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Research Synthesis 2

Academic and Science Careers

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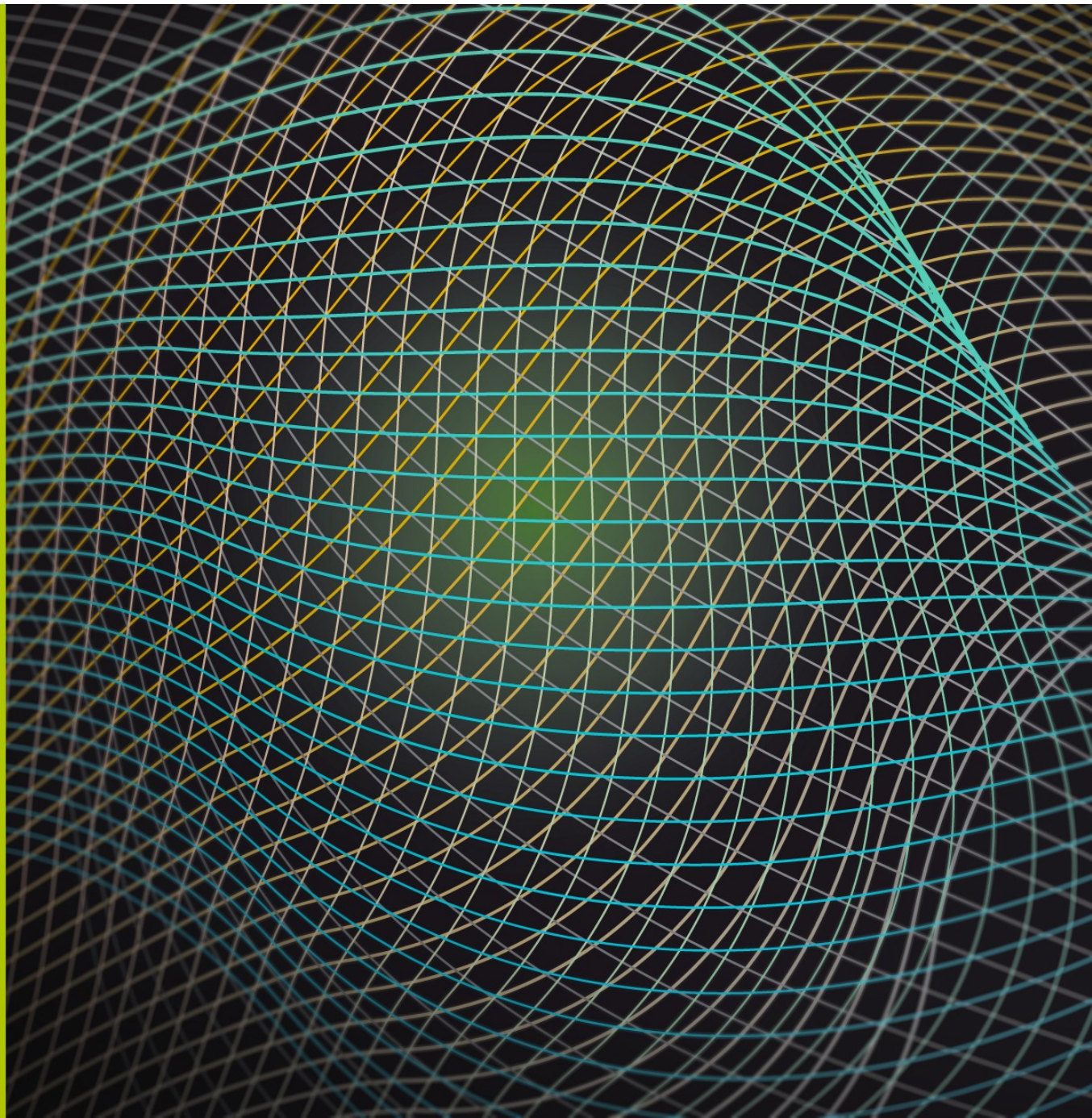

Description of the Problem

Women continue to be under-represented at the top of academic hierarchy. The ratio of women to men falls the higher up the career ladder, which has been explained by various metaphors including the 'leaky pipeline', the 'glass ceiling', the 'sticky floor' or represented as an open scissors diagram (GenSET, 2011). In 2010 in Europe, the proportion of female students (55%) and graduates (59%) exceeded that of male students, but women represented only 44% of grade C academic staff, 37% of grade B academic staff and 20% of grade A academic staff (EC, 2013:6). The percentage of women on the top rungs of the academic career ladder is not growing at the same rate as the number of women with the age and qualifications to reach these levels.

