of daily work-schedules:* Most female and male participants commonly perceived personal characteristics such as self-awareness, determination, hard work and resilience as enablers, at micro level, of career progression. For example:

> *"One of the things I have come to discover as I journey on in science is that it has to do with passion and determination… Knowing who you are and what you want to achieve as an individual. I happen to be someone who is self-driven and self-motivated and that I have my own focus. I don't allow people's belief s*

*and thoughts about me to influence where I am going. I like what I am doing, working hard day by day to build my future" (IDI, Male, #12, PDF).*

Some female participants expressed how they exercised their own agency through defying gender norms on early marriage to enhance their career progression in science. For example, a participant said:

*"As an individual I have had my own goals. I did not want to divulge into starting a family. I know that is a rite of passage, but I was determined to achieve something more [establish career first] before I get there" (IDI, Female, #19, Msc).*

Additionally, some married female participants with young children expressed how they coped with career and family life imbalance through utilisation of daily routine working schedules which enable proper planning and time management. Notably, this approach was particularly reported by those women who identified themselves as being in a dual scientific career partnership. As one of them noted:

*"For me, a routine program helps especially if you have young children…I have always found out that it is very important as try to fit my work routine within their routine, so it works for me… So, I wake up early and get them ready for school… I bring my kids to school myself then go straight to office…that allows me to be at work early…that means I can leave early because I have clocked all the hours that I need. That means I catch my children early in time to do their homework with them, cook dinner and ensure they are in bed by 8pm. Then I continue working until maybe 11pm, yeah and then I will go to bed and I will wake up at 5am to repeat it all over again. So on weekends, I try not to work, unless when I have deadlines… So, I think having a schedule that works maybe propagates more productivity… of course other mothers might have a different opinion" (IDI, Female, #26, PDF, married, under 5-year-old child, dual scientific career couple).*

*6.5.1.2 The role of religious faith:* This was commonly perceived by some female and male participants, particularly by those who identified themselves as Christians and coming from disadvantaged family backgrounds as useful for coping with the situation of uncertainty with research funding and limited career progression opportunities as detailed in a different paper (Liani et al., 2021b). The comfort they found in religious faith often provided a platform for resilience and determination as they pursue their scientific research career. For example:

*"I feel like having a Christian background allows me to deal with difficult situations and struggles you go through with life or even uncertainty with future on what will happen after my current grant is finished, all of those uncertainties that are part of science…the knowledge that I have a God that is faithful helps me sail through in my career…" (IDI, Female, #32, MCR).*

*"I happen to come from a very poor home. My mum is just a petty trader, and my father was a businessman although he died long time ago… finishing my Bachelors' degree was difficult…my mum was unable to meet my basic needs. So, I had to be working alongside studying doing some petty work like laundry to raise money for upkeep and clear my school fees. It was a bit tedious for me… I really thank God because he has and keeps helping me to skate through all those difficult phases in my life…right now I am a scientist and at the same time I am a Christian, I love God. I believe if I work hard and faithfully, God will reward my career path" (IDI, Male, #08, PhD).*

*6.5.1.3 Familial and spousal support:* Participants of both genders commonly reflected on the importance of moral support and encouragement, as well as practical support such as with childcare needs provided by parents, siblings, extended families, and spouses as enablers for scientific research career progression. Family and spousal support with childcare was mainly reported by some female participants with young children who perceived it as instrumental to managing the substantial demands of scientific mobility. This was linked to the expectation that children are women's responsibility as presented in a different paper (Liani et al., 2021a). This was illustrated using the following excerpt:

*"The support from my spouse [non-dual career partner] was critical for me to pursue my post doc in another country by allowing me to be away from home for two years. He offered me moral support and took care of our two children (all under 5 years old) with the help of my mother in-law. Most of the time, my children were with my husband…He has been very supportive in my career…this cannot work for every woman. It is difficult to get a supportive African spouse. I am just lucky" (IDI, Female, #06, PDF, married, non-dual career couple).*

The above participant commented on her situation as being unusual by pointing out how spousal support for childcare was rare. Moreover, some doctoral female research fellows in dual scientific career partnership reported receiving help with scientific writing from their spouses. They stressed that this support was a major enabler for their career progression, as exemplified by the following quote:

*"I also get support from my husband… he is there for me…. every time he is up to date with what I am doing. Of course, when I'm preparing grant or fellowship applications or writing my work, he helps with proof-reading and making necessary changes to ensure that it is well written. I mean he is there to materially, morally and socially support me" (IDI, Female, #12, PhD, Dual scientific career couple).*

### 6.5.2 Meso level efforts: Existing enabling mechanisms at the institutional level

#### 6.5.2.1 Good mentorship and supervision as critical for scientific career progression

In general, most female and male participants at all career stages reflected positively on career support received through good mentorship and supervision. Commonly identified benefits included: access to information around career progression and funding opportunities; support with preparing grant applications; fostering exposure and visibility through professional networking and research collaborations. For instance, a participant said that:

> *"For me, mentorship support and good supervision have been a very big one! Without it, I don't think I could be where I am now. I really appreciate my supervisor who is very keen into ensuring that I fit into the organisation pretty easy, and he is a good mentor. I was able to know what I wanted to do in my next, like in 3 years' time, I knew I wanted to do a PhD in this field, and it is through his mentorship and supervision that I was able to win the DELTAS Fellowship. So, he has been very instrumental into my career progression… helping network with other people…he is the one who taught me how to do literature reviews and how to critique papers. For me that is mentorship which cuts across different layers…I must mention that he was extremely critical in my decision to stay in science because of the mentorship support, the pastoral discussion around the opportunities that I could pursue after my PhD" (IDI, Female, #25, PDF).*

Even though participants were aware of the difference between supervision and mentorship, most of them observed that they had one person playing both roles which had enabled them to progress to their career level, pointing to their supervisors as mentors. However, the paucity of psycho-social mentorship was an issue for women researchers as described in another paper (Liani et al., 2021b). Participants stated that multiple types of mentors were required to serve various needs that ranged from career guidance and advice to psychosocial support, with the latter support particularly lacking as reported by most women from two sampled consortia. In contrast, in one consortium, both KIIs and junior researchers reported provision of psycho-social support through its formal mentoring programme for doctoral research fellows, known as the 'Studentship Monitoring and Advisory Committee' (SMAC), which was independent from the student's supervisory team. The SMAC included a third-party monitor, commonly referred to as 3PM person, to help deal with pastoral and personal life issues as exemplified using the following excerpt:

> *"We have a formal structure for mentorship within the program where every PhD student are assigned a SMAC, which has the chair and one member then you have a third-party monitor (3 PM person) who is of the same gender like yours, who is like an independent off the student monitoring committee and off*

*supervisors, a neutral person to get to talk to in case I have any challenges, either personal, or related to academics and it is a she.…So far she has been mentoring me and also encouraging and supporting my emotional growth and wellbeing. …she is a married woman with young children, and who is excelling in science. So she has been able to share with me her experiences, challenges and also pieces of advice in terms of trying to manage work and life by advising me on how to go about it… she has really been a source of support to me as I get to talk to her about any other thing apart from academics and she gets to give me pieces of advice" (IDI, Female, #23, PhD, married, under 5-year old-child).*

Most participants (in all three consortia) pointed to their DELTAS consortia research directors, notably all of whom were male, as natural mentors too; perceiving them as inclusive leaders passionate about enhancing career progression of women scientists:

*"The late Director [male] of our institute believed in having women in science and ensuring that they excel in their careers. He used to refer to us women scientists as "Amazons of [name of institution withheld]". To him, 'Amazon' meant female warriors in science…this really motivated us in our career paths in science…He placed us in a context where you are assured that research can be done by women. Such sentiments boost my morale to stay in science" (IDI, Female, #05, PDF).*

#### *6.5.2.2 Supporting researchers' well-being*

Participants reported that the sampled DELTAS Africa consortia incorporated different approaches to supporting research fellows' wellbeing. This included: initiating regular work-life discussion fora for fellows; and having a functional wellbeing department within an institution.

One consortium strived to enhance the wellbeing of its fellows through initiating regular work-life discussion fora during annual grantees meeting and other scientific events. Such events brought together women and men senior researchers from different institutions who were married with families for insight sharing to emerging research scientists on how they managed or were managing to deal with work-life balances. Such conversations were considered instrumental for "providing fellows with options suitable to their circumstances, whether married, or looking forward to getting married" (KII, Female, #09). For instance, a participant noted:

*"This is a platform where we discuss the personal issues and challenges that people are actually facing…hearing from people about what issues they have and also hearing from junior people what issues they have and trying to kind of learn from each other… that often changes people's perception because you always have the impression of so and so must be so successful, they surely can't have any problems. And then when*

*you actually talk to them, they often have overcome a lot of challenges and still have challenges that they are battling" (IDI, Female, #13, PhD).*

A research institute in another consortium, had an established and functional wellbeing department at the workplace that encouraged and supported staff to engage in physical activities as well as promoting a culture of not working on weekends. Although this was not directly linked to gender concerns, it is primarily relevant as this contributes towards addressing the challenge of the common long working hours culture of science research (Liani et al., 2021a) which has the potential to put women and men on a more level playing field at the institutional level. This was considered by fellows affiliated to this institution, as useful for achieving a work-life balance.

*"We have a well-being department that is very keen to support employees with work-life balance. I have been in this institution for five years since I joined in as PhD student. They usually encourage us to undertake exercises…they pay gym for me and my family members…. We are highly encouraged not work over the weekends…They real care about our wellbeing" [(IDI, Male, #05, PDF).*

#### *6.5.2.3 Support with caring responsibilities*

This was reported by female and male IDI participants as well as key informants, who narrated about provision of childcare support for female researchers while traveling abroad; allocation of research assistants to women who were overwhelmed with caring responsibilities to help with data collection and analysis; as well as extension of fellowship duration for women who went on maternity leave.

Most key informants across the three sampled consortia stated that there was no budgetary allocation for childcare support for female researchers while traveling abroad, as they did not include it in their DELTAS Africa funding proposal. However, they made efforts to support such fellows through provision of subsidies for child-care while on scientific travel, which was done on a case-by-case basis, dependent on available funding. In dealing with budgetary challenge for childcare support, one consortium embarked on establishing the needs of its fellows and supervisors through the collection of gender and diversity data, which supported a successful funding application for a childcare grant. With a dedicated gender budget, they provided proper targeted support through provision of child-care support for fellows and supervisors through sponsoring the baby and nanny while on engaging in scientific mobility. The following quote illustrates how a female participant benefitted from such an initiative:

*"[Name of consortium withheld] has been working towards supporting us with childcare when you travel… they sent us emails asking if we needed childcare support and facilities for the upcoming annual meeting*

*which was happening in Rwanda. So personally, I have a 10-month-old baby for which I took advantage of it by responding to the email… When that time came, I carried along my baby and the nanny. They catered for all my travel cost…I was booked in a hotel with a double room, so the nanny had her own room… I was given an allowance that was enough to cater for all of them for the three days we were at the meeting…This made my life easier as I concentrated at the meeting and could pop into the hotel room to breastfeed the baby" (IDI, Female, #13, PhD, married, under 5-year-old-child).*

To help overcome the challenge of family and caring demands, some female participants from one consortium reported that they had been supported by a sympathetic research director who allocated them research assistants to help with data collection and analysis. For instance, a participant stated:

"*I got my two children while doing my PhD here… I remember I had my first born who was six months and I was supposed to go abroad for one-month lab work…our director was very sympathetic and understanding. He sent someone there to do the lab work for me and I just analysed my data here…when I had the second baby, he again assigned me a research assistant to help with data collection in the field. This enabled me to finish my PhD in time" (IDI, Female, #06, PDF, married, under-5-year-old children).*

Across all the sampled consortia, most female participants who went on maternity leave indicated that they were granted a fellowship extension for the duration they were away from work/studies through support from their immediate supervisors. Overall, most key informants agreed to this; for example: "*I think the best thing to do is to really be supportive… I recently requested for a three-month extension with full stipend payment for my PhD student who was recently on maternity leave, and this was granted" (KII, Male, #01).*

### 6.5.3 Proposed solutions at micro, meso and macro levels

Our study participants made various suggestions and recommendations for enhancing gender equitable scientific career progression in Africa, while noting that: "*we still have a long way to go" (IDI, Male, #24, PDF).* This theme presents participants own proposed solutions pertaining to the desired actions for positive change aimed at the micro individual and societal level; meso institutional and consortia level; and macro programme-wide and funding level contexts.

#### *6.5.3.1 Micro-level actions for individual researchers and society*

Most early and mid-career female and male researchers cited the need for junior researchers to disclose the career progression challenges they face. Specifically, they noted that some junior female researchers

were not confident enough to share what was troubling them, as some could even hide pregnancy, which may be detrimental for their health and safety.

> *"Two years ago, I had a Masters' Fellow who came in while pregnant but didn't mention that she was expectant at that point. Unfortunately, I came to know about it much later as one day towards the last four months, she came to work and then she collapsed.…That is when I realised, she was pregnant as it was not visible…as a clinical scientist, my conclusions were that maybe working with chemical in the lab is what affected her…perhaps that is something if she had mentioned earlier, as her supervisor, I could have adjusted her work schedule for her own health and safety. At that early phase, there are chemicals that you shouldn't be exposed to, and we can adjust your schedule and project to suit such scenarios of your needs at that point" (IDI, Male, #24, PDF).*

> *"In most instances the younger women Masters' Fellows just don't ask if they are entitled for maternity leave while on fellowship…they should ask other women who have been there what should I do if I get pregnant…even ask your supervisor, ask widely, talk widely. There are other people you could approach, and ask what would be the best scenario for me while in this situation?" (IDI, Female, #28, MCR).*

Some female and male participants identified the need to create community and public awareness on the importance of what research scientists do to garner familial support. They highlighted that this should be particularly about the nature of science that requires long working hours and frequent scientific mobility, for which women researchers tend to be more disadvantaged based on their reproductive gender roles compared to the men. Indeed, the identified need to create community and public awareness on what research scientists do was demonstrated after the formal data collection period by some DELTAS fellows through the provision of a gender equity community and public engagement fund[11]. This was specifically aimed at supporting implementation of engagement project activities that contribute to the gender equity agenda in science research such as carrying out advocacy to attract more African women in science careers.

#### *6.5.3.2 Meso-level actions for institutions and research consortia*

Various suggestions were provided which ranged from the need to: build and nurture a supportive research community; commitment to create supportive and inclusive gender sensitive work

[11] https://mesh.tghn.org/articles/guide-evaluating-engagement-seed-funding/

environment; a formal and structured approach to mentoring for all research fellows; and improvement on gender balance in scientific leadership positions.

***Need to build and nurture a supportive research community:*** This suggestion was cited by most early career and mid-level female researchers, and was not mentioned by male participants and KIIs. This included the need to launching fora within institutions that encourage open dialogues for researchers to discuss and provide mutual support around career progression challenges, career decisions and work-life balance issues. *"We need to start creating an environment where conversation replaces silence…where people with families can share their experiences. Dialogues about career decisions and work-life balance"* (IDI, Female, #26, PDF). This was perceived as *"small intangible things can make a huge difference in fostering peer to peer mentoring"* (IDI, Female, #27, PDF).

They further reiterated that institutional and programme leaders develop a culture of 'catching up' with researchers to find out their needs and discuss how best they can be supported, as exemplified in the quote below:

> *"Honestly, the program should talk to us more. I think there just needs to be communication… that needs to be embedded within the institutional culture. The directors need to talk to scientists just 'catching up' with them to know what is going on with you? How can we support you better? … you cannot manage a group of scientists without doing that... You cannot second guess scientists needs…instead you have to deliberately sit down with me to find out what my challenges are…that is absolutely key, and sadly it is lacking here" (IDI, Female, #31, MCR).*

***Need for commitment to create supportive and inclusive gender sensitive work environment:*** Most IDI participants and key informants identified various actions for policy and practice changes towards making the workplace environment conducive and enabling for all. They highlighted the need to establish and implement formal standard operating procedures (SOPs) at consortia level on how to report and handle harassment and bullying, which was particularly reported by female researchers as discussed in a previous paper (Liani et al., 2021b), as well as improvement on communication of such policies. At the consortium level, the key informants asserted that they did not have SOPs in place to deal with issues around harassment, bullying and intimidation. Indeed, some suggested that going forward, it could be useful if DELTAS supported institutions and consortia establish an independent external mediation council to help resolve such matters.

> *"We don't have written policies for the consortium…but going forward as a network, we need to develop formalised SOPs or guidelines for [name of consortium with-held] on how to report and deal with sexual harassment, bullying and intimidation of fellows at workplace...and maybe what we could also do is to put together like a board of mediators within the network or outside the network for handling such issues" (KII, Male, #08).*

In the same vein, the need for provision of routine training and coaching to scientists and faculty staff on how to identify and deal with unconscious biases at workplace was also highlighted. In addition, an informant reiterated that: "*There is need to encourage women to be less acceptive of biases, generally men can be very aggressive than women"* (KII, Male, #14). Moreover, participants identified the need for confidential periodic review of fellows' experiences with their work environment. They also suggested the need to support strategic programmes within institutions that encourage gender equity, for instance through rolling out online campaigns on websites inquiring "*what is your institution doing to enhance gender equity at workplace?"* (IDI, Male, #17, MSc).

Most female and male participants identified the need to support the well-being of all researchers through promoting family-friendly policies and practices within institutions. They asserted that even though the practice of provision of flexible work arrangement based on supervisory agreement was granted to some fellows, as described in a different paper (Liani et al., 2021b), they proposed the need to develop formal policy or SOPs on provision of flexi-time to all research fellows. Nonetheless, to help alleviate the challenge of caregiving obligations, they highlighted the need for creating a more gender sensitive institutional environment favourable for all through provision of childcare support and mother and baby friendly facilities at the workplace. This was summed up by a participant using the following excerpt:

> *"I would like to see a favourable work environment, flexible timelines and support particularly for women in science, for which I think that would be exemplary. I would want to be in a situation where a woman can choose to pursue her career without necessarily feeling like they have to give up with family and childcare…the same thing for men, if they choose to have their families you don't have to give up… we need to work towards an environment where you can go to a conference presentation because you know that there is support for childcare" (IDI, Male, #25, PDF, married, dual career couple, under five-year-old child).*

Similarly, most key informants agreed with this; for example:

> *"We need to give women an enabling environment for them to progress career wise by setting up mother and baby friendly, and day-care facilities at workplace to address the push factors and trigger a pull factor for women to be retained in scientific careers" (KII, Male, #16).*

In one consortium, the lead partner institution had already initiated conversations about how to establish a crèche at workplace:

> *"Childcare provision at work is one of those things that I really think should be introduced. We have started discussing it at the secretariat to see even if we can apply for funding to introduce a crèche where students, researchers or even other employees can pay some minimal fee and just bring their kids and can check on them like every two hours" (KII, Male, #12).*

Indeed, some female participants recommended improving communication on such provisions in fellowship and job advertisements by advertising anticipated support besides the common declaration that 'female candidates are highly encouraged to apply':

> "*Declaring that women are highly encouraged to apply in adverts doesn't really count a lot. At the end of the call for applicants to fellowships, they should declare that they have childcare provision for women travelling with young children. That doesn't happen!" (IDI, Female, #03, PhD, married, under five-year-old child).*

A key informant alluded to this noting that:

> *"In the next call for DELTAS II, we will specify in the advert that we have different opportunities to support female fellows such as provision of maternity leave, prolonging the duration of completion of the fellowship, and support for childcare. It seems that most female fellows would shy away from applying if they are waiting for a baby or have young children to take care of" (KII, Male, #15).*

***Need for formal and structured approach to mentoring for all research fellows:*** Most key informants expressed the need for *"a more structured and reliable way to mentorship"* (KII, Male, #13), noting that most often, *"we tend to merge the roles of mentorship, supervision and role modelling into one, which should not be the case"* (KII, Male, #20). This was perceived as an important consideration for the next phase of DELTAS Africa Initiative.