It is widely agreed that women's preferences for different subjects cannot explain this phenomenon. A statistical analysis of career trajectories has proved that the higher up the career ladder – the number of women is smaller – regardless of discipline. Greater pipeline leakage occurs in the fields in which women are already very prevalent (psychology, life sciences and social sciences), compared with the maths intensive fields in which they are under-represented (Ceci et al., 2014).

There are many explanations for gendered differences in scientific career trajectories, but two main approaches stand out. The first is related to the structure of the scientific career and its modelling on the male 'norm', whilst the second relates to a lack of support and gender bias – that may or may not be unconscious. These two factors – although at play throughout the entire academic career – impact differently when they intersect with key points throughout the life-course.

Gendered differences in career outcomes in science have been partially explained by the 'Matthew Effect' of cumulative advantage which operates throughout the life-course. It explains how slight advantages in capacity, structural location and available resources experienced at the onset of a career, accumulate and result in increased opportunities for carrying out research, thereby positively impacting on career outcomes (Merton, 1968; Merton, 1988). The 'Matilda Effect' uses the same logic to explain how gender discrimination results in cumulative disadvantage – where small disadvantages experienced since early career stages can impact negatively on female scientists' career outcomes (Rositter, 1993).

Recent and New Insights from Research

‘Ideal’ Faculty Member and Career Trajectory Based on Male Norms

The scientific career continues to be based on an outdated male model – despite fundamental societal changes including increased female participation in the labour market (NAS, 2007). The academic career model which consists of completing a series of sequential stages within a specified timeframe – discriminates against those who take time out – this particularly affects women who are more likely to request periods of leave for caring responsibilities. Key transition points throughout the career trajectory have been identified (from PhD to Post-doc to Independent Researcher to Professor) – when women are more likely to either drop-out, are pushed out or are not promoted (NAS, 2007; ESF, 2009). Whilst there are many career paths to excellence – the traditional route (modelled on the male norm) of early success and steady progress continues to be the most rewarded (Vinkenburg, 2014).

Work-life tension is particularly acute during the ‘rush-hour’ when the pressure on junior researchers to secure tenure track coincides with pressure to form a family. The ‘rush hour’ consists of multiple professional demands to: obtain a doctorate, carry out research abroad, secure a post-doctoral position and engage in intense competition for a tenure track position (ESF, 2009). Achieving an independent research post is a major critical point that is a clear determinant of career advancement. The average age for reaching this stage varies according to national and disciplinary contexts – but it tends to be between 25 and 35 years old. This disadvantages women as it not only coincides with the biological clock i.e. prime childbearing age – but women still tend to be responsible for caregiving and domestic responsibilities (Caprile et al., 2012; Schiebinger & Gilmartin, 2010). Research has also compared crucial stages of scientific (biology) and medical (doctor) careers, where in the case of the latter, the critical career stage is entry into higher education i.e. before family formation, whereas for the former, competition is more intense during the search for faculty positions which coincides with family formation (Adamo, 2013). However, results of the study found that job security is the greatest factor in explaining increased retention of women in medicine in comparison with science (ibid). Geographic mobility is especially important in the quest for tenure track – single women without dependents are as mobile as men yet at the doctoral/ post-doc stage women tend to become less mobile due to differential gendered effects of young children and partnering (Xie & Shauman, 2003). Time and mobility constraints

may be relevant in explaining slight differences in scientific performance at the early stages of a career – which become magnified by subsequent opportunities/lack of opportunities for doing research, thereby impacting decisively on career outcomes.