> *"We don't have a formal mentorship scheme for all fellows. One of our plan for the future is to have an official structure where we assign mentors for PhD fellows as we do for our and post docs… that is*

*something that is to be considered for the next phase of DELTAS II going forward which I think would be helpful… it would be nice to also have an external mentor which is something I had while in [United Kingdom academic institution], having someone randomly from the university assigned to help you with non-scientific issues" (KII, Male, #13).*

In doing so, they highlighted the need for provision of both career & psycho-social mentoring for fellows, which was viewed as crucial for career progression. *"In DELTAS II, we plan to improve on this aspect of mentorship by providing fellows with career and psycho-social mentors" (KII, Male, #06).* Additionally, participants expressed the importance of mentor- mentee matching on the basis of disciplinary training background; social background and gender as exemplified using the following quotes:

*"Mentorship shouldn't just focus on the science alone. We need to also know the personal background and environment in which of our mentors grew in. We can feel motivated if you are able to identify easily with your mentor…Sometimes it is difficult to easily interact with a mentor whose scientific field of study is different from yours…disciplinary matching of mentor and mentee is necessary" (IDI, Male, #24, PDF).*

*"As a mentee, you need someone who understands your research background, social and life experiences. The mentorship process needs to be natural, and not just on scientific focus… so the mentorship you get from a male is different. Sometimes they are things you feel you can't easily share with a male mentor… the kind of support you can get from a female mentor is somewhat different. The understanding of the experiences that is similar to yours so the challenges you may have like to balance career and family" (IDI, Female, #11, PhD).*

They also pointed out the necessity of being involved in the selection of their mentors. Indeed, in one consortium, a key informant noted that in the next phase of the DELTAS Africa Initiative, a proposal had been made to have all fellows select their mentors as well as feedback provision of the mentorship process.

***Improving gender balance in scientific leadership positions***: This was considered necessary for enhancing gender equitable decision making on career progression matters affecting all research fellows, while noting that a greater critical mass of women leaders has the potential to reshape organisation cultures. Most female participants expressed a need for institutions to actively encourage

women to take up senior scientific and leadership positions to redress gender imbalance at higher levels as exemplified using the following quote:

> *"I do feel we should have more female top leadership. Right now, if you look at our top leadership, all our directors are male... they are all great leaders but there should be a room for improvement at least to have a female one on board" (IDI, Female, #27, PDF).*

They felt that this could be achieved through provision of mentorship, and leadership and empowerment training programmes from early career level onwards to help build confidence, resilience and support individual decision making around career progression.

Additionally, both IDI participants and key informants suggested the need for institutions to make a strategic decision to appoint more women in senior and leadership positions to serve as mentors and role models for emerging female researchers.

> *"We should aim to appoint a number of women in science leadership as manager and directors and also try to promote women to senior scientist positions… and provide them with personal mentorship on how to run a Research Centre or programme" (KII, Male, #06).*

Notably, some informants observed that the problem of gender imbalance in leadership was sometimes reinforced by funding agencies, who mainly appoint male leaders to take oversight of the institutions they fund, citing the need to also do better in serving as change agents.

> *"Well, I suppose we could do better with coordination of our most senior appointments offered to women…that would helpful. But then the funders as well have to a role to play in reducing the gender disparity gap in leadership … if you look across all the Wellcome programs in Africa, the directors are all male appointees…they need to do better from their end to serve as a good example for us, as opposed to insisting the problem needs to be fixed from our end" (KII, Female, #03).*

#### *6.5.3.3 Macro-level actions at the programme-wide and funding level*

***Need to foster and secure the careers of female and male researchers:*** Both IDI participants and key informants identified various measures to help overcome the challenge of uncertainties with research funding, and limited scientific career progression opportunities, which differentially impact on women and men within institutions (Liani et al., forthcoming). To begin with, they recommended that AESA (the DELTAS Africa coordinating agency in the African Academy of science), establish career centres to help with career advice as well as placement of fellows. In addition, they suggested that centres need to

negotiate for memoranda of understanding with research and academic institutions in Africa for career placement opportunities for DELTAS fellows. In doing so, they also underscored the need for deliberate efforts by the coordinators of DELTAS Africa initiative to lobby for establishment of parallel career development systems within African universities based on research activities rather than teaching alone. Secondly, most participants identified the need for provision of information to fellows about the possible career pathways available for them in their specific countries/contexts as illustrated using the following excerpt:

> *"Sometimes after PhD completion, you are just involved in projects that are under the responsibility of your PI without really clear yet in terms of career pathway. You get little bit confused because you don't know exactly what you want to do…. career pathways are different in each country. Maybe DELTAS could think of informing fellows of career pathways that are available in their own countries…* [as they have] *collaborators in all those countries who are aware of what is going on there" (IDI, Female, #21, PhD).*

In the same vein, some participants emphasised the need for a rethink of alternative career pathways for researchers given the limited opportunities in the mainstream academic scientific research in Africa. Similarly, a key informant alluded to this, noting that:

> *"Sometimes, I think that is very important for the fellows to also have alternative career path in science given that a lot of the time is very hard for them to succeed given the culture of funding uncertainties …so we also have to capacitate our fellows to also maybe jump to industry or government, open to them a career on entrepreneurships, start-ups, innovation, management but still where science can make a big impact not just in the academics" (KII, Male, #10).*

***Need to develop virtual research capacity strengthening programme:*** This was identified by some women researchers with caring responsibilities who may not be away from their families for long. They emphasised that the DELTAS Africa initiative should accommodate their different needs and situations by embracing use of online virtual approaches. For example, a participant narrated how she had forfeited on several occasions to apply for fellowship opportunities abroad because of family commitments. Accordingly, she explained that even if provision for childcare support was accorded to her, she could not travel abroad with a nine-month-old baby or take a child out of school for three or six months for the sake of career progression. Instead, she suggested that *"DELTAS should consider embracing online capacity building programme for women who can't be away from home for long"* (IDI, Female, #06, PDF).

***Support for language minorities research scientists:*** To help overcome the language barrier challenge experienced by Francophone speaking fellows who identified themselves as minorities in science research (Liani et al., in press), such participants suggested the need for provision of translational services while attending scientific gatherings. Additionally, participants expressed the need to extend fellowships at Masters' level where consortia did not provide such opportunities to enable earlier development of English language skills as they progress to doctoral levels and above.

***Need to embrace a different approach to funding:*** Some early career and mid-level female researchers recommended that funding agencies establish a separate competitive fund for African women in scientific research, due to the additional challenges posed by their caring responsibilities.

> *"They should create a kind of funding just for women, that men cannot apply for. Just make competition in between women. That will give the opportunity because they almost face similar issues…So they should give the chance to people having the same problem to compete in between them" (IDI, Female, #25, PDF).*

The above participant further observed that such kind of funding approach was provided by the Organization for Women in Science for the Developing World. In addition, some early career male participants suggested the need to remove age limit for female applicants to PhD and PDF positions given the motherhood and family responsibility penalty experienced by most women. Overall, such insights were corroborated by a key informant who said:

> *"What funders could do is to avail more funding which is specific for females…you find some of these sponsorships are restrictive of age. So, for the females, I would remove the age limit and then just keep it for the males. So, no age limit for female applicants and then specific number of people. Let's say maybe half should be specific for female and then they can compete for those slots…That is what I would do...because during their thirties that is when some women have children and then they can't continue with postgraduate studies. Sometimes it is difficult for them to go at PhD levels. Such an approach can enable them to plan for the family knowing that they don't have age penalty" (KII, Male, #13)*.

## 6.6 Discussion

The findings reported in this paper illustrate a range of efforts made by the individual researchers themselves alongside family support (micro-level) and those of the DELTAS Africa partner institutions and consortia (meso level) towards enhancing gender equitable scientific progression. In addition, female and male participants proposed solutions in the form of suggestions for actions to support

gender-equitable career progression within scientific research. These were perceived as necessary for achieving positive change, which could be pursued at different levels: individual and societal (micro-context), institutional and consortia (meso-context), the wider programme and at funding agencies (macro-context). Together, these provide useful insights on enablers of gender equitable scientific career progression of researchers in Sub-Saharan Africa.

### *Individual agency, family and religious support*

The coping strategies and mechanisms employed by most participants such as individual agency and resilience demonstrates what feminist scholars would characterise as use of agency to intervene, challenge, and in a modest way, to help transform their situation (Mabokela and Mlambo, 2015). Other studies from Africa have also found that women have identified family support (Mabokela and Mlambo, 2015) and religious faith, which serve as a framework for providing both reasoning about making career progression decisions (Johnson, 2014) as internal integral enablers for their professional success, aligning with our findings.

### *Flexible working and family friendly policies*

Institutional reforms and policy changes are required to enable individual researchers to achieve sustainable transformation of the structural and systemic barriers to career advancement (FAWE, 2015; Mabokela and Mawila, 2004; Okeke et al., 2017). As reported in the current study, given the lack of such changes, participants suggested the need for creating an inclusive environment through establishment of clear gendered policies and practices, which was also recommended in another study (Assié-Lumumba, 2006). The need to update workplace policies towards implementing family-friendly policies to accommodate women's dual productive and reproductive roles has commonly been recommended in the global North (Ackers, 2004; Bates et al., 2016; Goulden et al., 2011; Mavriplis et al., 2010), which could also be extended to SSA. For instance, Goulden and colleagues argued that researchers receive limited benefits when it comes to family responsive policies, such as paid maternity and parental leave, and that young scientists receive the least, emphasising that governments and universities should make concerted efforts in solving this systemic problem (Goulden et al., 2011). Mavriplis and colleagues study findings from the USA, Canada and Australia also underlined the need to design and implement maternity and child care leave policies (Mavriplis et al., 2010). In Europe, Ackers suggested that such family-friendly policies, including provision of child-care facilities at scientific conferences and workshops, should be promoted and highly advertised by institutions to encourage other universities

and research institutes to examine and improve their existing policies (Ackers, 2004). In addition, increased flexibility for women and men in global health research has been recommended to accommodate personal, domestic, and family obligations, including increasing part-time opportunities and longer extensions (Dhatt et al., 2017).

The need to foster institutional collaborative science research programs in Africa has also been identified as one of the key mechanism for sharing best practices globally and which is very often mutually beneficial (Okeke et al., 2017). Flexible collaborative programs that offer short-term training or research abroad are seen as practicable for early career researchers, often women, who cannot be away from their families for long periods (Okeke et al., 2017).

### *Improving the institutional environment: policies, culture and leadership*

Literature reveals that there has been a reported lack of support by organisational management in investigating, and properly handling malpractices and misconduct within the institution and research capacity strengthening initiatives (Mathad et al., 2019; Morley, 2005). This perpetuates both subtle and overt discrimination and unconscious biases, more particularly towards women researchers (Mathad et al., 2019). This points to the need for consortia level SOPs as suggested by our study participants. Moreover, inclusive leadership was also perceived as a lever of institutional change towards enhancing gender equitable scientific career progression. In particular, women leaders are essential catalysts for change, as they have the potential to create conditions for the empowerment of female researchers by raising awareness of and tackling the barriers that they face, and acting as role models (Jean et al., 2015; Liani et al., 2021b). As suggested in the current study, improvement on gender balance in scientific leadership positions could begin by women serving as heads of department. Other studies have found that academic head of department is the primary leadership position that impacts on women's career advancement, since they set the tone and influence the culture of the department, as well as playing a crucial role in governance (Obers, 2015). Nonetheless, given that most male participants recognised the costs that gender inequity exerts on women researchers, there is also a need for women leaders to encourage men to be allies for women at workplace as well as support their spouses by sharing parenting duties. Indeed, other studies have suggested the need for allyship as an agenda for change, which is perceived to play a significant role in championing pro-women policy recommendations, and pushing for a favourable environment and infrastructure for all (Coe et al., 2019; Dhatt et al., 2017).

Our findings demonstrated the need to build and nurture a supportive research community through launching fora within institutions that encourage open dialogues for researchers to discuss and provide mutual support around career progression challenges. Related to this is the need to create safe spaces for women to connect with each other as recommended by other researchers (Dhatt et al., 2017). Such safe spaces may enable women to share experiences that are unique to them, allowing validation of their experiences and a place for both personal and professional development through peer-to- peer support (Dhatt et al., 2017).

#### *Mentorship*

In line with the literature (Global Research Council, 2016; Obers, 2015), many participants in our study identified the need for mentorship opportunities to enable women progress in their research careers, rise in leadership and decision making positions, and serve as role models to potentially growing number of junior and early career female scientists. This is supported by our findings which suggest the need for a structured mentoring model to systematically support mentees' personal and career needs. Indeed, lessons on this could be drawn from the mentorship programme for African Women in Agricultural Research and Development (AWARD) in SSA. In their assessment of this initiative, Mukhebi and colleagues identify three main roles of mentoring including providing psycho-social support, career support, and serving as role models (Mukhebi et al., 2017). The authors further highlighted that for successful mentoring program, an important part of determining the right mentor-mentee match for research scientists is considering the sex of the mentor, socio-cultural background, age, and personality. In addition, they also recommended twelve monthly meetings over a year of the mentoring relationships as a way of enhancing optimal levels of engagement for mentees and mentors (Mukhebi et al., 2017).

### 6.6.1 Implications and future research directions

The findings from this study indicates that there is no one size fits all approach towards enhancing gender equitable scientific career progression of researchers in SSA. Achieving the participants' desired actions for positive change requires multifaceted efforts, such as resources, inclusive leadership and deliberate actions by institutional and consortia directors, and funders of working across the micro, meso and macro levels of institutions. Overall, our findings demonstrates that it is time for institutions to act through setting an agenda for positive change towards adopting more gender responsive policies and nurturing an enabling environment that is equally conducive for career progression of everyone

(Dhatt et al., 2017). Notably, participants' proposed solutions for dedicated and strategic programmes or schemes with the specific purpose of enhancing gender equity for researchers, echoes the principles and actions stipulated by the Global Research Council for promoting gender equity and diversity in research (Global Research Council, 2016). Such actions should be implemented in conjunction with broader policies promoting gender equity and fostering environment that supports all researchers, and be carefully evaluated periodically to assess their long-term impact (Global Research Council, 2016). Therefore, future longitudinal research study is warranted to assess the impact of various suggested measures in contributing to the desired actions for change for DELTAS Africa Phase II (2021-2025) and other related research capacity strengthening initiatives.

Based on our findings we argue that DELTAS Africa Phase II (2021-2025) should aim to be gender aware and transformative through implementing the above proposed solutions to challenge the current systems, practices and cultures in workplace that are 'gender blind', that is insensitive to needs of women and men researchers. In doing so, it could serve as a health research capacity strengthening initiative of excellence on gender equity and diversity matters, thus offering a window of opportunity for others to learn from and scale out in Africa.

Whilst there is some evidence on some existing strategies to enhance gender equitable scientific career progression, this needs institutionalisation for achievement of better and sustainable equitable career outcomes. Indeed, we have not come across empirical evidence from Africa on how this could be done. However, the Athena Scientific Women's Academic Network programme could serve as an example of how this could be realised. Established in 2000, this programme has become a common initiative to advance gender equity in the United Kingdom higher education and research institutions. It has been explicitly linked to public research funding (Ovseiko et al., 2017). Specifically, this initiative encourages and recognises commitment to advance women's careers in higher education and research in four key areas which includes: representation, progression of students into academia, journey through career milestones and working environment for all staff (Ovseiko et al., 2017; Rosser et al., 2019). It offers recognition awards at bronze, silver or gold levels to participating institutions, with each representing different achievements in promoting and documenting gender equity in the UK higher education institutions. This requires an assessment of gender equality, a four year action plan, and an organisational structure to implement the proposed actions (Ovseiko et al., 2017). This initiative has

been adopted by other countries, including Ireland and Australia (Caffrey et al., 2016; Ovseiko et al., 2017).

### 6.6.2 Study limitations

From a gender integration and analysis standpoint, we recognise the need to identify institutional strategies and participants' desired actions for change against the gender integration continuum. This is a tool that classifies approaches/actions by how they address gender inequities in programming, which could help organisations or programme implementors to establish where they are positioned along the continuum to facilitate self-reflection about next steps to be taken aimed towards achieving better equitable outcomes (USAID, 2007). We acknowledge that this was beyond the scope of this study for which we recommend it for related future studies. There is also a need to enlarge the scope of this research to document more existing institutional level strategies for enhancing gender equitable scientific career progression from other DELTAS consortia and related research capacity strengthening initiatives. In doing so, it is imperative to ascertain whether there are any differences from consortia led by women compared to those of men. For instance, the Consortium for Advanced Research Training in Africa, a women-led DELTAS consortium, has gender responsive multidisciplinary doctoral training program that caters for women's practical needs around childbearing and caring (Khisa et al., 2019). This is achieved through financially supporting husbands to travel with their spouse to serve as child minders in support of their wives during their engagement in short and long-term travel (Khisa et al., 2019).

## 6.7 Conclusions

This study provides empirical evidence on strategies utilised by individual researchers and existing enabling mechanisms at institutional level towards enhancing gender equitable scientific career progression. It also offers an array of empirical evidence of participants' recommendations on the desired actions for positive change, highlighting the existing gaps that need to be filled in future programming for long-lasting impact for individual researchers and the research institutions in SSA. Specifically, it presents the strategies and actions that can be implemented at societal, institutional, programme -wide level and by research funding agencies to create more gender equitable and inclusive organizational culture that is supportive to career advancement of women and men researchers. Overall, these study findings could be useful for supporting future programming, including DELTAS Africa II initiative (2021-2025), and related research capacity strengthening programmes by providing valuable insights to research leaders, principal investigators, and funders to reflect on what strategies and actions they could tap on and implement in narrowing barriers to gender equitable scientific career progression.

### 6.7.1 Data availability

Individual privacy could be comprised if data is made publicly available. For this reason, data cannot be shared.

### 6.7.2 Consent

Participants were provided with an information sheet that explained the aims of the study and related risks and benefits. All participants gave written informed consent. For participant anonymity and confidentiality, all identifiers have been replaced with pseudonyms.

### 6.7.3 Author contributions

**Author Roles:**

**Liani M:** Conceptualisation, Project administration, Methodology, Investigation, Formal Analysis, Writing – original draft preparation, Writing - review and editing.

**Nyamongo I:** Conceptualisation, Methodology, Validation, Writing – review and editing, Supervision

**Pulford J:** Methodology, Writing - review and editing, Funding acquisition.

**Tolhurst R:** Conceptualisation, Methodology, Validation, Writing – review and editing, Supervision, Funding acquisition.

### 6.7.4 Competing interests

No competing interests were disclosed.

### 6.7.5 Grant information

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# Chapter 7: Discussion and conclusions

## 7.1 Chapter overview

In each of the preceding results chapters, I have presented a detailed discussion, implications, study limitations and conclusions. In this chapter, I synthesise and discuss the main findings from the separate results chapters, relate them to each other, and to consider my contribution to the current literature that could inform policy and practice. I also provide additional limitations of the thesis mainly pertaining to the methodology, as well as my concluding remarks.

## 7.2 Summary of research process and main findings

Within chapter one of this thesis, I contextualise the thesis in wider discourses around gender equitable career pathways in science research. I have described how my research was set within the context of the DELTAS Africa initiative, aimed at exploring the barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions. This was intended to produce empirical evidence from a holistic, gender comparative and intersectional perspective that can be used to develop appropriate strategies to promote career equity for internationally competitive African scientific researchers. I have explained that this thesis departs from the common feminist analyses on women in science careers (Beoku-Betts, 2005), to consider how gender intersects with multiple intersectional axes of disadvantage to produce inequities in career progression for both female and male research scientists.

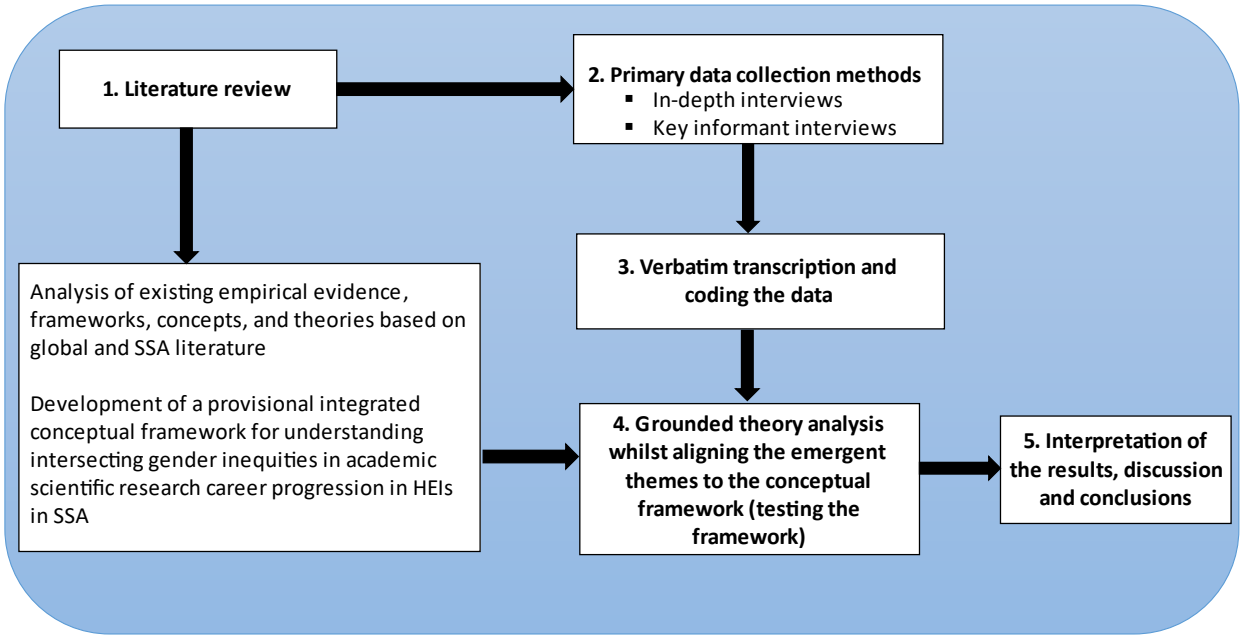
### 7.2.1 The process of conducting the research

This study has been conducted in five stages as shown in Figure 7.2.1.

1. To gain a deeper understanding of this research topic, I first embarked on conducting a systematised narrative literature review of emerging theories and empirical evidence on the dimensions of and reasons for the prevailing gender inequities in academic scientific research career progression in SSA, as presented in Chapter two. In doing so, I have contributed to new knowledge towards developing a theoretically informed and holistic analysis of the issue by positing an integrated conceptual framework for explaining gender inequities in scientific career advancement for women and men, and their intersections with multiple social axes of disadvantage in SSA (Liani et al., 2020). The literature review also examined the gaps in existing evidence requiring use of qualitative methods to understand the underlying factors and processes that produce intersectional gender inequities in scientific career progression.

2. The second stage of this research involved collecting primary data through in-depth interviews (IDIs) with trainees/research fellows at various career stages supported and affiliated to the three purposively selected DELTAS ARC. This was the main method of data collection. In addition, key informant interviews (KII) with consortia research leaders/directors, programme managers /coordinators, monitoring and evaluation officers, and supervisors (co-investigators) were also conducted to corroborate information gathered from the IDIs.
3. The third stage of the research involved verbatim transcription of the audio data, reading the transcripts several times to develop a coding framework, followed by coding of the data in QSR International's Nvivo 11 qualitative data management software.
4. The fourth stage involved using a grounded theory approach to analyse the data whilst employing a constant comparative approach, followed by linking the emergent concepts and themes to the developed conceptual framework. This was a way of testing the framework to ascertain its usefulness in explaining inequities in scientific career outcomes.
5. The last stage of the research process involved interpretation of the results, discussing the key findings based on existing literature and drawing conclusions.

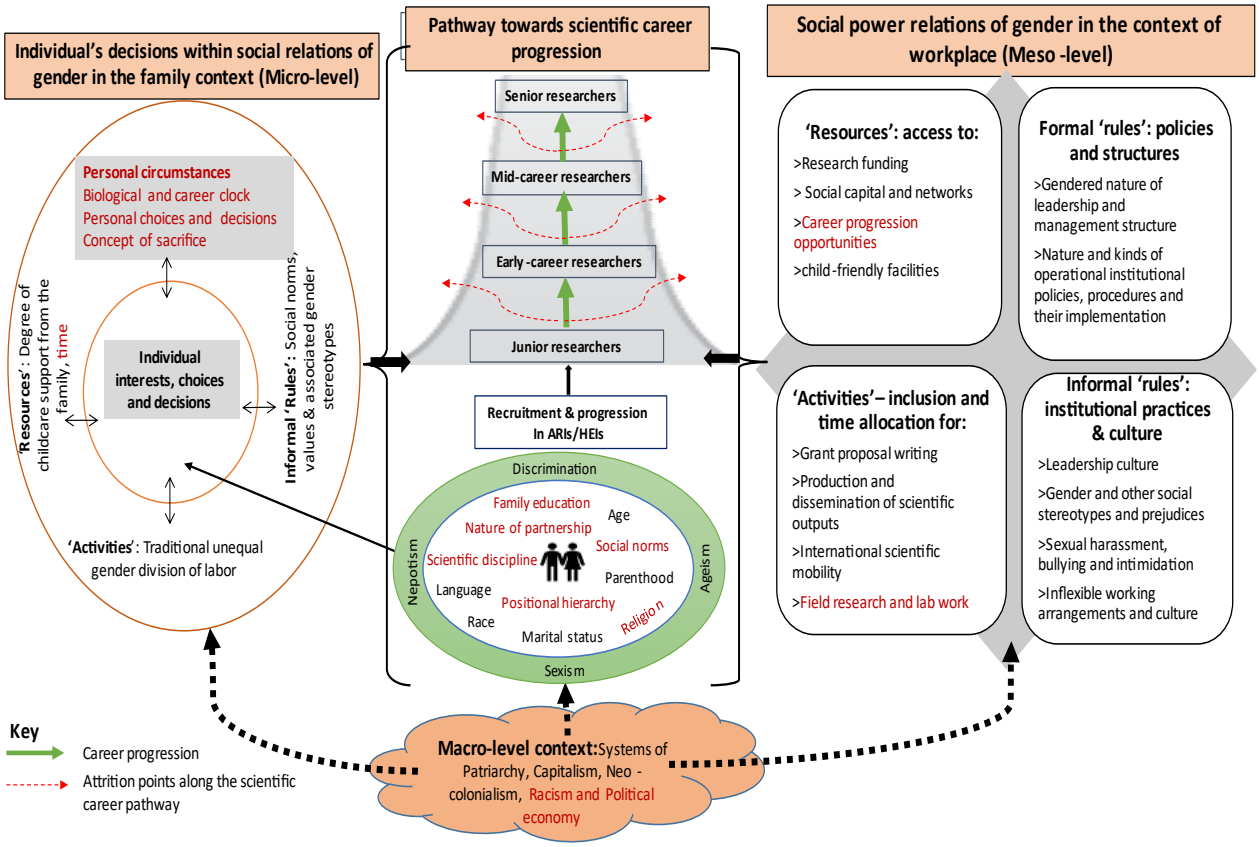
***Figure 7.2.1: Schematic diagram of the process of conducting the research***



### 7.2.2 Summary of findings on the barriers to gender equitable scientific career progression

In this sub-section, I provide a summary of the findings on barriers to gender equitable scientific career progression by drawing on insights from the lived experiences of researchers in SSA. I present these using a slightly modified framework (Figure 7.2.2) based on the initial provisional integrated conceptual framework for understanding intersecting gender inequities in academic scientific research career progression in SSA (Chapter two) to ascertain its usefulness in examining the research problem. It encompasses various elements of the intersectionality wheel as posited by Larson and colleagues (2016) which were identified as shaping career experiences and outcomes of women and men researchers. The innermost circle represents individual aspects or markers of identity. The new emergent markers of identities lacking from the initial provisional integrated conceptual framework includes positional hierarchy within the family and at workplace place, family educational status, nature of marital partnership – whether dual or non-dual scientific career couples, scientific discipline, religion and social norms. The outermost circle highlighted in green denotes the processes or systems of oppression at the wider institutional level which includes ageism, nepotism, sexism and discrimination. Notably, the global macro level systems and structures of power that mediate inequities are presented using a word bubble that is directly linked to the intersectionality wheel. The choice of aspects of individual identity presented in the initial integrated conceptual framework were drawn from insights emanating from the systematised narrative review of existing empirical evidence about the research problem (Chapter two). Nonetheless, Hankivsky (2014) notes that when analysing social problems using the intersectionality wheel, the importance of any category or structures of inequities cannot be predetermined a prior; rather they must be discovered in the process of investigation. On this basis, I did not interrogate all elements and dimensions of the intersectionality wheel. Indeed, most of the emergent aspects of individual identity and systems of oppressions based on participants' narratives are appearing in red font type. Similarly, conceptual framing of the new emergent findings are also presented in red font type.

*Figure 7.2.2: Modified conceptual framework for understanding the barriers to intersectional gender equitable scientific career progression in SSA*




The numerous factors presented in the findings chapters on familial and socio-cultural drivers on inequities, and institutional-level drivers impeding equitable progression of women and men researchers along the scientific career ladder are detailed in this framework. Specifically, I provide a summary description of how the various dimensions of the integrated conceptual framework - that is, 'Rules' (formal and informal), 'Resources', 'Activities', 'People', and 'Power' - based on the social power relations of gender within the family (micro context) and workplace (meso context), mediated by macro level forces of patriarchy, capitalism, neo-colonialism, racism and political economy - are linked together based on the key findings presented within the results chapters of this thesis.

In chapter four, participants described scientific research career progression as a linear process beginning with a postgraduate degree, through to senior scientific and leadership position, requiring significant 'time' commitments outside of core working hours, which does not reflect social realities for most women and some men in SSA. From an intersectional analysis, I have highlighted that emphasising English as the

standard scientific language places non-Anglophone speakers at a disadvantage since they struggle with undertaking scientific writing 'activities' resulting to reduced productivity and visibility within scientific literature (Chapter four). Nonetheless, progression in academic scientific careers also demands a very high level of participation in international mobility 'activities' with regard to which women with caring responsibilities are often disadvantaged as shaped by gender roles and social norms existing at the micro familial and societal level. Women, particularly those with children, find it difficult to balance the expected long working hours in the lab or engagement in field research and participation in scientific mobility 'activities' associated with advancing a scientific career whilst also being responsible for maintaining a successful family life. Such women expressed how problematic it is when family support for childcare is also lacking. Ideally, this is reinforced by the traditional unequal gender division of labour that ascribes 'activities' to women as 'homemakers' and men as 'breadwinners', creating difficulties for women to manage their normative reproductive gender roles within the family as well as their careers.

Owing to the influence of informal 'rules', I have shown how gendered social relations and processes within the institution of the family interact with societal norms, values, and expectations in shaping career progression opportunities of women and men in their day-to-day scientific research 'activities' (Chapter four). I have elucidated how such relations are mediated by other aspects of individual identity such as age, marital status, parental status, religion, positional hierarchy in the family, and social norms around birth order, shaping differential outcome for women and men researchers who struggle in meeting the career progression requirements. For example, I have emphasised that it is problematic to assume that men do not experience career progression challenges pertaining to gendered social power relation within the family and wider society. For an intersectional gender analysis, I have illuminated for instance how positional hierarchy within the family, which is mediated by patriarchal requirements, creates additional family responsibilities for some men who due to customary values and expectations, are assumed as the de facto household heads, requiring their frequent 'availability' at home, which puts them at a disadvantage to engage in scientific mobility oriented 'activities' compared to other men (Chapter four).

I have also presented and discussed about how informal 'rules' evidenced through broader patriarchal societal norms and values in SSA put pressure on women to start a family at the same time when their scientific career is also expected to progress (Chapter four). Managing the 'two different lives' of career and family results in time pressure and sense of work-life imbalance, impacting negatively on their relationships and personal wellbeing. I have analysed how women are faced with personal circumstances

and dilemmas related to managing the 'two different lives' and their impacts for which they highlighted how they made different and conscious trade-offs by utilising metaphor such as the 'biological clock and career clock'. They also made personal choices and decisions by using the metaphor of 'glass and rubber ball', and the concept of 'sacrifice' as illustrated on chapter four. These present new insights that is lacking from the SSA literature, thus not indicated in the initial provisional integrated conceptual framework.

At the meso-institutional level as provided in chapter five, I have presented about how informal 'rules' perpetuate negative practices and culture at workplaces, which affects mainly women researchers at all career stages, who often experience a hostile environment characterised by gender biases, sexual harassment, bullying and intimidation. I have also demonstrated how such gendered power relations of family are also carried over into the workplace, with unmarried female researchers reporting negative stereotypical attitudes at work towards career women from male colleagues who occasionally questioned them on why they are prioritising their career over marriage. In addition, I have also illuminated on how women and some men suffer because of a lack of flexible working arrangements, which are dictated by institutional formal 'rules' imposed at the leadership level by the people in positions of power. In relation to formal 'rules', such women suffer because of a lack of a safe and unbiased formal reporting system for seeking help, as well as fear of negative repercussions, jeopardising their career progression in the same or other institutions, which is indicative of existing power relations embedded in institutional policies and structures. I have analysed and discussed the resultant implications of such experiences on women's under-representation in scientific leadership and decision-making, which is in line with formal 'rules'. Notably, the paucity of women involved in the leadership levels compounds the lack of gender-responsive policies.

Within the institutional environment (Chapter five), inequitable access to support systems within institutions exist, which was manifested through lack of provision of physical 'resources' pertaining to mother and baby-friendly nursing facilities, which disadvantages women researchers with nursing needs. I have also discussed on how inequitable access to social 'resources' pertaining to the lack of psycho-social mentoring and female role models within institutions exacerbate gender inequities in scientific career progression. In addition, I have presented and discussed how higher education and research institutions are highly complex and competitive environments for career progression, pertaining to allocation of financial 'resources' around research funding, and human 'resources' in the form of progression opportunities. I have analysed how these challenges are underpinned by macro-level forces of capitalism,

neo-colonialism, and political economy which influence national and institutional funding models. They are further exacerbated by positional hierarchies within institutions, which intersect with racism, ageism, nepotism, and patriarchy, shaping the way the funding environment is experienced. This culminates to differential gendered implications and outcomes for researchers' career progression and personal well-being.

Overall, as demonstrated from findings across the distinct chapters of the thesis, an intersectionality perspective was critical for facilitating greater understanding about how gender intersects with other social identities to influence career progression outcomes for women and men researchers, thus advancing new knowledge to the existing literature. The findings also resonates with Kabeer's (1994) notion that one cannot focus entirely on one dimension of the SRA, as they are interrelated.

**Strengths and weaknesses of the modified framework**

The strength of the modified framework is based on the fact that it provides a comprehensive and holistic approach to identify factors at individual, familial, socio-cultural and institutional levels that shape career progression of women and men academic scientific researchers characterised by multiple social identities from junior to senior levels. This thesis takes a first step in this direction to ascertain the usefulness of this framework by analysing the data inductively using the grounded theory methodology, as detailed in chapter three, whilst aligning the emergent themes to the framework, as highlighted in chapters four and five. Notably, this framework is robust enough to accommodate experiences of researchers who identify their sexual orientation as lesbians, gay, bisexual, transgender or queer (LGBTQ+), although in this study there were no researchers who identified themselves as such. However, this was not by choice or bias given that with regard to gender identity, I asked participants to self-identify their gender for which only two gender categories were identified – woman and man. This is perhaps unsurprising in the current African social context within which public disclosure of non-binary or transgender identities is not encouraged. Nonetheless, I was not aware of any individuals in the DELTAS Africa initiative who identified as non-binary or transgender, nor does the DELTAS reporting system offer an opportunity to make such a statement. I acknowledge these silences in the data as a weakness of the research.

On the other hand, given that this research study serves as proof of-concept for testing the integrated conceptual framework for understanding intersecting gender inequities in academic scientific career progression in SSA (Liani et al., 2020) through the DELTAS Africa HRCS initiative, the fact that study sample

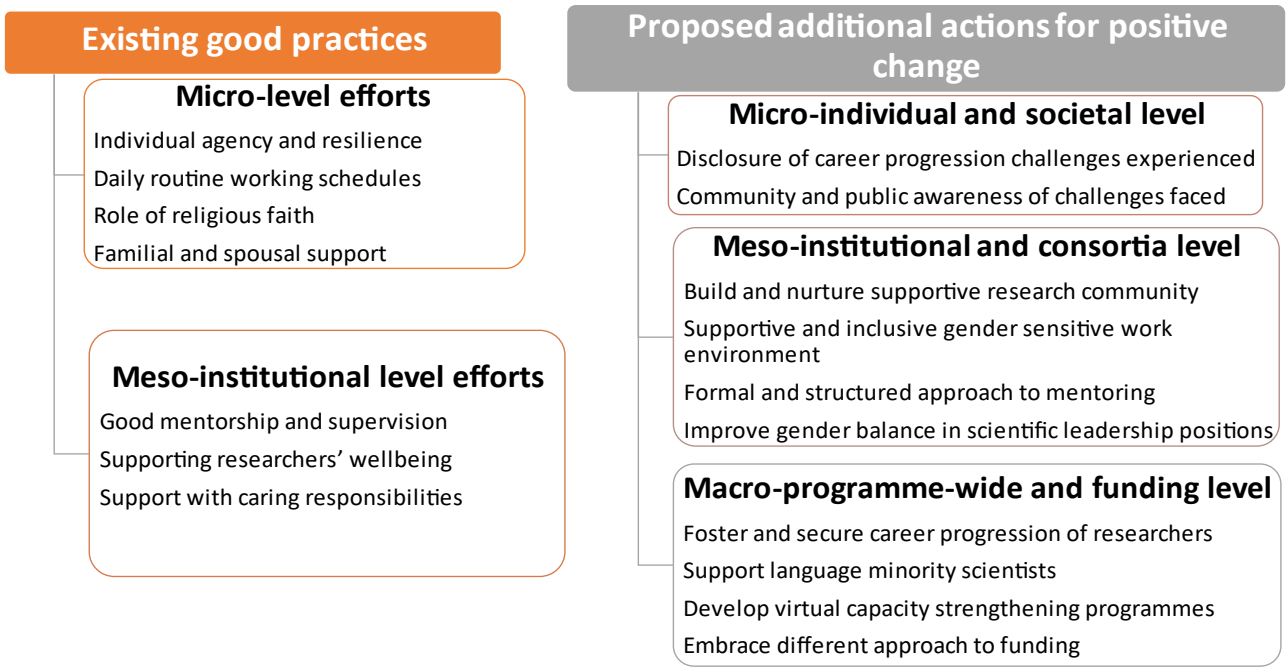
did not include people living with physical disability as had originally intended to is a weakness. Even though I sought diversity along axes of career stage, scientific discipline, and nationality through maximum variation sampling, there were no researchers who identified themselves as disabled within the sampled consortia and the overall DELTAS Africa initiative. Efforts to identify and recruit such individuals from the wider host and participating institutions in selected consortia were prevented by the need for country-level ethical clearances for each institution. This was not possible within the time constraints of the study, as previously indicated in chapter four. Thus, the absence of researchers living with physical disability meant I could not get data on their lived experiences as they pursue scientific research careers. However, some insights emerged from KIIs (based on KII interview guides) around the non-accommodative nature of the built environment and physical infrastructure within many African institutions, as well as the lack of tailor-made protective wear for lab-based scientists which is exclusionary for such people. Therefore, given that my unit of analysis is the IDI study participants, I have not utilised such findings in this thesis. I plan to present these findings as a commentary for Wellcome Open Research. Nonetheless, I recognise my personal bias towards inclining to persons living with physical disability as opposed to interrogating disability as whole, for which those with visual and hearing impairment could have been excluded. Indeed, my choice of focus on such form of disability was informed by my inability to comprehend sign language for persons with hearing impairment. A novel approach to researching such groups of people may require use of case study approach, while working with co-researchers who are conversant with the language used by vision, hearing or speech impaired individuals. In doing so, we must be aware of our biases and define disability in a broader sense so as to accommodate other disabilities.