Recent research highlights the generational effects at play: people's attitudes are changing while institutions are not (Van Engen et al., 2012; Pedulla & Thebaud, 2015). Young male academics are more likely to have a professional partner and be more committed to taking part in domestic labour and childcare (Damaske et al., 2014; Hill et al., 2014). There is an emerging strand of research that charts these new and changing attitudes about science and careers – as young researchers both male and female strive for a more balanced life (Hammermann et al., 2015). The 'ideal' scientist model based on 100% dedication with a clear demarcation between work and family is not only divisive between men and women, but also creates divisions between men who fit this 'ideal' and those younger men with different aspirations. Research has charted how both academic men and women engage in resistance to the outdated notion of the 'ideal' scientist – by intentionally highlighting their own commitment to the academic career and family (Colbeck & Drago, 2005; Ollilainen & Richards Solomon, 2014).

Work-life balance issues may explain why some women and also some men drop out of science, but it does not fully explain why those women who stay do not advance. There is also no clear evidence that women without children have better career prospects, or that they succeed in catching up with men in their careers. Xie & Shauman (2003) demonstrate that researchers' productivity reflects their position in the academic hierarchy and the resources that are made available to them as a result of that position. Their research shows how, if academic track, academic position, type of institution and available resources are constant, men and women scientists publish at the same rate – whilst family status, marriage or parenthood have no impact on productivity. Research suggests that

"Research has charted how both academic men and women engage in resistance to the outdated notion of the 'ideal' scientist – by intent-ionally highlighting their own commitment to the academic career and family"

women academics experience different treatment in the workplace and are subject to discriminatory structures (Machado-Taylor & White, 2014).

Lack of Support and Gender Bias

Gender discrimination can be seen to operate on two distinct but inter-related levels. The first level is the lack of informal support for career advancement which can lead to discouragement. This can take various forms, including exclusion from social occasions to hostile working conditions and sexual harassment. The second level is concerned with bias in formal assessment procedures – which can impact on access to positions and funding.

In an attempt to understand vertical segregation in scientific careers, attention has been drawn to women's isolation and lack of supportive network ties (Dyer & Montelone, 2007; Etzkowitz & Kemelgor, 2001; Belle et al., 2014; Abramo et al., 2013). Informal networks have been shown to be crucial for career development in science – they serve various functions including fostering a sense of belonging in the scientific community, providing access to professional resources, and opportunities for advancement and encouragement. Research has shown how women tend to have less social support than their male colleagues, which negatively impacts on their ability to obtain the necessary resources for a successful career (Bagihole & Goode, 2001).

Research has also shown how gender discrimination both overt and covert takes place – in academia the latter may take the form of 'non-occurrences' – which are particularly difficult to challenge (Husu, 2001). Qualitative research has documented these, with authors noting the difficulties of generalising individual experiences to female experiences – thereby resulting in a lack of recognition of this issue (Koski & Tedre, 2003). Women adopt coping strategies and strategies of resistance to challenge this covert discrimination (Husu, 2001). An unsupportive working environment has also been identified in explaining why women may be less inclined to apply for funding or promotion (Fox & Xiao, 2013; White Berheide & Walzer, 2014).

Research in the US has shown how a good mentoring relationship can have a positive impact on retention, productivity, professional satisfaction and career advancement (NAS, 2009). These outcomes are specifically relevant for women and ethnic minorities – whilst outcomes for men are negligible. This shows how formal

mentoring programmes can provide the much needed support that men may often find in their informal networks. Mentoring has been identified as particularly important at the PhD and post-doctoral phase – when junior researchers are at a critical stage of their career trajectory (ESF, 2009). A lack of mentoring has also been identified as decreasing the likelihood of women applying for full professorships (White Berheide & Walzer, 2014).

The work climate in academic environments, as in other male-dominated work environments, has been identified as sometimes hostile for women. This can manifest in different ways – including exclusion from social activities, bullying and sexual harassment (Bagihole & White, 2013). Sexual harassment may take various forms including serious harassment or the exaggeration of sexual roles (Mankkinen, 1995). One poll in the United States conducted by the Washington Post says that one in five women have been sexuality assaulted at college. It could be one incident or occur more frequently, but crucially it is under-reported. The effects of sexual harassment are therefore underestimated in assessments of female researchers' career trajectories.