### 7.2.3 Summary of findings on the enablers to gender equitable scientific career progression

In chapter six, I have presented and discussed findings on the enablers to gender equitable scientific career progression of researchers in SSA. Figure 7.2.3 sums up these findings by highlighting the existing strategies utilised by participants, institutional support mechanisms, as well as the desired actions for positive change towards enhancing equitable scientific career progression. At the micro-family level, support mechanisms and coping strategies utilised by women and men researchers includes individual agency and resilience; importance of effective time management through daily routine working schedules; the role of religious faith; and supportive family relationships from their spouses, parents, and extended family members through childcare and moral support. From an intersectional perspective, I have shown for instance how some doctoral female research fellows in dual scientific career partnership

reported receiving help with scientific writing activities from their spouses, which they perceived was a major enabler for their career progression (Chapter six).

*Figure 7.2.3: Summary of the enablers to gender equitable scientific career progression in sub-Saharan Africa*




At the meso-institutional level, I have highlighted how participants perceived good mentorship and supervision as integral to their career progression. I have also illustrated how institutional support for researchers' wellbeing was demonstrated through initiating regular work-life discussion fora for fellows; having a functional wellbeing department within an institution; as well as extension of fellowship duration for women who went on maternity leave. Lastly, I have reported on how some research consortia offered support for those with caring responsibilities through provision of subsidies for child-care while on scientific travel; and allocation of research assistants to women participants who were overwhelmed with caring responsibilities to help with data collection and analysis. All these were perceived as providing enabling mechanisms for enhancing gender equitable scientific career progression of researchers.

Going forward, participants proposed varied additional actions for positive changes which I categorised as applicable either at the micro individual and societal level, meso-institutional and consortia level, or at the macro- programme wide and funding level as illustrated in Figure 7.2.3. To help alleviate the barriers to career progression experienced at the micro context of individual, family and society, most female and

male participants suggested the need for disclosure of challenges faced as well as on the importance of creating community and public awareness on the importance of what research scientists do to garner familial support. At the meso-institutional and consortia level, they proposed the need to:

i. Build and nurture a supportive research community through launching fora within institutions that encourage open dialogues for researchers to discuss and provide mutual support around career progression challenges, career decisions and work-life balance issues;
ii. Commit to creating a supportive and inclusive gender sensitive work environment through provision of childcare support, and mother and baby friendly facilities at the workplace;
iii. Develop a formal and structured approach to career and psycho-social mentoring for all research fellows;
iv. Improve gender balance in scientific leadership positions.

At the macro- programme wide and funding level, they proposed the need to foster and secure the careers of female and male researchers such as through establishing career centres to help with career advice as well as placement of fellows, a rethink of alternative career pathways for researchers in SSA outside the mainstream academic scientific research. Participants also proposed the need to embrace a different approach to funding by establishing a separate competitive fund for African women in scientific research. To help overcome the language barrier challenge experienced by Francophone speaking fellows, participants expressed the need to extend fellowships at Masters' level where consortia did not provide such opportunities to enable earlier development of English language skills as they progress to doctoral levels and above. Nonetheless, the need to develop virtual research capacity strengthening programmes was also highlighted.

## 7.3 Implications for policy, practice and further research

Taken together, this thesis has found that there is no 'one size fits all' or single 'silver bullet' approach towards enhancing gender equitable scientific career progression of researchers in SSA. Indeed, the findings offers several implications for research, policy, and practice, such as the need for reforms in institutional human resources policies and systems to foster an inclusive conducive institutional work environment that is sensitive to gender, and diversity needs of researchers. This could be achieved through provision of more practical support to parenting such as lactation areas, and on-site childcare centres which would enable parents to balance their careers, family and personal wellbeing, and parental leave, including for men. This may help women to navigate the 'two different lives' and also to

shifting norms so that this work is less seen as the sole responsibility of women (Khisa et al., 2019; Prozesky and Mouton, 2019).

By drawing insights from the Consultative Group for International Agricultural Research (CGIAR) consortium, there is need for a consortium level workplace gender and diversity strategy with clearly developed action plans on how the consortium commits to implement gender sensitive policies that support career progression and improve the gender balance in research and decision- making in the human resources management departments of its partner institutions/centres (CGIAR, 2011). Such a strategy should provide the justification and rationale for why gender equity matters in scientific research career progression; a description of the gender-responsive goals and objectives in the consortium, and the gender and diversity impact pathways, and activities to be undertaken to produce outputs; a description of the monitoring, evaluation and reporting system to be used to track progress towards gender-responsive objectives (CGIAR, 2011). In doing so, the consortium should work with partner institutions that are interested in implementing the recommended best practices both in research and in human resources management (CGIAR, 2011).

The findings also highlight the need for a rethink of mentorship schemes through embracing a structured approach, that is cognisant of both career and psycho-social needs of women and men researchers (Mukhebi et al., 2017). In addition, there is need to work towards better representation of women in leadership roles within institutions as they are likely to promote gender-responsive policies that could enhance better institutional culture. Women leaders are essential catalysts for change, as they are likely to create conditions for the empowerment of female researchers by raising awareness of and tackling the barriers that they face, and acting as role models. Thus improvement on gender balance in scientific leadership positions could begin by women serving as heads of department, as well as playing a crucial role in institutional governance (Obers, 2015). In addressing gendered challenge pertaining to the dearth of female role models in science, lessons could be drawn from the Royal Society's initiative that profiled UK mothers in science in a booklet which illustrates, graphically, the timelines of career path of women research group leaders, and important events in their family life about how they combined their career and family commitments (The Royal Society, 2011). Insights from their profiles depicts how spousal support in childcare and household roles, and spouse switching to part-time working arrangements enabled them to combine a successful and fulfilling scientific research career with motherhood. Such an approach could be implemented by research capacity strengthening

initiatives in Africa to also highlight perspectives about how African women with children have made it to senior scientific and leadership positions. This could motivate the junior and early career female research scientists who were already married or were planning to get married and establish families, who expressed a sense of dilemma about how to successfully manage both career and family as described in Chapter five.

There is need for a more fundamental re-think of the current normative scientific career progression structure, to consider future career systems that are multi-dimensional, and which challenge the ingrained classic linear pipeline model (European Union, 2012), as a way of recognising contextual realities in SSA pertaining to limited scientific research career progression opportunities. This may include a shift from solely focusing on academic scientific career towards encouraging and supporting science research innovators to develop careers in and out of academia, and whose achievements should be recognised for delivering social and economic benefits to humanity (European Union, 2012). In addition, attention should be paid to developing a more locally appropriate and achievable approach to measuring 'excellence' for individuals, in line with existing debates at the level of national scientific research funding systems (Chataway et al., 2019). This may include considering research achievements in the context of research opportunities for individuals (e.g. over a full time working equivalent period) (Global Research Council, 2016).

Whilst English is the standard language for scientific research communication (Minja et al., 2011), this calls for the need of additional support and potential adjustments to expectations for language minorities in science so as to create equal progression opportunities for all. This could be achieved through enhanced institutional collaborations between Anglophone and Francophone researchers to help strengthen researcher English language skills.

Embracing gender transformative approaches in science to ameliorate the impact of unequal gendered power relations both within and beyond scientific research institutions and funding systems is required. Such approaches actively strive to examine, question, and challenge the rigid oppressive systems, gender norms and power imbalances as a means of achieving more lasting gender equity outcomes (Kagesten and Chandra-Mouli, 2020). They also encourage critical awareness among women and men of gender roles and norms, promote the position of women, challenge the distribution of resources and allocation of duties between men and women, and/or address the power relationships particularly in

male dominated society and cultures (Kagesten and Chandra-Mouli, 2020; Rottach et al., 2009). For instance, to help deal with the familial and socio-cultural barriers to gender equitable scientific career progression, continuous implementation of community conversations and /or dialogues at workplace on what scientists do might be useful. This could be particularly about raising awareness on the nature of science that requires long working hours and frequent scientific mobility, for which compared to the men, women researchers tend to be more disadvantaged based on their reproductive gender roles. Such initiative could aid in garnering familial and spousal support with household responsibilities and care giving obligations thus serve as a gender transformative approach towards challenging the unequal gender division of labour and associated social norms impeding equitable scientific career progression.

## 7.4 Study limitations

I have already explored the specific limitations relevant to the methodology within the relevant result chapters. Here, I will reflect on some of the additional limitations of the thesis particularly pertaining to the study design. Although I had initially proposed to undertake institutional case study, it became impossible since most institutions forming the purposively selected consortia were so diverse and diffuse. For example, some had only two fellows of similar gender at same career stage making it difficult to construct a case study. Since adopting a case study approach requires providing a detailed account of each case, either in prose or in a tabular summary (Creswell, 2006), using such a study design was likely to breach confidentiality of the study participants. Case study approaches also require drawing data from multiple sources including a review of written records to add texture, depth, and multiple insights to an analysis (Creswell, 2006). I had initially planned to undertake a review of institutional level policy and procedural documents to gather information about: organisational culture such as openness and communication; workplace gender and sexual harassment policies; family-friendly policies including timing of meetings, maternity/paternity/adoption leave and return to work policies, and flexible working policies; and equitable remuneration policies. For this reason, and in consultation with my supervisors, I redefined the study design towards adopting an exploratory qualitative approach utilising a grounded theory methodology as detailed in Chapter three. Yin (2011) notes that qualitative research has no array of fixed designs, as might appear to exist in doing experiments, rather the chosen design can change within the course of a study. Thus, a key component of any qualitative research design is flexibility, as one may change the methods once they get to the field (Yin, 2011). I also wish to declare that this thesis mainly focuses on the salient issues that emerged from the participants' narratives. Questions around recruitment process, as indicated in the interview guides, were not

perceived by study participants as a major issue, given the almost equal number of fellows recruited into the DELTAS Africa Initiative. This did not turn out to be a relevant question for them.

## 7.5 Concluding remarks

In conclusion, I have found that career progression of female and male researchers, characterised by multiple social identities, to senior positions is influenced by many factors, including familial and socio-cultural as well as institutional barriers, which are shaped by broader forces of patriarchy, capitalism and neo-colonialism, that perpetuate inequities. This thesis provides empirical evidence on existing strategies utilised by individual researchers at the micro level of the family, and enabling mechanisms at the meso institutional level towards enhancing gender equitable scientific career progression. It also offers an array of empirical evidence of participants' recommendations on the desired actions for positive change, highlighting the existing gaps that need to be filled in future programming for long-lasting impact for individual researchers and the research institutions in SSA.

Overall, the findings in this thesis could be useful for supporting future programming, including DELTAS Africa II initiative (2021-2025) and related HRCS programmes, by providing valuable insights to institutional and consortia research leaders, principal investigators, funders, and policy makers to reflect on what strategies and actions they could implement to narrow barriers to gender equitable scientific career progression. To maximize the impact of HRCS and achieve equitable scientific career progression outcomes for female and male researchers, there is need to carefully implement the participants' recommended actions whilst simultaneously monitoring the progress against gender and diversity indicators. This could be achieved by having a dedicated budget for gender equity to enable responding to differential needs of researchers. It also calls for working together with a gender and social inclusion specialist at the funding and consortium level, and gender focal points in the partnering institutions to aid in developing an all-inclusive gender strategy and implementation plan. I argue that these are essential for achieving capacity strengthening aims of enhancing equitable career progression and hence should be incorporated into programme planning, budgeting, and monitoring. Finally, we must keep in mind that great achievements and outcomes take time and sustained effort from everyone.

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# Appendices

## Appendix A: Summary of the total number of documents reviewed from SSA (n=35)

| Author | Type of publication | Context/setting | Theory/concepts | Method | Focus/data |
|---|---|---|---|---|---|
| Adusah-Karikari (2008) | Thesis | Ghana | Postcolonial feminism | Qualitative | Experiences of Women faculty and administrators in Higher Education in Ghana. |
| Assié-Lumumba (2006) | Report | SSA | N/A | Desk review | Gender and policy context of gender and higher education. |
| Beoku-Betts (2004) | Peer-reviewed article | SSA - Ghana, Nigeria, Sierra Leone, Cameroon and Zimbabwe | N/A | Qualitative | Experiences of female women doctoral level scientists in research and academic institutions. |
| Beoku-Betts (2005) | Peer-reviewed article | SSA - Ghana, Sierra Leone, Nigeria, Cameroon, Sudan, Zimbabwe, and Uganda. | Concepts of 'Getting On' and 'patriarchal closure' | Qualitative | Experiences of women in academic scientific careers. |
| Callaghan (2016) | Peer- reviewed article | South Africa | N/A | Quantitative | Bivariate and multivariate analysis of relationships between the pressures faced by female and male academics to publish vis a vis family life. |
| Campion and Shrum (2004) | Peer-reviewed article | Ghana and Kenya | N/A | Quantitative | Comparison of female and male research careers in state research institutes, Universities, NGOs and international research centres. |
| FAWE (2015) | Report | SSA | N/A | Desk review | Gender inequality in HEIs. |
| Jansen Van Rensburg (2007) | Thesis | South Africa | N/A | Mixed method | Results from the survey and interviews with women at middle and senior management showed that challenges of work-life balance and lack of networking as highly ranked career advancement barriers. |
| Johnson (2014) | Peer-reviewed article | SSA - Zimbabwe, Ghana, Nigeria, and Madagascar | Intersectionality | Qualitative | Life and career path experiences of female higher education administrators in SSA. |

| | | | | | |
|---|---|---|---|---|---|
| Lumby and Azaola (2014) | Peer-reviewed article | South Africa | Constructs of mothering, agency and emotional capital | Qualitative | Construction of motherhood by female academics and how these impacts on their leadership role in learning institutions. |
| Mabokela (2003) | Peer-reviewed article | South Africa | "Donkeys of the University" metaphor | Qualitative | Workplace experiences of Black women administrators in four HEIs. |
| Mabokela and Mawila (2004) | Peer-reviewed article | South Africa | Concepts of 'gendered organizational cultures of universities' | Qualitative | Experiences of professional advancement of Black female scholars and administrators in HEIs. |
| Mabokela and Mlambo (2015) | Peer-reviewed article | Ghana | Black feminist theorists (US) | Qualitative | Professional experiences of female academics at University in Ghana. |
| Mama (2006) | Peer-reviewed article | SSA | N/A | Desk review | Gender in and masculine institutional culture of African universities. |
| Mama and Barnes (2007) | Peer-reviewed article | SSA | N/A | Desk review | Gender inequalities in Africa's public universities. |
| Masanja (2010) | Report | SSA | N/A | Desk review | Women's participation in education and specifically STEM. |
| Matonya (2016) | Thesis | Tanzania | Social model of disability | Qualitative | Barriers to participation of women with disabilities in higher education. |
| Mawela (2014) | Book chapter | South Africa | Critical-interpretivist paradigm | Qualitative | Journeys of female Professors in SET fields in higher education. |
| Morley (2005) | Peer-reviewed article | SSA - Uganda, Nigeria, South Africa and Tanzania | N/A | Desk review | Gender and higher education in low-income Commonwealth countries. |
| Morley (2006) | Peer-reviewed article | Nigeria, South Africa, Tanzania, Uganda | N/A | Qualitative | Focuses on the subtle and complex ways in which discrimination against female academic staff and managers takes place in HEIs as evidenced through interviews. |
| Moswela and Mukhopadhyay (2011) | Peer-reviewed article | Botswana | Social model of disability | Qualitative | Experiences of male and female university students with disabilities in higher education. |

| | | | | | |
|---|---|---|---|---|---|
| Mukhebi et al. (2017) | Peer-reviewed article | SSA | N/A | Mixed method | Case study exploring the role of mentoring in increasing the pool of women in agricultural research (AWARD program) |
| Nyamongo (2007) | Peer-reviewed article | Kenya | N/A | Desk review | Socio-cultural factors influencing differential enrolment and completion for undergraduate and postgraduate anthropology students. |
| Obers (2015) | Peer-reviewed article | South Africa | N/A | Mixed method | Constraints and enablers of women academics' research careers within at Rhodes University. |
| Okeke et al. (2017) | Peer-reviewed article | SSA | N/A | Desk review | Women's underrepresentation in pursuing STEM disciplines. |
| Onsongo (2006) | Book chapter | Kenya | N/A | Mixed method | Inequities and discrimination in staff recruitment, training, promotion and work environment in public universities. |
| Onsongo (2007) | Peer-reviewed article | Kenya | Feminist perspective | Mixed method | Gendered relations in public universities and implications of the growth of private universities on gender equity in higher education. |
| Prozesky (2006) | Peer-reviewed article | South Africa | N/A | Secondary data analysis | Gender differences in journal publication productivity among academics 1990-2001. |
| Prozesky (2008) | Peer-reviewed article | South Africa | N/A | Qualitative | Early career and family experiences of women and men in relation to research productivity. |
| Prozesky and Beaudry (2019) | Peer-reviewed article | SSA | N/A | Quantitative | Multi-county survey (41 African countries) on geographic mobility of academic scientists in Africa, and how it relates to gender and career development. |
| Raburu (2015) | Peer-reviewed article | Kenya | Feminist perspective | Qualitative | Experiences of women academics from three universities. |
| Snyder (2014) | Peer-reviewed article | South Africa | Critical Race Feminism | Qualitative | Experiences of female doctoral students of colour in educational progress. |
| Teferra and Altbach (2004) | Peer-reviewed article | SSA | N/A | Desk review | Problems faced by female students and academic staff in African HEIs. |
| UNESCO (2007) | Report | Global | N/A | Desk review | Women and science in higher education. |
| UNESCO (2015) | Report | Global | N/A | Desk review | Statistical trends in women's representation in science research careers. |

## Appendix B: AESA approval letter for this research study

The African Academy of Sciences

*Driving Scientific and Technological Development in Africa*

Thursday, July 27, 2017

**TO WHOM IT MAY CONCERN**

**Re: AESA approval for Learning Research Programme (LRP) data collection activities conducted in support of the DELTAS Africa initiative.**

The Alliance for Accelerating Excellence in Science in Africa (AESA) is a funding platform established by the African Academy of Sciences and the New Partnership for Africa's Development (NEPAD) Agency with the aim of developing science strategies and funding research in Africa. The Developing Excellence in Leadership, Training and Science (DELTAS) Africa, a scheme initiated by the Wellcome Trust, is a flagship AESA programme. DELTAS Africa consists of eleven African-led health research consortia, spanning over 52 institutions from across 21 African countries, that collectively seek to: produce world-class scientific research that addresses African health and research priorities through scientific discourse and collaborative supervision; strengthen scientific research training and build career pathways for scientific researchers; foster mentorship, leadership and equitable collaboration in science, and engagement with public and policy stakeholders; and cultivate professional environments to manage and support scientific research.

The Capacity Research Unit (CRU), Liverpool School of Tropical Medicine (LSTM), has been funded by the Wellcome Trust and the UK Department for International Development to embed a 'Learning Research Programme' (LRP) within the DELTAS Africa initiative for the period 2016-2020. The LRP is designed to complement routine monitoring and evaluation activities and will inform programme implementation during the course of the DELTAS Africa initiative. In order to carry out the LRP, CRU research staff and PhD students (inclusive of Ms. Millicent Liani, Ms. Violet Murunga and Ms. Nadia Tagoe) will be required to occasionally collect programme-specific information from DELTAS staff, students and stakeholders in areas pertaining to research training, research careers, research uptake and consortia management. This information may be collected by questionnaire, interview, focus group discussion, observation or document review and, following appropriate analysis, will be reported to AESA and all relevant DELTAS consortia and stakeholders for the purpose of programme review.

As Director of AESA, I confirm our support for the LRP and associated activities as described above. AESA further supports the dissemination of LRP-derived DELTAS information through presentation at scientific conferences, technical reports, academic publication and (in the case of the PhD students) dissertations pending approval from a registered Kenyan medical ethics review board.

Sincerely,

Dr Thomas Kariuki
**Director, AESA**

## Appendix C: Screening questionnaire for potential study participants

**An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

Principal Investigator: Ms. Millicent L. Liani, PhD candidate, Liverpool School of Tropical Medicine, United Kingdom

Supervisors: 1). Dr. Rachel Tolhurst, Liverpool School of Tropical Medicine, United Kingdom

2). Prof. Isaac K. Nyamongo, University of Nairobi, Kenya

**Respondent's demographic and background information**

1. Respondent's name _____
2. Contact information (This will solely *be used for correspondence purposes pertaining to this research study*)

   Email address_____

   Cellphone number (*indicate country code i.e +254 for Kenya*) _____
3. Respondent's gender identity? [ ] Male [ ] Female [ ] Other (*Specify*) _____
4. Name of the affiliated DELTAS consortium (Specify) _____
5. What is your nature of involvement/affiliation with the above mentioned DELTAS Consortium programme or current institution if not a DELTAS affiliate (*Tick only one option*)

   [ ] Student/junior research fellow (*Then proceed to question 7*) [ ] Staff [ ] Both
6. If identified as a staff or both (as a staff and student), in Question 5 above, What is the name of your current institution of work? _____

   a. What is your current research position/rank?

      [ ] Junior researcher (Masters/PhD student)

      [ ] Early career stage researcher/Postdoctoral research fellow

      [ ] Mid-level researcher

   b. If affiliated to a DELTAS programme, as indicated in question 4 above, for how long, in years, have you been working/serving in your current position within this programme?

      _____

   c. For how long, in years, have you been working in this scientific research institution in general? _____

   d. What is your highest level of academic qualification? _____

7. If identified as student/junior research fellow in Question 5 above:
    a. What is your current postgraduate level of study? [ ] Masters [ ] PhD
    b. What is your current year of study? [ ] 1st [ ] 2nd [ ] 3rd [ ] 4th
    c. In which month and year did the DELTAS fellowship commence? Month _____Year_____
8. What is your current field of science specialization? _____
9. Which age category do you currently belong to?

| | | | |
|---|---|---|---|
| Below 25 years | 25 to 29 years | 30 to 34 years | 35 to 39 years |
| 40 to 44 years | 45 to 49 years | Above 50 years | Prefer not to say |

10. What is your marital status? (*Select only one*)
    [ ] Single [ ] Cohabiting [ ] Married [ ] Divorced/ separated/widowed [ ] I prefer not to respond
11. How many children do you have, if any? What are their age/s? (*Write the total number of children, and their respective ages in the space provided*) _____
12. What is your nationality/current citizenship? _____
13. What is your preferred language of communication _____
14. What is your religious affiliation? _____
15. What is your ethnic affiliation? _____
16. Do you consider yourself to have any physical disability? [ ] YES [ ] NO. If yes, briefly describe the nature of the disability? _____

**Thank you for your participation!**

## Appendix D: Interview guides

**An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

### Key informant interview schedules

***A) Questions for institutional research leaders/research managers and coordinators***

Name of the institution …….

Date of interview: Day ……Month…….Year:.....

Interviewed by:.....

Start time: …… End time: ……

***Demographic characteristics***

i. What is your name _____
ii. What is your gender?
iii. How many years of employment in scientific institutions do you have? _____
iv. How long have you worked in this institution? _____years
v. What is your position in your institution/department? _____
vi. What is your position in the DELTAS programme? _____
vii. How long have you worked in your present position? _____years

***Interview questions***

1) Tell me about the management structure of the DELTAS programme and how it operates in this institution? What is your role in the DELTAS programme?
2) In your opinion and experience, how well are female and male scientists represented in your institution? How about in the DELTAS programme? Why? What are the main factors enabling this?
3) In your opinion and experience, how well are female and male scientists represented in senior positions in your institution? How about in the DELTAS programme? Why? What are the main factors enabling this?
4) Are there any (other) social groups that you feel are under-represented (e.g. people with disabilities, language minorities) in your institution, in the DELTAS programme, and in the senior management? Why do you say so?
5) What would you say are the main reasons for the under-representation of women (*assuming this is identified in the question above*) or men? [*Probe for in general and at senior levels*]. Is this affected by any other factors such as age or family responsibility? What about other under-represented groups?

6) Do you think that your institution should play a role in improving the representation of women in science/at senior levels? What kind of role can they play?
7) Tell me about the mechanisms that are currently in place to enhance equitable career progression of female and male scientists at all levels in this institution? Probes:
    a. Equitable appointment and promotion processes – communication, nomination, staff support, constitution of the selection panel etc.
    b. Representation of female and male scientists on decision making bodies.
    c. Fairness in remunerations for individual female and male researchers doing a similar job.
    d. Institutional structures and systems on career development and advice - career mentoring scheme, support for professional networking and role models, capacity building programmes. [*How do these work in the DELTAS programme, and how has the programmme contributed to opportunities for female scientists and other under-represented groups, if any*]
    e. Institutional arrangements and culture - family-friendly and flexible working policies; systems to ensure equitable distribution of workload; mechanism for recognizing, valuing and rewarding individual female and male researchers.
8) In your opinion, what changes to institutional working practices and policies/directives would enhance career progression and retention of female and other under-represented groups at this institution? What about retention of female and other under-represented groups at this institution?
9) Is there any general comment or a question you would like to ask me in relation to what we have just discussed?

**Thank you for your participation!**

In-depth Interview guide for DELTAS sponsored Masters and PhD students

Date of interview: Day ……Month……. Year .....

Interviewed by: .....

Start time: …… End time: ……

**PERSONAL INFORMATION**

1. What is your name? _____
2. What is your gender?
3. What is the name of the DELTAS consortium that is sponsoring your research study?

   _____
4. What is your current postgraduate level of study? [ ] Masters [ ] PhD
5. What is your current year of study? [ ] 1st [ ] 2nd [ ] 3rd [ ]4th
6. What is your current field of science specialisation? _____
7. How old are you now?
8. What is your marital status?
9. If married, are you currently living together with your spouse or the spouse is away? What is your spouse's: highest academic qualification _____-, specialty_____, occupation and position_____
10. Number of children and their age, if any _____
11. Other background information

| Citizenship/nationality | Preferred language of communication | Religious Affiliation | Do you consider yourself to have any disability? |
|---|---|---|---|
| | | | |

**A) Career history into science**

1) Could you please reflect and tell me about your journey to scientific field of study, and all that you can remember about yourself on how you have come to be an Msc/PhD student? Probes:
   a. When you were growing up, what type of profession/career did you think about pursuing? Why did you choose to move away from it or pursue the early-life dream career?
   b. Can you reflect on any key moments or time periods that were particularly significant in the journey to becoming an Msc/PhD student? [Probe for any career breaks – e.g. for maternity or medical leave].

2) Tell me about the family background in which you grew up?[*Probe for: family type, age and educational level of parents, parents' occupational status, number of siblings and their gender, interviewee's early life educational experiences*] As you reflect on the story of your journey to this point of your present level of study, can you identify any important influences on your progress? Probes:
    a. What did your family think of your choice of career? And what did your community think of your choice of career?
    b. What did their opinions mean to you?
    c. What about other important people in your life – e.g. peers?
    d. What social cultural factors, if any, played a role in your perceptions and experiences to becoming who you are today?
3) What or who would you say has helped you reach where you are in your career?
4) What would you say is holding you back from developing in your science career/postgraduate studies?
5) Can you reflect on how these things that have helped or hindered you relate to who you are – e.g. as a [*married/unmarried, older/younger e.t.c.*] man/woman?

**B) How institutional environment shapes career experiences of individual postgraduate students/junior researchers**

*1)* I want to ask you a few questions about how important or influential the institutional environment has been to you in terms of shaping your career to who you are today. First of all, how 'friendly' do you find the institution to you as a as [*mention the descriptive characteristics of the interviewee* e.g. a married/unmarried, older/younger] man/woman?
    a. Probe for those with dominant language challenges: what is the main language spoken in the institution, how comfortable are you with it, how does it influence your communication and dissemination of scientific work orally, and through publications?
2) Tell me about any hurdles or barriers that you might have faced in this institution as a junior researcher/postgraduate student. Can you tell me about any incidents or issues that illustrate this?
    a. What attitudes are like in the institution towards male and female postgraduate students? [*Any encounter of gender stereotyping, discrimination, and any other biases etc*] How did/do you deal with them?

b. What would you say about the financial support/student living allowance (stipend) from DELTAS fellowship? Is it enough to sustain your financial needs? If NO, how do you deal with personal finance issues as a student/junior researcher?

3) How do you balance between studies/work and your personal life?
    a. How well does the institutional culture help you achieve this? [*i.e. timing of meetings, expectations of responses to emails, attitudes towards dealing with family issues etc*].
    b. How about the institutional policies and procedures (e.g. flexibility of working hours, opportunities for family-related leave)?
    c. What are some of the unwritten rules that govern how things are done in your current institution?
4) Tell me about how your Masters/PhD supervision works? [*Probe for: relationship between male-female supervisor/; communication mechanisms- any language barrier issues; challenges associated with supervision; and how such challenges should be resolved*]
5) Tell me about some of your fellow colleagues in your program, if any, who withdrew from studies before completing requirements for the degree? [*Probe: their gender, reasons for leaving*]

**C) Capacity strengthening programmes for female and male junior career researchers/postgraduate students**

1) In your own opinion, how would you describe a successful scientist? What do you think you have to do to be seen as a successful scientist? *[Probe for: mentorship, professional networks& DELTAS-oriented student networks, visibility in science etc*].
    a. What helps/has helped you in doing this? (Share any mentorship, role model supports, professional networking and encouragement, among others, you may have experienced/received from the DELTAS programme in your journey to becoming who you are today).
    b. What holds you back in becoming a successful scientist? How does your personal identity as a *[gender, age, marital status, etc.]* affect your opportunities towards becoming a successful scientist?
2) Tell me about the kind of scientific career development training programs that have been offered to you by the current institution. [*Probe specifically for DELTAS-funded opportunities*]

3) What aspects of scientific career development do you feel you require more capacity and support? [*Probes: hard skills – {subject specific}; soft skills {research uptake, communication, publishing, leadership etc}].* What opportunities are there in this institution to increase your capacity and support? How equitably are these offered to all students (regardless of funding source)?
4) What are your future scientific career aspirations? What should be done for you to meet/realize these aspirations? How could these be done?

**D) Strategies to enhance gender equitable scientific career progression**

1) What changes could be made within the institution, and the DELTAS programme to help postgraduate students/junior researchers like you to progress in academia/scientific careers?
2) As you look back on your academic life, was there ever a situation where you found yourself at a point of wanting to leave your current postgraduate study programme? If so, could you please describe this situation? What influenced your decision of wanting to leave? What made you to stay?
3) Is there any general comment or a question you would like to ask me in relation to what we have just discussed?

**Thank you for your participation!**

In-depth interview guide for DELTAS funded/supported staff working in the selected ARC

Name of the institution …….

Date of interview: Day ……Month……Year:.....

Interviewed by:.....

Start time: …… End time: ……

**Background and Personal Information**

1. What is your name? _____
2. What is your gender?
3. What is your highest formal academic qualification? _____
4. In which field of science specialisation is your highest academic qualification? _____
5. What is your current research position/rank?_____
6. How old are you now?
7. What is your marital status?
8. If married, are you currently living together with your spouse or the spouse is away? What is your spouse's: highest academic qualification _____ specialty_____, occupation and position_____
9. Number of children and their age, if any _____
10. Other background information

| Citizenship/nationality | Preferred language of communication | Religious affiliation | Do you consider yourself to have any disability? |
|---|---|---|---|
| | | | |

**A. Career history into science**

1) Could you please tell me about your journey to a science career up to this point of your present job, and all that you can remember about yourself on how you have come to be a *[mention the research career stage of the interviewee i.e. mid-level scientist]*? Probes:
    a. Why did you make this career choice?
    b. When did you start your career in science?
    c. In what position did you start your career in science?

d. Can you reflect on any key moments or time periods that were particularly significant in the journey to becoming [*mention the career stage of the interviewee*]? [*Probe for any career breaks – e.g. for maternity, medical leave*]

2) Tell me about your family background in which you grew up? [*probe for: type of family, age and educational level of parents, parents' occupational status, number of siblings and their gender, interviewee's early life educational experiences*]? As you reflect on the story of your journey to this point of your present work, can you identify any important influences on your progress?

Probes:

a. What did your family think of your choice of career?
b. What did their opinions mean to you?
c. What about other important people in your life – e.g. peers?
d. What social cultural factors, if any, played a role in your perceptions and experiences to becoming who you are today?

3) What or who would you say has helped you reach where you are in your science career?
4) What would you say are the things holding you back from developing in your science career?
5) Can you reflect on how these things that have helped or hindered you relate to who you are – e.g. as a <married/unmarried, older/younger e.t.c. > man/woman?

**B. How institutional environment shapes career experiences of individual scientists**

1) I want to ask you a few questions about how important or influential the institutional environment has been to you in terms of shaping your career to who you are today. First of all, how 'friendly' do you find the institution to you as a [*mention the descriptive characteristics of the interviewee* e.g. <*married/unmarried, older/younger* > man/woman?

a) Probe for those with dominant language challenges*: What is the main language spoken, how comfortable are you with it, how does it influence your communication and dissemination of scientific work through publications*?

2) Tell me about any hurdles or barriers that you might have faced in this institution to reaching your current position or doing your job well. Can you tell me about any incidents or issues that illustrate this?

a. What attitudes are like in the institution towards male and female scientists? [*Probe: Any encounter of gender stereotyping, discrimination, and any other biases etc*]
b. How do/did you deal with them?

3) How do you feel about your work-life balance?

a. How well does the institutional culture help you achieve this? [*i.e. timing of meetings, expectations of responses to emails, attitudes towards dealing with family issues etc*].
b. How about the institutional policies and procedures (e.g. flexibility of working hours, opportunities for family-related leave)?
c. What are some of the unwritten rules that govern how things are done in the institution?

4) What are your thoughts about your remuneration as it compares with others doing a similar job? If any differences, what do you attribute the differences to? What could be done to enable fairness in remunerations?

**C. Recruitment processes and opportunities to progress within institutions**

1) How equitable do you think the recruitment processes for scientists like you exist in your current institution? Please tell me more.
2) Tell me about your perception of promotion opportunities for you as a scientist working in this institution? How does your social identity as a [*mention the descriptive characteristics of the interviewee e.g. <married/unmarried, older/younger e.t.c>]* man/woman impact on these?
3) What do you think about the promotion processes? How fair are they? Are there hidden/unwritten reasons for promotion? What would you say are the differences between the 'official' and unofficial promotion criteria?
4) How is the contribution of a scientist like you usually evaluated in this institution? What are the key aspects of performance indicators used during evaluations? What is your opinion about the evaluation criteria? What challenges do you face in achieving these criteria? How do they relate (if at all) to you as a [*mention the descriptive characteristics of the interviewee e.g. <married/unmarried, older/younger e.t.c>*] man/woman?
5) Describe to me how easy or hard it is to achieve publication targets? What shapes this for you?
6) Based on your familiarity by working in this institution, what does the institution do to help staff returning from career breaks to progress in their work? Is there a clear policy on how career breaks and part time working are considered at appointment and promotion? Please tell me more.

**D. Institutional capacity strengthening of women and men scientists to progress along the career ladder in the future**

1) What do you have to do to be seen as a successful scientist? *[Probe for: professional networks, visibility in scientific fora etc*]. What helps/has helped you in doing this? (Share any mentorship, role

model supports, and encouragement you may have experienced on your journey in becoming who you are today). What holds you back? How does your personal identity as a *[married/unmarried, older/younger e.t.c.]* man/woman affect your opportunities towards becoming a successful scientist?

2) By working in your current scientific career field, what are the roles of collegial networks? Explain what these networks look and mean to you?
3) Tell me about the kind of scientific career development training programs that have been offered to you by the current institution. [Probe specifically for DELTAS-funded opportunities]
4) What aspects of scientific career development do you feel you require more capacity and support? [*Probes: research uptake, communication, publishing, leadership etc*]. What opportunities are there in this institution to increase your capacity and support? How equitably are these opportunities available female and male scientists in your institution?
5) What are your future scientific career aspirations? What should be done for you to meet/realize these aspirations? How could these be done?

**E. Strategies to promote and enhance gender equitable career progression in institutions**

1) What would you recommend to be done to improve your experiences of the [*mention the DELTAS programme*] for <*married/unmarried, older/younger e.t.c*.> women/men in scientific studies like you?
2) As you look back on your scientific career life, was there ever a situation where you found yourself at a point of wanting to leave science career? If so, could you please describe this situation? What influenced your decision of wanting to leave? What made you to stay?
3) Is there any general comment or a question you would like to ask me in relation to what we have just discussed?

**Thank you for your participation!**

## Appendix E: Coding Framework

**Description of a scientific research career**

- Linear process
- Time commitment

**Social power relations of gender within the family and wider society**

- Unequal gender division of labor
    - Excessive work commitments and limited time
- Gendered social norms and values
- Gender stereotypes

**Difficulties with managing 'two different lives' – family and career**

- Time pressure and work-life imbalance related to scientific writing
- Pressures around participation in scientific mobility
- Relationships suffering
- Disrupting wellbeing

**How women navigate the 'two different lives'**

- Biological clock and career clock
- Glass ball and rubber ball
- Sacrifice

**Complex and competitive institutional environment**

- Research funding structure and the resultant implications
- 'Hustle' for career progression opportunities

**Inequitable access to support systems within institutions**

- Insufficient mentoring
- Dearth of female role models
- Inflexible working arrangement
- Lack of support for women with nursing needs

**Negative practices and culture at workplace**

- Stereotypical attitudes
    - Career women
    - Social scientists
- Gender biases - 'hot' and 'hidden'

- Sexual harassment
- Bullying and intimidation
- Implications of women's under-representation in senior positions

**Coping mechanisms**

- Individual agency and resilience
- Daily work-schedules
- Role of religious faith
- Support system
    - Spouse
    - Parents and family

**Institutional support mechanisms**

- Good supervision and mentorship
    - Career support
    - Psycho-social support
    - Consortia research directors as natural mentors
- Mindful of researchers' well-being
    - Work-life discussion fora
    - Role of wellbeing department at workplace
- Support with caring responsibilities
    - Childcare support while traveling
    - Allocation of research assistants for data collection and analysis
    - Extension of fellowship duration

**Proposed solutions**

- Individual and societal level actions
    - Disclosure of faced challenges
    - Community and public awareness
- Institutional and consortia level actions
    - Supportive research community
    - Supportive and inclusive gender sensitive work environment
    - Formal and structured approach to mentoring
    - Improvement on gender balance in scientific leadership positions
- Wider programme and funding level actions

    - Foster and secure careers of researchers
    - Virtual research capacity strengthening programme
    - Different approach to funding
    - Support for language minorities in science

**Other intersectional axes of inequities**

- Family educational background
- Scientific discipline
- Religious affiliation
- Professional cadre
- Marital status
- Language minority
- Parental status
- Nature of partnership
    - Dual scientific career couple
    - Non-dual scientific career couple
- Age
- Positional hierarchy
- Social norms