The allocation of tasks, research, administration and teaching – specifically in mid-career – has been used to explain gendered outcomes in career trajectories of researchers (Ledin et al., 2007). Tasks are valued differently: research tends to be highly valued due to the impact of publications on career development; administration and teaching, although time consuming, are devalued for promotion (Awando et al., 2014). Studies have shown how women at the mid-level disproportionately engage in teaching and administration, whilst men are more likely to engage in research (Izquierdo et al., 2004). The general view is that gender differences in the allocation of time to research, teaching and administrative tasks have important consequences for career advancement – especially for senior positions (Caprile et al., 2012).

"An unsupportive working environment has also been identified in explaining why women may be less inclined to apply for funding or promotion"

The assessment of excellence shapes the scientists' career trajectory at different stages, through selection, recruitment and promotion, whilst also playing a crucial

role in peer review (Moss-Racusin et al., 2012; Reuben et al., 2014; Sheltzer & Smith, 2014; Wennerås & Wold, 1997). Whilst the assessment of excellence is an integral part of a scientists' job, until recently 'excellence' itself was not subject to scrutiny. Excellence was perceived as 'objective', i.e. beyond context and culture, but recent research has highlighted the subjective nature of its assessment and has demonstrated how unconscious bias impacts on the formal assessment of excellence, negatively affecting women's career advancement (Reuben et al., 2014). Research has also shown that in comparison to male senior faculty, women faculty with equal accomplishments are less likely to be in receipt of similar levels of resources: salaries, laboratory space, grants, awards and other forms of support (Hopkins et al., 2002; Bedi et al., 2012).

The higher we climb up the academic ladder, we can see more pervasive effects of the 'old boys' network which combine with above described mechanisms. Research has highlighted how the low female presence at the highest levels of the scientific hierarchy points to the incapacity of research institutions to keep up with societal changes. This brings to light the contradictions of a dysfunctional system that, despite undertaking the critical role of assessing excellence, has not weakened the 'old boys' network system of co-optation. This means that key decisions regarding promotion are taken on the basis of who forms part of the 'club' – and not on merit (Palomba, 2006). This highlights the importance of a push for greater transparency in human resource decision-making in research institutions – and how this may impact positively on diminishing the bias of an academic system that systematically hinders women from fulfilling their potential and reaching top positions in academia.

Implications for Policy

There are a raft of policies which aim at promoting women's careers through career and skills training, stipends and scholarships, networking and mentoring, and measures for work-life balance. Evaluations of these policies have shown how they are highly beneficial at the individual level, but their impact on the structural level remains to be fully explored (Castaño et al., 2010). This calls for an approach which examines the relationship between the individual benefit from these type of policies and institutional change. There is also a clear need to re-think the outdated linear model of science careers and not penalise those researchers that do not fit into this model.

In Europe and the US, there has been a push for institutional change which attempts, amongst other things, to make decision-making more transparent and remove unconscious bias from institutional practices in research institutions. This is a much welcomed approach.

In the US, this type of work has begun as a result of institutional change initiatives funded through the ADVANCE programme. In Europe, work on institutional change is just beginning to bear fruit as a raft of structural change projects funded by the European Commission begin to publish their results (INTEGER; FESTA; Genis-Lab; STAGES; TRIGGER; Gender-net-ERA), in parallel with a range of national level actions (for example, Athena Swan in the UK). It is hoped that these institutional change initiatives will impact substantially on gender equality in research and innovation.

Global Perspectives – A Commentary

For the second and final update of each thematic Research Synthesis, GenPORT requested and incorported comments of experts from outside Europe. The following descriptions and reflections on the current situation in South Africa concerning Academic and Science Careers have been kindly provided by Lieketseng Mohlakoana-Motopi (University of Pretoria) and Sabrina Liccardo (Rhodes University).