## Appendix F: Timeline of my thesis journey

| Period | Activities |
|---|---|
| **2017** | ▪ June – Presented my research proposal to LSTM annual postgraduate student conference.<br>▪ July – Presented my research proposal to the LSTM gender and health group for feedback provision.<br>▪ July – Attended and presented my research proposal at the DELTAS AGM held in Accra, Ghana. |
| **2018** | ▪ Feb – Visited the African Academy of Sciences to present my methodology and discuss plans for research ethics.<br>▪ June - Presented my literature review findings to the LSTM's annual postgraduate student conference, and 'Women in Science Conference: Inspiring the next generation'.<br>▪ July – Attended the DELTAS AGM that was held in South Africa.<br>▪ Oct – Poster presentation of literature review findings at the 5th Global Symposium on Health Systems Research, in Liverpool, United Kingdom.<br>▪ Dec – Presented my literature review findings at a seminar organised by LSTM's Women's Leadership Group on a topic titled 'How gender analyses of the health workforce and science can deepen understanding and harness change'. |
| **2019** | ▪ May – Presented my preliminary findings to AESA/Wellcome Trust chairs' visit to Kenya.<br>▪ June - Presented my preliminary research findings to LSTM annual postgraduate student conference.<br>▪ July – Attended and presented my preliminary research findings at the DELTAS AGM held in Senegal, for which I was awarded a prize for the overall best female poster presenter. Available at https://aasopenresearch.org/documents/2-131<br>▪ July – Invited guest speaker at the Global Forum on Women in Scientific Research convening, in Dakar, Senegal, where I gave a presentation about 'What drives gender inequities in scientific research career progression in Africa?'. Available at https://www.slideshare.net/AWARDFellowships/gender-inequities-in-science-careers<br>▪ Nov – Held a seminar presentation to the LSTM's gender and health group and CCR team about my preliminary research findings – Emergent themes and my thesis structure. |
| **2020** | ▪ Jan – Presented my preliminary research findings at the International Summit on women in STEM, in New Delhi, India on a thematic panel titled: "The future of Women in STEM – policies for enhancing diversity in STEM fields". The conference proceedings are available at https://bit.ly/2QrQjyg<br>▪ Feb – Presented my preliminary research findings at the KEMRI's 10th Annual Scientific and Health conference, held in Nairobi, for a thematic panel session titled: "Gender and Science: Harnessing the potential of women in addressing health". Available at https://www.kemri.org/2020/02/10/pomp-and-colour-as-kemri-turns-40/<br>▪ Feb – Prepared a high-level recommendation learning report on "Gender equitable careers" aimed at informing funding decisions and how best to support DELTAS II Initiative (2021-2025). |

| | |
|---|---|
| | ▪ Mar - Prepared and confidentially shared feedback reports based on the emergent findings on existing enabling strategies, key challenges, and recommendations for enhancing gender equitable scientific career progression for each of the three consortia studied, with the respective consortia leaders.<br><br>▪ Sept – Presented preliminary finding at the Association of African Universities virtual conference on 'Advancing African and Diaspora Academic Relations: Role of the Diaspora in Higher Education and Innovation in Africa' under a thematic panel discussion organised by the Alliance for African Partnership of Michigan State University, titled: "Building women research leaders from African Institutions – Sharing perspectives".<br><br>▪ Nov – Produced a short film for DELTAS Africa LRP which summarised my PhD findings. Available at https://bit.ly/3doNCqh |
| **2021** | ▪ Feb – In honour of the International Day of Women and Girls in Science, I published a blog in the UKCDR blog post that summarises my PhD study findings. Available at http://bitly.ws/cLFi<br><br>▪ Mar – Presented my overall PhD research findings at the DELTAS LRP online dissemination meeting, marking the closure of the LRP programme. Report available at https://bit.ly/3nkE56R |

## Appendix G: LSTM letter of ethical approval

Ms Millicent L. Liani
Liverpool School of Tropical Medicine
Pembroke Place
Liverpool
L3 5QA

LSTM
LIVERPOOL SCHOOL OF TROPICAL MEDICINE
Pembroke Place,
Liverpool, L3 5QA, UK
Tel: +44(0)151 705 3100
Fax: +44(0)151 705 3370
www.lstmed.ac.uk

Wednesday, 01 August 2018

Dear Ms Liani,

**Research Protocol (17-075) 'An examination of barriers and enablers to sender equitable scientific career pathways in the DELTAs funded African research institutions'**

Thank you for your letter of 5 April 2018 and 24 July 2018 providing the necessary in-country approvals for this project. I can confirm that the protocol now has formal ethical approval from the LSTM Research Ethics Committee.

The approval is for a fixed period of three years and will therefore expire on 31 July 2021. The Committee may suspend or withdraw ethical approval at any time if appropriate.

Approval is conditional upon:

- Continued adherence to all in-country ethical requirements.
- Notification of all amendments to the protocol for approval before implementation.
- Notification of when the project actually starts.
- Provision of an annual update to the Committee.
  Failure to do so could result in suspension of the study without further notice.
- Reporting of new information relevant to patient safety to the Committee
- Provision of Data Monitoring Committee reports (if applicable) to the Committee

Failure to comply with these requirements is a breach of the LSTM Research Code of Conduct and will result in withdrawal of approval and may lead to disciplinary action. The Committee would also like to receive copies of the final report once the study is completed. Please quote your Ethics Reference number with all correspondence.

Yours sincerely

Angela Obasi

Dr Angela Obasi
Chair
LSTM Research Ethics Committee

## Appendix H: SUIRB ethics approval

Strathmore UNIVERSITY

5th April 2018

SU-IRB 0172/18

Millicent L. Liani
P.O Box 14446 - 00800
Nairobi.

Email: millyliani@gmail.com

Dear Millicent Liani,

**REF** **Protocol ID:** SU-IRB 0172/18
**Title: An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

We acknowledge receipt of your application documents to the Strathmore University Institutional Ethics Review Committee (SU-IERC) which includes:

1. Study Proposal version 3 dated March 2018
2. Participant Information sheets and consent Forms Version 2 dated March 2018
3. Research tools (Screening questionnaire and interview guide dated January 2018)
4. Approved research budget
5. Evidence of completion of Human subject Protection Training
6. CV
7. Research Assistant confidentiality agreement dated January 2018
8. Liverpool School of Tropical Medicine Research Ethics Committee in principle approval letter
9. Ethics support letter for carrying out the study from the Alliance for Accelerating Excellence in Science in Africa (AESA)

The committee has reviewed your application, and your study *"An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions"* has been granted **approval**.

This approval is valid for one year beginning **5th April 2018** until **4th April 2019.**

In case the study extends beyond one year, you are required to seek an extension of the Ethics approval prior to its expiry. You are required to submit any proposed changes to this proposal to SU-IERC for review and approval prior to implementation of any change.

SU-IERC should be notified when your study is complete.

Thank you

Sincerely,

Amina Salim
**Regulatory Affairs Fellow**

STRATHMORE UNIVERSITY INSTITUTIONAL REVIEW BOARD
APPROVED

## Appendix I: Participant information sheets and informed consent forms

### Information sheet and informed Consent Form for responding to a screening questionnaire for identification of eligible case study participants

**Study title: An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

Principal Investigator: Millicent L. Liani, PhD candidate, Liverpool School of Tropical Medicine, United Kingdom

Supervisors: 1). Dr. Rachel Tolhurst, Liverpool School of Tropical Medicine, United Kingdom

2). Prof. Isaac K. Nyamongo, University of Nairobi, Kenya

Sponsor's Name: DELTAS Learning Research Programme of the Capacity Research Unit, Liverpool School of Tropical Medicine, United Kingdom

**Consent information sheet**

**Introduction**

**RE: Request for research participation**

Dear participant,

My name is Millicent Liani. I am full-time offsite PhD candidate in the Department of Social Sciences and International Public Health at the Liverpool School of Tropical Medicine in United Kingdom, and currently based in Nairobi, Kenya. As part of the PhD requirement, I am in the process of conducting my doctoral dissertation by completing a research study titled: "**An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions"**. I am seeking your consent to respond to a screening questionnaire that will guide in selection of case study participants. I would appreciate if you agree to participate. Before you decide on whether to complete the screening questionnaire or not, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully and feel free to ask the researcher if there is anything that is not clear or if you need more information.

**Study background and purpose**

This research aims to learn about the impediments and enablers to equitable advancement in scientific careers of male and female researchers working in African Research Institutions, that are part of the Developing Excellence in Leadership, Training and Science (DELTAS) Africa Programme. The DELTAS Africa, a scheme initiated by the Wellcome Trust, is a flagship programme of the Alliance for Accelerating Excellence in Science in Africa (AESA), which was launched in 2015 with the aim of supporting the Africa-led development of world-class researchers and scientific leaders in Africa. The DELTAS Africa programme seeks to strengthen scientific research training and build career pathways for African scientific researchers through conducting collaborative health research while offering training fellowships and mentorship, and investment in research infrastructure. The Capacity Research Unit of Liverpool School of Tropical Medicine was funded by the UK Department for International Development and Wellcome Trust to embed a 'Learning Research Programme' within the DELTAS Africa initiative for the period 2016-2020. The DELTAS LRP is a project aimed at generating evidence about the effectiveness

of various aspects of its capacity building approach and feed them back to inform improvements within the life of the DELTAS Africa programme. One of the DELTAS LRP thematic area is promotion of equitable career pathways for internationally competitive African researchers including women and other under-represented groups, upon which this doctoral research study is nested.

**Procedure for participation in the study**

I am seeking to interview women and men research scientists at different career stages in the cadre of junior researchers, early career stage researchers, mid-level researchers, and senior researchers, who are affiliated with or working/ever worked within the selected DELTAS Research Consortia. Your responses to this questionnaire will be used to guide in the selection of the case study participants for in-depth interviews. If you are selected, you will be contacted at a later time via email and/or telephone for your verbal and/or written consent to participate as well as scheduling of the case study in-depth interviews. You are therefore being invited to participate in this study by responding to the questionnaire. The time commitment for completing the questionnaire is minimal, just 10-15 minutes of your time.

**Risks to participating in this study**

The study does not foresee any risks associated with your participation in completing the screening questionnaire. The responses that you provide will remain strictly confidential, and only anonymized data will be published. The information will only be used to address the research objectives.

**Benefits to participating in this study**

There will be no direct benefit to you for your participation in this study. However, the information you provide through the questionnaire will be useful for the study in the identification of potential participants for in-depth interviews, of which you might be one of them.

**Voluntarily participation and withdrawal from the study**

Your participation in this study is entirely voluntary. It is up to you to decide whether or not to take part in the study. However, if you decide not to take part in this study, you are not bound to provide any reasons. In such a case, no penalty or disfavor will be shown towards you. Your decision not to participate will not be disclosed to anyone. You are encouraged to ask questions you may have about this study through email correspondence before completion of the questionnaire. If you respond by completing the questionnaire, it will indicate that you have received the information and have consented to take part in this study.

**Privacy and Confidentiality**

All the information you share will remain strictly confidential. The information will be used only for the purposes of the study and confidentiality will be maintained. Your name will not be recorded with your responses or identified in any way. A unique code number/pseudonym will be assigned to identify you. Your institution will also have a unique code and the name of your institution will not be used in presenting results. Your identity will not be revealed in any reports or publications emerging from this study. Your participation in this study will not be revealed to anyone. The information will be available to myself and two supervisors, until it is published.

**Conservation of data**

The study paper documents such as informed consent sheets collected from you will be kept in a locked cabinet at the Institute of Anthropology, Gender and African Studies of the University of Nairobi, in an office that belongs to my PhD supervisor, and the pseudonym key will be stored separately in a different

locked cabinet in order to protect your privacy. The key to the filing cabinet will be under my custody as the principal researcher. Electronic copies of received completed questionnaire will be coded and held in password protected computer files and flash drive, and then deleted from the digital recorder as soon as possible after the interview. The USB memory sticks and laptop/s will be encrypted and be protected by a "power-on password" to prevent unauthorized use of the sensitive or confidential data. The list containing your name and assigned code will be kept in a different filing cabinet. The electronic version of this list will be secured in a password-protected computer and kept in a separate file directory other study documents. The anonymized electronic data together with the paper data will be kept for utmost five years and thereafter destroyed. Specifically, information gathered on paper documents will shredded while soft copy data in computer hard disk, memory sticks will permanently be destroyed using the eraser software, which is a file shredder program that is used to remove sensitive data from hard drive by overwriting it several times.

**Compensation**
There will be no monetary or other compensation for your participation in the study.

**Do you have any questions?**
Please feel free to ask any questions you may have concerning this study before we begin. Or if you might have questions later, you may contact the researcher through email via Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Contact Information**
Should you need to clarify your rights as a study participant please contact the chairperson of Strathmore University Institutional Review Board (SUIRB) based at Strathmore University, Madaraka Estate, Ole Sangale Road, Nairobi, Kenya. P.O. Box 59857-00200 Nairobi, Kenya. Telephone number: +254 703 034 375; Fax Number: +254 020-607498; E-mail: ethicsreview@strathmore.edu

You may also contact my supervisors: Prof. Isaac K. Nyamongo, University of Nairobi, Kenya. Telephone number: +254 722 706 839; E-mail: inyamongo@yahoo.com AND Dr. Rachel Tolhurst, Senior Lecturer in the Department of Social Sciences and International Public Health, Liverpool School of Tropical Medicine, United Kingdom. Tel. + 44 151 705 3251; Email: Rachel.Tolhurst@lstmed.ac.uk

Should you need any help or information regarding the study, feel free to contact the researcher, Millicent Liani, Tel. +254 723 258 104, P.O Box 14446-00800 Nairobi, Email: Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Part II: Certificate of Consent**

**Research participant**
I have been invited to participate by responding to a screening questionnaire for the study on "An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions". The foregoing information, as provided in Part 1: consent information sheet, has been read to me. I have had the opportunity to ask questions about it and have been answered to my satisfaction. I hereby declare that I have voluntarily opted to participate in this survey.

Signature: _____
Date: _____

Time: _____

**Researcher**
I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:
1. The information given shall be handled in a confidential manner
2. Their true identity will not be revealed
3. Their freedom to withdraw from the study will be guaranteed and no disfavour will be shown to them in case they decide to withdraw.

I confirm that the participant has had opportunity to ask questions about the study and have answered him/her correctly. The participant has freely and voluntarily accepted to participate in the study by responding to the screening questionnaire, and has not been coerced into giving consent. The participant has been provided with a copy of this informed consent form.

Interviewer's Name:_____ Signature:_____ Date: _____
Time: _____ Participant Code No. _____

## Information sheet and informed Consent Form for In-depth interviews with DELTAS sponsored junior research fellows

**Study title: An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

Principal Investigator: Millicent L. Liani, PhD candidate, Liverpool School of Tropical Medicine, United Kingdom

Supervisors: 1). Dr. Rachel Tolhurst, Liverpool School of Tropical Medicine, United Kingdom

2). Prof. Isaac K. Nyamongo, University of Nairobi, Kenya

Sponsor's Name: DELTAS Learning Research Programme of the Capacity Research Unit, Liverpool School of Tropical Medicine, United Kingdom

This Informed Consent Form has two parts:

- Information sheet (to share information about the research with you)
- Certificate of Consent (for signatures before face to face interviews and/or an acknowledgement email from you with the details stated in the 'Research participant' portion for skype or telephone interviews, if you agree to take part)

You will be given a copy of the full informed consent form.

**Part I: Consent information sheet**

**Introduction**

**RE: Request for research participation**

Dear participant,

My name is Millicent Liani. I am full-time offsite PhD candidate in the Department of Social Sciences and International Public Health at the Liverpool School of Tropical Medicine in United Kingdom, and currently based in Nairobi, Kenya. As part of the PhD requirement, I am carrying out a research study titled: "**An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions"**. I am seeking your consent to collect data for this study and would appreciate if you agree to participate. Before you decide on whether to join the study or not, you will be provided with information regarding the study, a chance to ask questions and availed with a copy of this information sheet to keep.

**Study background and purpose**

This research study aims to learn from you about the impediments and enablers to equitable advancement in scientific careers of male and female researchers working in African Research Institutions, that are part of the Developing Excellence in Leadership, Training and Science (DELTAS) Africa Programme. The DELTAS Africa, a scheme initiated by the Wellcome Trust, is a flagship programme of the Alliance for Accelerating Excellence in Science in Africa (AESA), which was launched in 2015 with the aim of supporting the Africa-led development of world-class researchers and scientific leaders in Africa. The DELTAS Africa programme seeks to strengthen scientific research training and build career pathways for African scientific researchers through conducting collaborative health research while offering training fellowships and mentorship, and investment in research infrastructure. The Capacity Research Unit of Liverpool School of Tropical Medicine was funded by the UK Department for International Development and Wellcome Trust to embed a 'Learning Research Programme' (LRP) within the DELTAS Africa initiative for the period 2016-2020. The DELTAS LRP is a project aimed at generating evidence about the effectiveness of various aspects of its capacity building approach and feed them back to inform improvements within the life of the DELTAS Africa programme. One of the DELTAS LRP thematic area is promotion of equitable career pathways for internationally competitive African researchers including women and other under-represented groups, upon which this doctoral research study is nested.

This study seeks to learn about your lived experiences in relation to career trajectories particularly concerning your: career history into science; present everyday experiences of the science career in relation to institutional environment, policies and practices; desired future scientific career aspirations through suggestion of strategies that could promote and enhance gender equitable career progression in research institutions in Africa. The study focus is on individual women and men research fellows and scientists at different career stages in the cadre of junior researchers, early career stage researchers, mid-level researchers, and senior researchers, who are affiliated with or working/ever worked within the selected DELTAS Research Consortia.

**Procedure for participation in the study**

You are being invited to participate in this study as I have purposively identified you based on the information received from your institution/responses in the screening questionnaire as a DELTAS sponsored African female/male junior research fellow, currently pursuing Masters or PhD studies at an African Public University that is affiliated to a Research Consortium that is part of the DELTAS Program. You will be asked to reflect on your journey to a scientific career path which will provide insights on understanding the barriers and enablers to scientific career progression through the lived experiences of a junior researcher like you. If you agree to participate, you will be taking part in the in-depth interviews. This will be conducted either in person, by phone or Skype at a time of your convenience. The overall data collection will be up to a period of 15 months, within which the interviews will be conducted. The interviews will take approximately one to two hours of your time. If need be at a later time, I will also conduct one follow-up interview via telephone or Skype call that might last for about half an hour. In the follow up interview, you will be asked to provide additional information or to clarify unclear issues that might emanate from the first interview. Therefore, if you accept to participate in this study, you are expected to be available for a follow up interview. I would like to seek your permission to tape record the conversations as well as take notes to ensure the accuracy of the data captured. All interviews conducted either in person, by phone or Skype will be recorded using a digital voice recorder and later on transcribed. I will also request you to review the transcript of the interview for individual member checking of the information provided by yourself for data credibility purposes.

**Risks to participating in this study**

There are no physical risks expected from your participation. However, your participation in this study will entail that you volunteer information that may have minor risk such as emotional concern about negative repercussions that the information you share may have on the barriers faced by yourself as a research scientist affiliated or working in an African Research Institution. These concerns may include speaking about issues such as hostile and unfriendly institutional environment, work-life balance challenges among others. Although the interview questions are not intended to be intrusive or cause distress, you may at any time refrain from answering any questions that you feel are invasive/causing distress in you during the interview. However, in the event that I sense or observe distress on you, I will stop the interview and recommend that you seek counselling support from a service provider that will be provided for in collaboration with your institution. I will take every effort to minimize these risks. The information will be used to address the research objectives.

**Benefits to participating in this study**

There will be no direct benefit to you for your participation in this study. However, your responses will be useful in providing information about how to improve and track research career equity for internationally competitive African researchers while acknowledging their multiple social identities.

**Voluntarily participation and withdrawal from the study**

Your participation in this study is entirely voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign two copies of this consent form and hand a copy back to me before commencement of in-person interview. For telephone or Skype

interviews, I will seek your verbal and/or written consent. Specifically, you will receive an email containing the information and consent sheet at least one week in advance, giving you time to read and decide whether to be part of the study. Prior to commencement of the interview, I will also read out the information sheet, while explaining to you about the study and giving you time to ask any questions before you provide a verbal and/or written consent. If you agree to participate in telephone/Skype interviews, you will be required to acknowledge receipt of the email through providing details stated in the 'Research participant' section as a proof of written consent to participate in the study. If you prefer to provide verbal consent, I will request that your verbal consent be recorded by use of the digital voice recorder, which will be transcribed later, as an assurance that you have agreed and verbally consented to participate. After you provide consent to participate in the study, whether in-person interview, by telephone or Skype, you are still free to withdraw at any time and are not bound to provide any reasons. In such a case, no penalty or disfavor will be shown towards you. Your decision not to participate will not be disclosed to anyone. If you choose to withdraw from the study, you may request that all data gathered until the time of your withdrawal be destroyed. During interviews, you have the right to only say what you are comfortable telling the interviewer or to request to have portions of your interview removed from the transcripts, at the end of the interview. You are encouraged to ask questions about this study at the beginning or any time during the research study.