Recruitment and Promotion of Women Researchers in South Africa by *Lieketseng Mohlakoana-Motopi*

Introduction

South Africa attained democracy after the first democratic elections in 1994, making it one of the youngest in terms of liberation as compared to other African countries that attained their independence from colonialism from early 1960s. The new liberated Constitution was Enacted in 1996 as one of the most sophisticated constitutions with its provision for a chapter on Bill of Rights. Section 9 of the Constitution under the Bill of Rights provides for Equality. Chapter 9 of the Constitution provides for the establishment of Institutions Supporting Constitutional democracy under Section 181, herein called Chapter Nine Institutions, which are independent bodies which are geared towards promotion of democracy in the country and holding the state and other entities accountable. Such institutions entail:

a) The Public Protector.
b) The South African Human Rights Commission.
c) The Commission for the Promotion and Protection of the Rights of Cultural, Religious and Linguistic Communities.
d) The Commission for Gender Equality.
e) The Auditor-General.
f) The Electoral Commission.

The Commission for Gender Equality derives its mandate from Section 187 of the Constitution and the Commission for Gender Equality Act 39 of 1996. As a country

South Africa started to participate officially in international human rights dialogues from the beginning of democratic dispensation. One of the milestones that came out of the Beijing Conference which was the fourth international women's conference was the development of National Gender Policy Framework that aimed at promoting gender mainstreaming on national policies and programmes as a road map towards achieving gender equality in the country in compliance with the international standards. The Commission for Gender Equality mandate therefore is to ensure that government and the private sector implement gender mainstreaming and are held accountable to conformity.

Background on South Africa

Research in South Africa indicates that the pool of the scientific workforce is shrinking as scholars are getting older and retiring. It has been found out that black women scientists, technologists and engineers are still not entering the scientific labor market and publishing ranks. The Department of Science and Technology, realizing the status quo regarding these matters has since made efforts to put in place strategies for attracting women into the field of Science, Engineering and Technology. The initiatives made by the Department of Science and Technology have been paying off as women are now entering the sector, even though it's at a very low pace. Statistics indicates that there are still more white women entering the sector than black women.

Studies Conducted focusing on Basic Education (Primary and High School) indicate that gender parity has been achieved and that both girls and boys have access to Mathematics and Science. However, proceeding to higher education, the numbers for girls entering universities of technologies and science faculties drop and range between 48% - 52%. The numbers drop further at doctoral level to 12% but between 2001 and 2005, there was a steady increase from 12% to 19% for women.

The National Advisory Council on Innovation (NACI) executes several studies annually tracking the level of transformation in terms of creating an enabling environment for the promotion of gender equality in the field of science, engineering and technology field. The mandate of NACI is articulated below:

"The National Council on Innovation Act, 1997 (Act No. 55 of 1997), provides the mandate for NACI (2015). The Act mandates NACI to advise the Minister for Science

and Technology and, through the Minister, Cabinet, on the role and contribution of science, mathematics, innovation and technology, including indigenous technologies, in promoting and achieving national objectives, namely, to improve and sustain the quality of life of all South Africans, develop human resources for science and technology, build the economy, and strengthen the country's competitiveness in the international arena".

In 2005, NACI indicated that the percentage of female doctoral graduates had changed since 2001 to:

- 37% in the Biological Sciences from 32% in 2001
- 15% in Agricultural Sciences from 7% in 2001
- 14% in Chemical Sciences dropping from 29% in 2001

It is always important for South Africa to consider racial disaggregation as it is an important indicator of transformation. In 2005, white women were found to dominate doctoral studies with 57% of the total enrolment.

Subotsky (2003) acknowledges that the number of women entering higher education has increased since democratic dispensation, however, they are more concentrated in Social Sciences than in SET faculties.

Challenges Leading to Exclusion of Women from Science and Technology Fraternity

Among the common factors why progress has been so slow in terms of achieving higher participation of women in SET, one can list especially for the South African context the following poins:

- Financial constraints before and during tertiary studies
- Gender stereotyping
- Legacy of disadvantages in black communities
- Negative dynamics in the work place with regards to women's specific needs
- Apartheid legislation that reserved employment within the state run SET for men and for whites only is still entrenched within the mindset of many hence deterring new dynamics to emerge.