**Privacy and Confidentiality**

To ensure privacy during in-person interviews, I will make all efforts to conduct the data collection in a place/room that is private and comfortable for you. No-one apart from myself and perhaps a research assistant will be present at the interviews. For Skype or/and telephone interviews, you are requested to find a quiet place or room where you can hold a private conversation without disturbance. Notably, Skype calls are encrypted, thus the conversation will not easily be hacked. However, there is potential for loss of confidentiality if a third party enters the room during a Skype/telephone conversation. In case this happens, you are advised to immediately alert the researcher to pause the interview by hanging up the call or have it rescheduled for another day at a time of your convenience. To make sure the information is captured correctly, the conversation held through in-person, telephone or skype will be recorded on a voice recorder in addition to taking notes. All the information you share will remain strictly confidential. The information will be used only for the purpose of the study and confidentiality will be maintained. Quotes from this interview will be anonymized and will only be used if you give me permission to do so. Each interview will be transcribed by myself, together with the help of a professional transcriber. The transcriber will sign a non-disclosure form prior to transcribing the interviews. The content will only be discussed with the research assistant/transcriber, supervisors and research committee members. Your name will not be recorded with your responses or identified in any way. A unique code number/pseudonym will be assigned to you to identify your taped interview and interview transcripts. Your institution will also have a unique code and the name of your institution will not be used in presenting results. Your identity will not be revealed in any reports or publications emerging from this study. Your participation in this study will not be revealed to anyone. The information will be available to myself and two supervisors, until it is published. If desired, a copy of the data to be published can be sent to you to verify before publication.

**Conservation of data**

The interview paper documents such as informed consent sheets and field notes collected from you will be kept in a locked cabinet at the Institute of Anthropology, Gender and African Studies of the University of Nairobi, in an office that belongs to my PhD supervisor, and the pseudonym key will be stored separately in a different locked cabinet in order to protect your privacy. The key to the filing cabinet will be under my custody as the principal researcher. Electronic copies of transcripts and audio recordings

will be coded and held in password protected computer files and flash drive, and then deleted from the digital recorder as soon as possible after the interview. The USB memory sticks and laptop/s will be encrypted and be protected by a "power-on password" to prevent unauthorized use of the sensitive or confidential data. The list containing your name and the assigned code will be kept in a different filing cabinet. The electronic version of this list will be secured in a password-protected computer and kept in a separate file directory other than the data transcripts. The anonymized electronic data together with the paper data will be kept for at most five years and thereafter destroyed. Specifically, information gathered on paper documents will shredded while soft copy data in computer hard disk, memory sticks will permanently be destroyed using the eraser software, a file shredder program that is used to remove sensitive data from hard drive by overwriting it several times.

**Compensation**
There will be no monetary or other compensation for your participation in the study.

**Do you have any questions?**
Please feel free to ask any questions you may have concerning this study before we begin. Or if you might have questions later, you may contact the researcher through email via Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Contact Information**
Should you need to clarify your rights as a study participant please contact chairperson of Strathmore University Institutional Review Board (SUIRB) based at Strathmore University, Madaraka Estate, Ole Sangale Road, Nairobi, Kenya. P.O. Box 59857-00200 Nairobi, Kenya. Telephone number: +254 703 034 375; Fax Number: +254 020-607498; E-mail: ethicsreview@strathmore.edu

You may also contact my supervisors: Prof. Isaac K. Nyamongo, University of Nairobi, Kenya. Telephone number: +254 722 706 839; E-mail: inyamongo@yahoo.com AND Dr. Rachel Tolhurst, Senior Lecturer in the Department of Social Sciences and International Public Health, Liverpool School of Tropical Medicine, United Kingdom. Tel. + 44 151 705 3251; Email: Rachel.Tolhurst@lstmed.ac.uk

Should you need any help or information regarding the study, feel free to contact the researcher, Millicent Liani, Tel. +254 723 258 104, P.O Box 14446-00800 Nairobi, Email: Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Part II: Certificate of Consent**

**Research participant**
I have been invited to participate in the study on "An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions". The foregoing information, as provided in Part 1: consent information sheet, has been read to me. I have had the opportunity to ask questions about it and have been answered to my satisfaction. I hereby declare that I have voluntarily opted to participate in the study.

Signature: _____
Date: _____
Time: _____

**Researcher**

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:
1. The information given shall be handled in a confidential manner
2. Their true identity will not be revealed
3. Their freedom to withdraw from the study will be guaranteed and no disfavour will be shown to them in case they decide to withdraw.

I confirm that the participant has had opportunity to ask questions about the study and have answered him/her correctly. The participant has freely and voluntarily accepted to participate in the study and has not been coerced into giving consent. The participant has been provided with a copy of this informed consent form.

Interviewer's Name:_____ Signature:_____ Date: _____
Time: _____ Participant Code No. _____

## Information sheet and informed Consent Form for In-depth interviews staff working under a DELTAS sponsored program

**Study title: An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

Principal Investigator: Millicent L. Liani, PhD candidate, Liverpool School of Tropical Medicine, United Kingdom

Supervisors: 1). Dr. Rachel Tolhurst, Liverpool School of Tropical Medicine, United Kingdom

2). Prof. Isaac K. Nyamongo, University of Nairobi, Kenya

Sponsor's Name: DELTAS Learning Research Programme of the Capacity Research Unit, Liverpool School of Tropical Medicine, United Kingdom

**Part I: Consent information sheet**

**Introduction**

**RE: Request for research participation**

Dear participant,

My name is Millicent Liani. I am full-time offsite PhD candidate in the Department of Social Sciences and International Public Health at the Liverpool School of Tropical Medicine in United Kingdom, and currently based in Nairobi, Kenya. As part of the PhD requirement, I am carrying out a research study titled: "**An examination of barriers and enablers to gender equitable scientific career pathways in the**

**DELTAS funded African research institutions"**. I am seeking your consent to collect data for this study and would appreciate if you agree to participate. Before you decide on whether to join the study or not, you will be provided with information regarding the study, a chance to ask questions and availed with a copy of this information sheet to keep.

**Study background and purpose**

This research study aims to learn from you about the impediments and enablers to equitable advancement in scientific careers of male and female researchers working in African Research Institutions, that are part of the Developing Excellence in Leadership, Training and Science (DELTAS) Africa Programme. The DELTAS Africa, a scheme initiated by the Wellcome Trust, is a flagship programme of the Alliance for Accelerating Excellence in Science in Africa (AESA), which was launched in 2015 with the aim of supporting the Africa-led development of world-class researchers and scientific leaders in Africa. The DELTAS Africa programme seeks to strengthen scientific research training and build career pathways for African scientific researchers through conducting collaborative health research while offering training fellowships and mentorship, and investment in research infrastructure. The Capacity Research Unit of Liverpool School of Tropical Medicine was funded by the UK Department for International Development and Wellcome Trust to embed a 'Learning Research Programme' (LRP) within the DELTAS Africa initiative for the period 2016-2020. The DELTAS LRP is a project aimed at generating evidence about the effectiveness of various aspects of its capacity building approach and feed them back to inform improvements within the life of the DELTAS Africa programme. One of the DELTAS LRP thematic area is promotion of equitable career pathways for internationally competitive African researchers including women and other under-represented groups, upon which this doctoral research study is nested.

This study seeks to learn about your lived experiences in relation to career trajectories particularly concerning your: career history into science; present everyday experiences of their science careers as it relates to institutional environment, policies and practices; desired future scientific career aspirations through suggestion of strategies that could promote and enhance gender equitable career progression in research institutions in Africa. The focus is on individual women and men research fellows and scientists at different career stages in the cadre of junior researchers, early career stage researchers, mid-level researchers, and senior researchers, who are affiliated with or working/ever worked within the selected DELTAS Research Consortia.

**Procedure for participation in the study**

You are being invited to participate in this study as I have purposively identified you based on the information received from your institution/your responses in the screening questionnaire as a DELTAS sponsored African early career research fellow/mid-career researcher/senior researcher, currently affiliated to a Research Consortium that is part of the DELTAS Program. You will be asked to reflect on your journey to a scientific career path which will provide insights on understanding the barriers and enablers to scientific career progression through the lived experiences of a researcher like you. If you agree to participate, you will be taking part in the in-depth interviews. This will be conducted either in person, by phone or Skype at a time of your convenience. The overall data collection will be up to a period of 15 months, within which the interviews will be conducted. The interviews will take approximately one to two hours of your time. If need be at a later time, I will also conduct one follow-up

interview via telephone or Skype call that might last for about half an hour. In the follow up interview you will be asked to provide additional information or to clarify unclear issues that might emanate from the first interview. Therefore, if you accept to participate in this study, you are expected to be available for a follow up interview. I would like to seek your permission to tape record the conversations as well as take notes to ensure the accuracy of the data captured. All interviews conducted either in person, by phone or Skype will be recorded using a digital voice recorder and later on transcribed. I will also request you to review the transcript of the interview for individual member checking of the information provided by yourself for data credibility purposes.

**Risks to participating in this study**

There are no physical risks expected from your participation. However, your participation in this study will entail that you volunteer information that may have minor risk such as emotional concern about negative repercussions that the information you share may have on the barriers faced by yourself as a research scientist affiliated or working in an African Research Institution. These concerns may include speaking about issues such as hostile and unfriendly institutional environment, work-life balance challenges among others. Although the interview questions are not intended to be intrusive or cause distress, you may at any time refrain from answering any questions that you feel are invasive/causing distress in you during the interview. However, in the event that I sense or observe distress on you, I will stop the interview and recommend that you seek counselling support from a service provider that will be provided for in collaboration with your institution. I will take every effort to minimize these risks. The information will be used to address the research objectives.

**Benefits to participating in this study**

There will be no direct benefit to you for your participation in this study. However, your responses will be useful in providing information about how to improve and track research career equity for internationally competitive African researchers while acknowledging their multiple social identities.

**Voluntarily participation and withdrawal from the study**

Your participation in this study is entirely voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign two copies of this consent form and hand a copy back to me before commencement of in-person interview. For telephone or Skype interview, I will seek from you verbal and/or written consent. Specifically, you will receive an email containing the information and consent sheet at least one week in advance, giving you time to read and decide whether to be part of the study. Prior to commencement of the interview, I will also read out the information sheet, while explaining to you about the study and giving you time to ask any questions before you provide a verbal and/or written consent. If you agree to participate in telephone/Skype interviews, you will be required to acknowledge receipt of the email through providing details stated in the 'Research participant' section as a proof of written consent to participate in the study. If you prefer to provide verbal consent, I will request that your verbal consent be recorded by use of the digital voice recorder, which will be transcribed later, as an assurance that you have agreed and verbally consented to participate. After you provide consent to participate in the study, whether in-person interview, by telephone or Skype, you are still free to withdraw at any time and are not bound to provide any reasons. In such a case, no penalty or disfavor will be shown towards you, Your decision not to participate will not be disclosed to anyone. If you choose to withdraw from the study, you may request that all data

gathered until the time of your withdrawal be destroyed. During interviews, it is your right to only say what you are comfortable telling the interviewer or to request to have portions of your interview removed from the transcripts, at the end of the interview. You are encouraged to ask questions about this study at the beginning or any time during the research study.

**Privacy and Confidentiality**

To ensure privacy during in-person interviews, I will make all efforts to conduct the data collection in a place/room that is private and comfortable for you. No-one apart from myself and perhaps a research assistant will be present at the interviews. For Skype or/and telephone interviews, you are requested to find a quiet place or room where you can hold a private conversation without disturbance. Notably, Skype calls are encrypted, thus the conversation will not easily be hacked. However, there is potential for loss of confidentiality if a third party enters the room during a Skype/telephone conversation. In case this happens, you are advised to immediately alert the researcher to pause the interview by hanging up the call or have it rescheduled for another day at a time of your convenience. To make sure the information is captured correctly, the conversation held through in-person, telephone or skype will be recorded on a voice recorder in addition to taking notes. All information you share will remain strictly confidential. The information will be used only for the purpose of the study and confidentiality will be maintained. Quotes from this interview will be anonymized and will only be used if you give us permission to do so. Each interview will be transcribed by myself, together with the help of a professional transcriber. The transcriber will sign a non-disclosure form prior to transcribing the interviews. The content will only be discussed with the research assistant/transcriber, supervisors and research committee members. Your name will not be recorded with your responses or identified in any way. A unique code number/pseudonym will be assigned to you to identify your taped interview and interview transcripts. Your institution will also have a unique code and the name of your institution will not be used in presenting results. Your identity will not be revealed in any reports or publications emerging from this study. Your participation in this study will not be revealed to anyone. The information will be available to the myself and two supervisors, until it is published. If desired, a copy of the data to be published can be sent to you to verify before publication.

**Conservation of data**

The interview paper documents such as informed consent sheets and field notes collected from you will be kept in a locked cabinet at the at the Institute of Anthropology, Gender and African Studies of the University of Nairobi, in an office that belongs to my PhD supervisor, and the pseudonym key will be stored separately in a different locked cabinet in order to protect your privacy. The key to the filing cabinet will be under my custody as the principal researcher. Electronic copies of transcripts and audio recordings will be coded and held in password protected computer files and flash drive, and then deleted from the digital recorder as soon as possible after the interview. The USB memory sticks and laptop/s will be encrypted and be protected by a “power-on password” to prevent unauthorized use of the sensitive or confidential data. The list containing your name and the assigned code will be kept in a different filing cabinet. The electronic version of this list will be secured in a password-protected computer and kept in a separate file directory other than the data transcripts. The anonymized electronic data together with the paper data will be kept for at most five years and thereafter destroyed. Specifically, information gathered on paper documents will shredded while soft copy data in computer hard disk, memory sticks will permanently be destroyed using the eraser software, which is a file shredder program that is used to remove sensitive data from hard drive by overwriting it several times.

**Compensation**
There will be no monetary or other compensation for your participation in the study.

**Do you have any questions?**
Please feel free to ask any questions you may have concerning this study before we begin. Or if you might have questions later, you may contact the researcher through email via Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Contact Information**
Should you need to clarify your rights as a study participant please contact the chairperson of Strathmore University Institutional Review Board (SUIRB) based at Strathmore University, Madaraka Estate, Ole Sangale Road, Nairobi, Kenya. P.O. Box 59857-00200 Nairobi, Kenya. Telephone number: +254 703 034 375; Fax Number: +254 020-607498; E-mail: ethicsreview@strathmore.edu

You may also contact my supervisors: Prof. Isaac K. Nyamongo, University of Nairobi, Kenya. Telephone number: +254 722 706 839; E-mail: inyamongo@yahoo.com AND Dr. Rachel Tolhurst, Senior Lecturer in the Department of Social Sciences and International Public Health, Liverpool School of Tropical Medicine, United Kingdom. Tel. + 44 151 705 3251; Email: Rachel.Tolhurst@lstmed.ac.uk

Should you need any help or information regarding the study, feel free to contact the researcher, Millicent Liani, Tel. +254 723 258 104, P.O Box 14446-00800 Nairobi, Email: Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Part II: Certificate of Consent**

**Research participant**
I have been invited to participate in the study on "An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions". The foregoing information, as provided in Part 1: consent information sheet, has been read to me. I have had the opportunity to ask questions about it and have been answered to my satisfaction. I hereby declare that I have voluntarily opted to participate in the study.

Signature: _____
Date: _____
Time: _____

**Researcher**
I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:
1. The information given shall be handled in a confidential manner
2. Their true identity will not be revealed
3. Their freedom to withdraw from the study will be guaranteed and no disfavour will be shown to them in case they decide to withdraw.

I confirm that the participant has had opportunity to ask questions about the study and have answered him/her correctly. The participant has freely and voluntarily accepted to participate in the study and has not been coerced into giving consent. The participant has been provided with a copy of this informed consent form.

Interviewer's Name:_____ Signature:_____ Date: _____
Time: _____ Participant Code No. _____

## Information sheet and informed Consent Form for Key Informant interviews

**Study title: An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

Principal Investigator: Millicent L. Liani, PhD candidate, Liverpool School of Tropical Medicine, United Kingdom

Supervisors: 1). Dr. Rachel Tolhurst, Liverpool School of Tropical Medicine, United Kingdom

2). Prof. Isaac K. Nyamongo, University of Nairobi, Kenya

Sponsor's Name: DELTAS Learning Research Programme of the Capacity Research Unit, Liverpool School of Tropical Medicine, United Kingdom

**Part I: Consent information sheet**

**Introduction**

**RE: Request for research participation**

Dear participant,

My name is Millicent Liani. I am full-time offsite PhD candidate in the Department of Social Sciences and International Public Health at the Liverpool School of Tropical Medicine in United Kingdom, and currently based in Nairobi, Kenya. As part of the PhD requirement, I am carrying out a research study titled: "**An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions"**. I am seeking your consent to collect data for this study and would appreciate if you agree to participate. Before you decide on whether to join the study or not, you will be provided with information regarding the study, a chance to ask questions and availed with a copy of this information sheet to keep.

**Study background information and purpose**

This research aims to learn from you about the impediments and enablers to equitable advancement in scientific careers of male and female researchers working in African Research Institutions, that are part of the Developing Excellence in Leadership, Training and Science (DELTAS) Africa Programme. The DELTAS Africa, a scheme initiated by the Wellcome Trust, is a flagship programme of the Alliance for Accelerating Excellence in Science in Africa (AESA), which was launched in 2015 with the aim of supporting the Africa-led development of world-class researchers and scientific leaders in Africa. The DELTAS Africa programme seeks to strengthen scientific research training and build career pathways for African scientific researchers through conducting collaborative health research while offering training fellowships and mentorship, and investment in research infrastructure. The Capacity Research Unit of Liverpool School of Tropical Medicine was funded by the UK Department for International Development

and Wellcome Trust to embed a 'Learning Research Programme' (LRP) within the DELTAS Africa initiative for the period 2016-2020. The DELTAS LRP is a project aimed at generating evidence about the effectiveness of various aspects of its capacity building approach and feed them back to inform improvements within the life of the DELTAS Africa programme. One of the DELTAS LRP thematic area is promotion of equitable career pathways for internationally competitive African researchers including women and other under-represented groups, upon which this doctoral research study is nested.

**Procedure for participation in the study**

To triangulate information gathered from in-depth interviews conducted with individual science researchers at different career stages who are affiliated/working or were previous research employees of your current research institution, I intend to conduct interviews with key informants who are knowledgeable about the institutional management structure and its operations, working practices and policies/directives that are related to career progression of researchers. Therefore, by virtue of your role and position within your research institution as either consortia institutional research leader/director, or research coordinator/manager, I have purposively identified you and hereby invite you to participate in this study as a key informant. I hope to learn from you about your experiences and views concerning the barriers to gender equitable scientific career progression as well as strategies that are there or should be in place to enhance careers of male and female researchers working in an African research institution like yours. If you agree to participate, you will be taking part in the key informant interviews. This will be conducted by myself either in person, by phone or Skype at a time of your convenience. The overall data collection will be up to a period of 15 months, within which the interviews will be conducted. The interviews will take approximately 45 to 60 minutes of your time. If need be at a later time, I will also conduct one follow-up interview via telephone or Skype call that might last for about half an hour. In the follow up interview you will be asked to provide additional information or to clarify unclear issues that might emanate from the first interview. Therefore, if you accept to participate in this study, you are expected to be available for a follow up interview. I would like to seek your permission to tape record the conversations as well as take notes to ensure the accuracy of the data captured. All interviews conducted either in person, by phone or Skype will be recorded using a digital voice recorder and later on transcribed. I will also request you to review the transcript of the interview for individual member checking of the information provided by yourself for data credibility purposes.

**Request for supplementary documentary data**

After the interview, I would also request if you could voluntarily provide me with copies of supplementary documents such as programmatic reports, institutional policy content and their implementation, if available, that pertains to issues relevant to this study. Access to such documents is not intended for matters such a policing or investigating for quality assurance, but rather, a review of such documents will be useful in providing contextual background as is required in any institutional case study research. I will also aim to protect the institutional reputation through extracting information that is only relevant to the study objectives and by taking care to anonymize institutions in reporting findings.

**Risks to participating in this study**

There are no major risks expected from your participation. However, your participation in this study will entail that you volunteer to answer questions that might make you feel anxious or upset about

your involvement in institutional policy processes. This may cause you some potential emotional concerns and discomfort about negative repercussions that the information you share may have on the barriers faced by research scientists affiliated or working within your research institution. These concerns may include speaking about issues such as hostile and unfriendly institutional environment, work-life balance challenges and related policies/directives among others. Although the interview questions are not intended to be intrusive or cause distress, you may at any time refrain from answering any questions that you feel are invasive/causing distress in you during the interview. However, in the event that I sense or observe distress on you, I will stop the interview and recommend that you seek counselling support from a service provider that will be provided for in collaboration with your institution. I will take every effort to minimize these risks. The information will be used to address the research objectives.

**Benefits to participating in this study**

There will be no direct benefit to you for your participation in this study. However, your responses will be useful in providing information about how to improve and track research career equity for internationally competitive African researchers while acknowledging their multiple social identities.

**Voluntarily participation and withdrawal from the study**

Your participation in this study is entirely voluntary.

It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign two copies of this consent form and hand a copy back to me before commencement of in-person interview. For telephone or Skype interview, I will seek from you verbal and/or written consent. Specifically, you will receive an email containing the information and consent sheet at least one week in advance, giving you time to read and decide whether to be part of the study. Prior to commencement of the interview, I will also read out the information sheet, while explaining to you about the study and giving you time to ask any questions before you provide a verbal and/or written consent. If you agree to participate in telephone/Skype interviews, you will be required to acknowledge receipt of the email through providing details stated in the 'Research participant' section as a proof of written consent to participate in the study. If you prefer to provide verbal consent, I will request that your verbal consent be recorded by use of the digital voice recorder, which will be transcribed later, as an assurance that you have agreed and verbally consented to participate. After you provide consent to participate in the study, whether in-person interview, by telephone or Skype, you are still free to withdraw from the study at any time and are not bound to provide any reasons. In such a case, no penalty or disfavor will be shown towards you. Your decision not to participate will not be disclosed to anyone. If you choose to withdraw from the study, you may request that all data gathered until the time of your withdrawal be destroyed. During interviews, it is your right to only say what you are comfortable telling the interviewer or to request to have portions of your interview removed from the transcripts, at the end of the interview. You are encouraged to ask questions about this study at the beginning or any time during the research study.

**Privacy and Confidentiality**

To ensure privacy during in-person interviews, I will make all efforts to conduct the data collection in a place/room that is private and comfortable for you. No-one apart from myself and perhaps a research assistant will be present at the interviews. For Skype or/and telephone interviews, you are requested to find a quiet place or room where you can hold a private conversation without disturbance. Notably, Skype calls are encrypted, thus the conversation will not easily be hacked. However, there is potential for loss of confidentiality if a third party enters the room during a Skype/telephone conversation. In case this happens, you are advised to immediately alert the researcher to pause the interview by hanging up

the call or have it rescheduled for another day at a time of your convenience. To make sure the information is captured correctly, the conversation held through in-person, telephone or skype will be recorded on a voice recorder in addition to taking notes. All information and documents you share will remain strictly confidential. The information will be used only for the purpose of the study and confidentiality will be maintained. Quotes from this interview will be anonymized and will only be used if you give us permission to do so. Each interview will be transcribed by myself, together with the help of a professional transcriber. The transcriber will sign a non-disclosure form prior to transcribing the interviews. The content will only be discussed with the research assistant/transcriber, supervisors and research committee members. Your name will not be recorded with your responses or identified in any way. A unique code number/pseudonym will be assigned to you to identify your taped interview and interview transcripts. Your institution will also have a unique code and the name of your institution will not be used in presenting results. Your identity will not be revealed in any reports or publications emerging from this study. Your participation in this study will not be revealed to anyone. The information will be available to myself and the project team, until it is published. If desired, a copy of the data to be published can be sent to you to verify before publication.

**Conservation of data**

The interview paper documents such as informed consent sheets and field notes collected from you, as well as hard copies of requested documents will be kept in a locked cabinet at the Institute of Anthropology, Gender and African Studies of the University of Nairobi, in an office that belongs to my PhD supervisor, and the pseudonym key will be stored separately in a different locked cabinet in order to protect your privacy. The key to the filing cabinet will be under my custody as the principal researcher. Electronic copies of requested supplementary documents, together with transcripts and audio recordings will be coded and held in password protected computer files and flash drive, and then deleted from the digital recorder as soon as possible after the interview. The USB memory sticks and laptop/s will be encrypted and be protected by a “power-on password” to prevent unauthorized use of the sensitive or confidential data. The list containing your name and the assigned code will be kept in a different filing cabinet. The electronic version of this list will be secured in a password-protected computer and kept in a separate file directory other than the data transcripts. The anonymized electronic data together with the paper data will be kept for at most five years and thereafter destroyed. Specifically, raw data gathered on paper documents will shredded while soft copy data in computer hard disk, memory sticks will permanently be destroyed using the eraser software, which is a file shredder program that is used to remove sensitive data from hard drive by overwriting it several times.

**Compensation**

There will be no monetary or other compensation for your participation in the study.

**Do you have any questions?**

Please feel free to ask any questions you may have concerning this study before we begin. Or if you might have questions later, you may contact the researcher through email via Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Contact Information**

Should you need to clarify your rights as a study participant please contact the chairperson of Strathmore University Institutional Review Board (SUIRB) based at Strathmore University, Madaraka

Estate, Ole Sangale Road, Nairobi, Kenya. P.O. Box 59857-00200 Nairobi, Kenya. Telephone number: +254 703 034 375; Fax Number: +254 020-607498; E-mail: ethicsreview@strathmore.edu

You may also contact my supervisors: Prof. Isaac K. Nyamongo, University of Nairobi, Kenya. Telephone number: +254 722 706 839; E-mail: inyamongo@yahoo.com AND Dr. Rachel Tolhurst, Senior Lecturer in the Department of Social Sciences and International Public Health, Liverpool School of Tropical Medicine, United Kingdom. Tel. + 44 151 705 3251; Email: Rachel.Tolhurst@lstmed.ac.uk

Should you need any help or information regarding the study, feel free to contact the PhD research student, Millicent Liani, Tel. +254 723 258 104, P.O Box 14446-00800 Nairobi, Email: Millicent.Liani@lstmed.ac.uk / millyliani@gmail.com

**Part II: Certificate of Consent**

**Research participant**
I have been invited to participate in the study on "An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions". The foregoing information, as provided in Part 1: consent information sheet, has been read to me. I have had the opportunity to ask questions about it and have been answered to my satisfaction. I hereby declare that I have voluntarily opted to participate in the study.

Signature: _____
Date: _____
Time: _____

**Researcher**
I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:
1. The information given shall be handled in a confidential manner
2. Their true identity will not be revealed
3. Their freedom to withdraw from the study will be guaranteed and no disfavour will be shown to them in case they decide to withdraw.

I confirm that the participant has had opportunity to ask questions about the study and have answered him/her correctly. The participant has freely and voluntarily accepted to participate in the study and has not been coerced into giving consent. The participant has been provided with a copy of this informed consent form.

Interviewer's Name:_____ Signature:_____ Date: _____
Time: _____ Participant Code No. _____

## Appendix J: Research Assistant and Translator Confidentiality Agreement

**An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

Principal Investigator: Ms. Millicent L. Liani, PhD candidate, Liverpool School of Tropical Medicine, United Kingdom

Supervisors: 1). Dr. Rachel Tolhurst, Liverpool School of Tropical Medicine, United Kingdom

2). Prof. Isaac K. Nyamongo, University of Nairobi, Kenya

**RE: Research Assistant/Transcriber Confidentiality Agreement**

I, _____ [name of research assistant/transcriber], agree to assist the principal investigator with this study by undertaking verbatim transcription of audio-taped research data in English. I agree to maintain full confidentiality when performing these tasks.

Specifically, in accordance to LSTM's data protection policy and other general data privacy and protection requirements, I agree to:

1. keep all research information shared with me confidential by not discussing or sharing the information in any form or format (e.g., disks, tapes, fieldnotes, transcripts) with anyone other than the principal investigator;
2. hold in strictest confidence the identification of any individual that may be revealed during the course of performing the research tasks;
3. not make copies of any raw data in any form or format (e.g., disks, tapes, fieldnotes, transcripts), unless specifically requested to do so by the principal investigator;
4. keep all raw data that contains identifying information in any form or format (e.g., disks, tapes, fieldnotes, transcripts) secure while it is in my possession. This includes:
    - keeping and carrying all digitized raw data in an encrypted laptop computer or USB drive, as well as ensuring the laptop is protected by a "power-on password" to prevent unauthorized use. Files containing the project data must also be password-protected and password should often be changed and particularly within a duration of 3 months.
    - keeping written raw data such as field notes in a locked filing cabinet for which there will be one key, which will be at the Institute of Anthropology, Gender and African Studies of the University of Nairobi, in an office that belongs to my PhD supervisor. To avoid damage from tampering, loss or theft, never leave the key to the cabinet unattended

- permanently deleting any e-mail communication containing the data; and
- using closed headphones when transcribing recordings.

5. commit to closing any computer programs and documents of the raw data and locking the computer whilst it is unattended;
6. give, all raw data in any form or format (e.g., disks, tapes, fieldnotes, transcripts) to the principal investigator when I have completed the research tasks;
7. destroy all research information in any form or format that is not returnable to the principal investigator (e.g., information stored on my computer hard drive) upon completion of the research tasks through use of an eraser software, a free online file shredder program that is used to remove sensitive data from hard drive by overwriting it several times.

Provide the following contact information for transcriber/research assistant:

Printed name of transcriber/research assistant_____

Email Address:_____

Telephone number:_____

Signature of transcriber/research assistant_____ Date _____

Printed name of principal investigator_____

Signature of principal investigator_____ Date_____

**An examination of barriers and enablers to gender equitable scientific career pathways in the DELTAS funded African research institutions**

Principal Investigator: Ms. Millicent L. Liani, PhD candidate, Liverpool School of Tropical Medicine, United Kingdom

Supervisors: 1). Dr. Rachel Tolhurst, Liverpool School of Tropical Medicine, United Kingdom

2). Prof. Isaac K. Nyamongo, University of Nairobi, Kenya

**RE: Translator Confidentiality Agreement**

I, _____ [name of translator], do hereby agree to maintain full confidentiality when serving as a French translator for this research project.

I will be performing the following translation services:

i. Verbally translating information from English into French and vice versa,
ii. Transcribing recordings or other raw data into English from French

I verify that I possess the qualifications to accurately perform the translations.

Specifically, in accordance to LSTM's data protection policy and other general data privacy and protection requirements, I agree to:

1. keep all research information shared with me confidential by not discussing or sharing the information in any form or format (e.g., disks, tapes, fieldnotes, transcripts) with anyone other than the principal investigator;
2. hold in strictest confidence the identification of any individual that may be revealed during the translation of recordings, during a live oral interview, or in any other raw data;
3. not make copies of any raw data in any form or format (e.g., disks, tapes, fieldnotes, transcripts), unless specifically requested to do so by the principal investigator;
4. keep all raw data that contains identifying information in any form or format (e.g., disks, tapes, fieldnotes, transcripts) secure while it is in my possession. This includes:
    - keeping and carrying all digitized raw data in an encrypted laptop computer or USB drive, as well as ensuring the laptop is protected by a "power-on password" to prevent unauthorized use. Files containing the project data must also be password-protected and password should often be changed and particularly within a duration of 3 months.
    - keeping written raw data such as field notes in a locked filing cabinet for which there will be one key, at the Institute of Anthropology, Gender and African Studies of the University of Nairobi, in an office that belongs to my PhD supervisor. To avoid damage from tampering, loss or theft, never leave the key to the cabinet unattended;
    - permanently deleting any e-mail communication containing the data; and
    - using closed headphones when translating and transcribing recordings.
5. there should be a commitment to closing any computer programs and documents of the raw data and locking the computer whilst it is unattended;
6. give, all raw data in any form or format (e.g., disks, tapes, fieldnotes, transcripts) to the principal investigator when I have completed the research tasks;

7. destroy all research information in any form or format that is not returnable to the principal investigator (e.g., information stored on my computer hard drive) upon completion of the translation tasks through use of an eraser software, a free online file shredder program that is used to remove sensitive data from hard drive by overwriting it several times.

Provide the following contact information for the translator:

Printed name of translator_____

Email Address:_____

Telephone number:_____

Signature of translator_____ Date _____

Printed name of principal investigator_____

Signature of principal investigator_____ Date_____

## Appendix K: The PhD work schedule

| **Activity** | **Year one** | | | | **Year two** | | | | **Year three** | | | | **Year four** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| PhD registration | | | | | | | | | | | | | | | | |
| Protocol development | | | | | | | | | | | | | | | | |
| Ethics submissions | | | | | | | | | | | | | | | | |
| Data collection | | | | | | | | | | | | | | | | |
| Data analysis & writing | | | | | | | | | | | | | | | | |
| Thesis first draft | | | | | | | | | | | | | | | | |
| Thesis revision | | | | | | | | | | | | | | | | |
| Thesis submission | | | | | | | | | | | | | | | | |
| Thesis defense | | | | | | | | | | | | | | | | |

## Appendix L: Approved Budget

**PhD Study Sponsor License Number: WBN38URF9**

**PhD Research budget presented to DELTAS LRP Project Manager for Approval**

**Name: Dr. Justin Pulford**

**Signature**  **Date of Approval 26.03.2018**

**Four-year budget for PhD research = 20,000 GBP (28, 000 USD)[i]**

| | Item | Amount in USD | | | | |
|---|---|---|---|---|---|---|
| | | Year 1 (2017) | Year 2 (2018) | Year 3 (2019) | Year 4 (2020) | Total (USD) |
| **1** | **Research ethical clearance fees *1** | | | | | |
| 1.1 | LSTM REC IRB | 175.00 | - | - | - | 175.00 |
| 1.2 | IRB in Kenya | - | 350.00 | - | - | 350.00 |
| 1.2 | IRB in South Africa | - | 400.00 | - | - | 400.00 |
| 1.3 | IRB in Senegal | - | 400.00 | - | - | 400.00 |
| | **Total fees for ethics clearance fees** | **175.00** | **1,150.00** | **-** | **-** | **1,325.00** |
| | | | | | | |
| **2** | **Equipment and consumables *2** | | | | | |
| 2.1 | Digital voice recorder | - | 215.00 | - | - | 215.00 |
| 2.2 | Polycom speaker for Skype interviews | - | 150.00 | - | - | 150.00 |
| 2.3 | 2 Pairs of headphones for transcription purposes | - | 80.00 | - | - | 80.00 |
| 2.2 | Air-time for internet and telephone communication purposes | - | 250.00 | 250.00 | 100.00 | 600.00 |
| 2.4 | Laptop computer for the RA (to be encrypted) | - | 450.00 | - | - | 450.00 |
| 2.5 | Stationery/printing/photocopying/scanning | - | 500.00 | 500.00 | 200.00 | 1,200.00 |
| | **Equipment and consumables sub -total** | **-** | **1,645.00** | **750.00** | **300.00** | **2,695.00** |
| | | | | | | |
| **3** | **Field research & data analysis services *3** | | | | | |
| 3.1 | Field allowances PhD researcher (accommodation & meals) - Lump sum estimate | - | 4,000.00 | 2,000.00 | - | 6,000.00 |
| 3.2 | Field allowance - Francophone research Assistant (Accommodation, meals and professional fee) | - | - | 2,000.00 | - | 2,000.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.3 | Transcriber's allowances (approx. 100 interviews @30USD) | - | 3,000.00 | - | - | 3,000.00 |
| 3.4 | Refreshment during face to face interviews (100 study participants @ 5 USD) | - | 500.00 | - | - | 500.00 |
| | **Personnel Sub-total** | **-** | **7,500.00** | **4,000.00** | **-** | **11,500.00** |
| | | | | | | |
| **4** | **Travel cost *4** | | | | | |
| **4.1** | **Fieldwork activities** | | | | | |
| 4.1.1 | Field travel PhD (domestic - Kenya) | - | 1,000.00 | - | - | 1,000.00 |
| 4.1.2 | Field travel PhD (International - S.A & Senegal) | - | 2,000.00 | | - | 2,000.00 |
| 4.1.3 | Field travel French translator (Flight to Senegal/ DELTAS activities) | - | 1,000.00 | - | - | 1,000.00 |
| 4.1.4 | Visa, vaccinations & insurance (Lump sum) | - | 500.00 | - | - | 500.00 |
| 4.1.5 | Local transport in S.A & Senegal | - | 200.00 | 200.00 | - | 400.00 |
| | **Fieldwork travel cost sub-total** | **-** | **4,700.00** | **200.00** | **-** | **4,900.00** |
| | | | | | | |
| **4.2** | **Disseminating research knowledge and networking** | | | | | |
| 4.2.1 | DELTAS AGM and related Consortia activities (cost covers flight, printing of posters, airport transfers, local transport, accommodation, and meals) | 1,700.00 | 1,700.00 | 1,700.00 | - | 5,100.00 |
| | **Research dissemination sub-total** | **1,700.00** | **1,700.00** | **1,700.00** | **-** | **5,100.00** |
| | | | | | | |
| **5** | **Career development support trainings for the PhD researcher *5** | | | | | |
| 5.1 | Attendance to short trainings courses locally in Kenya (Grant writing; scientific writing and publication etc) | - | - | 500.00 | - | 500.00 |
| 5.2 | Cost of Library use at the offsite host institution (Nairobi University) | 20.00 | 20.00 | 20.00 | 20.00 | 80.00 |
| | **Career development and trainings sub-total** | **20.00** | **20.00** | **520.00** | **20.00** | **580.00** |
| | | | | | | |
| 6 | **Thesis Production (corrections, editing, & binding) *6** | - | - | - | **500.00** | **500.00** |
| **7** | **Contingency (5% of total cost)** | | | | **1,400.00** | **1,400.00** |
| | **GRAND TOTAL** | **1,895.00** | **16,715.00** | **7,170.00** | **2,220.00** | **28,000.00** |

**Notes/Justification**

*1 Covers the cost for IRB review fee at the training institution (LSTM) and In-country IRBs where the study will be conducted.

*2 Equipment and consumables are to cover the cost of purchasing data collection equipment which includes: a digital voice recorder for capturing verbatim data, a polycom speaker for conducting and recording skype interviews, 2 Pairs of headphones to be used transcription purposes by the PhD researcher and the research assistant, a laptop computer to be encrypted and used by the research assistant helping with transcription of interviews. Airtime costs are to cover the amount of money to be spent while making calls for telephone interviews or internet connectivity during skype calls. Stationery/printing/photocopying/scanning item cover the cost of stationery such as notebooks, pens, extra batteries, files for carrying and storing signed consent forms, as well as printing and photocopying of the research instruments (interview guides and consent forms) and scanning receipts for accountability purposes.

*3 This item covers the field allowances for PhD researcher and a francophone research assistant to cover for accommodation & meals. Professional fees for the francophone field research assistant and the transcription services is also covered. This item also covers the cost of refreshments during in-person interviews estimated at five USD per study participant.

*4 Travel cost for fieldwork activities include the domestic travel cost for the PhD researcher while undertaking data collection in Kenya as well as airfare to South Africa and Senegal for fieldwork as well local transport while in the two countries. The cost for visa, vaccinations & insurance in preparation for the international travel is also included. A tentative arrangement has been made to have the francophone research assistant who is currently by the CRU of LSTM in UK, to accompany the PhD researcher to Senegal to help with conducting interviews in French. The cost of travel for present the results of this research during the DELTAS annual general meetings alongside the nested DELTAS activities such as workshops is included.

*5 The cost for attendance to short career development trainings courses locally in Kenya such as grant writing and scientific writing and publication. This will come during the data analysis and writing phase of the PhD study. The annual cost for use of the graduate library at the University of Nairobi for the four years is also included.

*6 Costs of printing and binding the thesis as well as making corrections from defense examiners boards.

*7 Covers miscellaneous expenses including currency exchange losses.

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[i]At the time of preparing this research budget, 1 GBP was equivalent to 1.4 USD (https://www.centralbank.go.ke/forex/ site visited on 16th February 2018)