- Gender blindness within the work place environment and active gender hostility of educators
- The SET environment is still dominated by masculine organizational culture hence not allowing women to balance their care work and academic careers.
- Department of Science and Technology being aware of all these hindrances put in place mechanisms to mitigate these challenges to create an enabling environment for women to enter SET sector. Such mechanisms entail:

International Policies

1. CEDAW
2. Beiing Platform for Action
3. Agenda 2063
4. Sustainable Development Goals (Agenda 2030)

South Africa is a state party to all these international instruments hence obliged to implement their provisions which also make reference to promotion of gender equality to SET.

Domestic Laws

1. Africa Institute of South Africa Act 23 of 1968
2. National Advisory Council on Innovation Act 55 of 1997
3. Academy of Science of South Africa Act
4. Technology Innovation Agency Act 2008
5. South African National Space Agency Act
6. Promotion of Access to Information Manual

Conclusion

The Department of Science and Technology in their 5 year Strategic Plan highlight human development as their key priority, emphasizing the need to address gender and racial imbalances in the make-up of Science and Technology workforce 2015-2020. The department aims to each an output of 5000 PhDs per annum. Acknowledging the likely lack of capacity in South Africa, the department indicates partnerships with private sector as viable strategy as well as sending eligible candidates overseas for their training period.

In terms of retention of women in the field of SET, institutions that the department usually commission to conduct such studies include:

1. Academy of Science of South Africa
2. The Council for Scientific Industrial Research
3. National Research Foundation
4. South African National Space Agency
5. NACI
6. Human Science Research Council
7. Technology Innovation Agency.

Acknowledging all the work and regulatory framework as well as mechanisms that South Africa has put in place to promote women's participation in SET and Research, the challenge remains to break the glass ceiling within the academic institutions as the environment in general does not present opportunities for women to balance their growth academically and their care work within their private spheres. As indicated during the e-discussion held on GenPORT, it is important to create an enabling environment to attract and retain women in SET. This strategy should be a long term strategy entailing training and mentoring of women in the field and ensuring that they are reach the same academic career levels as their male counterparts, even after their long maternal leave.

It is also important to continue lobbying for political will and advancement of the monitoring and evaluation system for programmes to ensure that an enabling environment for women is sustained and standardized across the board.

Academic and Science Careers of Black Women in South Africa by *Sabrina Liccardo*

Access to and engagement with scientific knowledge in South Africa is not only gendered but the 'intersectionality' (Crenshaw, 1991) of race with the formation of class structures is central. Being a Black woman working in science in South Africa entails more than individual aptitude, requiring the crossing of multiple social locations because of the ways in which the categories of race and gender exist as axes of power in society. I will provide a brief description of my research project on the life histories of Black South African women scientists with the aim of adding new insights to the GenPORT Research Synthesis 2 Academic and Science Careers.

From 2007 to 2011, I worked as a programme evaluator in the Transformation Office at a Historically White University (HWU) where I was responsible for the monitoring, evaluation and development of the Student Equity Projects. One such programme was the 'Oya' Scholarship, which provided twenty academically talented first-generation South African women, who came from families with scarce financial resources, with the necessary support to aid their adjustment and throughput in the notoriously difficult STEM fields. Without negating the critical factors of financial access and academic support, I came to realise that this programme had effectively created a 'happy marriage' between transformation and elitism by conflating race, class, and academic talent (see, Botsis, Dominguez-Whitehead & Liccardo, 2013); thus, reproducing the dominant white middle-class institutional culture that serves to perpetuate alienation, marginalisation and exclusion. I became aware of how the racialised, gendered and class habitus of the STEM-HWU field generated practices of 'symbolic violence' (Bourdieu, 2004) in that it provided these women access to its field by selecting them for a prestigious scholarship programme but simultaneously blocked their everyday participation within the field through implicit or exclusionary practices masked as 'the University's way of doing things' thus contributing to the academic failure of young Black women in STEM. As these women had internalised the standards of 'excellence' based on a system of meritocracy, their experiences of failure at university created intense feelings of shame, depression, and inferiority. As a result, I decided to pursue a PhD based on the experiences of the young women in the Oya scholarship programme.

The current country-wide fallist movement for financial access and decolonisation of the university in Africa is a turning point in history. It is a critical moment of

confrontation with what W.E.B. Du Bois (2013, p.119) has called “the problem of the color-line”. In other words, it is a stark reminder of the widening gap between the rhetoric of transformation and the experiences of students at South African universities. What is needed is a radical change of institutional cultures and practices inherited from the colonial and apartheid past and exacerbated by neoliberal economic forces. The cultivation of “ecologies of knowledges” is dependent on equity and diversity as the cornerstones of transformation and innovation. However, the developmental potential of higher education is not easily attainable due to the racialised, classed and gendered assumptions that remain deeply entrenched in institutional practices.

Ndlovu-Gatsheni (2013) has noted that we need to shift the geography of knowledge as well as the biography of knowledge. The question is how do we create institutional cultures that cultivate “ecologies of knowledges”. To decolonise the curricula and institutional practices of knowledge production we need to rethink the methods of approaching what it means to know and become a knowledge producer. We need innovative methods of qualitative research that make visible the unequal power relations and mundane practices, disguised as neutral, that serve to other and exclude young Black women from domains of knowledge. We also need to move beyond the cycle of endless repetition of research about social and cultural reproduction and invent methods that “uncover alternative epistemic traditions and trajectories that allow for different ways of analysing and therefore of knowing, understanding, being and doing in the world [i.e. the objective of the Apartheid Archive Project]” (Stevens, Duncan & Sonn, 2013, p. 39).

The life histories of Black South African women scientists provide a telling story of psychosocial transformation because they experience the world as an outlier group; paradoxically positioned within an interstitial space between their dual sense of belonging to and alienation from a marginal and an elite group. Their simultaneous membership of these two outlier groups creates shifting senses of self-identification and belonging as well as dis-identification and alienation to academic communities which make explicit the white, male and middle-class normative constructions of science and scientists.

I propose an infinity symbol as a metaphor to illustrate the psychosocial rhythms of Black women’s identity transformations and the reproductions of disciplinary and institutional cultures at HWUs. The intersection of (non)belonging, located at the middle of the infinity symbol, represents a space where these women resist systems of oppression through “community cultural wealth” and reconstruct new subjectivities

and ways of doing science that connect them to new “imagined communities” (Anderson, 1991). Over time, these patterns of psychosocial (trans)formations are weaved into a tapestry of meanings that bind the material/symbolic, social/personal, and historical/psychical. This network of interconnections coalesces in individual life narratives, which emphasise the inherent entanglement between the individual, social, cultural and historical. The infinity symbol, as self-relations lived in everyday life, is thus illustrative of the process of decolonisation as rhythms of co-generation, de-generation and re-generation cross- generations.

The consequences of misrecognition and alienation shatter one’s sense of self and temporal coherence, which necessitates the reconstruction of meaning. The middle of the infinity symbol represents a space within infinity; an ever-changing present, where we renegotiate, reconfigure, re-imagine, and rewrite ourselves. I explore the ways in which these women use their life stories as a strategy to make sense of the chaos of everyday life and restore their shattered selves into meaningful ‘wholes’.

Given the imperatives of decolonality and transformation as well as the current equity debates across the South African Higher Education landscape, this research project has social policy and educational implications and offers insights into the unique experiences of Black women scientists whose individual life histories tell the story of a society in transition.

For more an in depth analysis, you can check Liccardo (2015).

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Note: The present document gives a brief overview of recent research findings regarding *Academic and Science Careers*. Further research syntheses on (1) Education and Training, (3) Institutional Practices and Processes, (4) Gender in Research Content and Knowledge Production, (5) Policy Setting and Implementation, and (6) Historical Perspectives and Future Scenarios are available at www.genderportal.eu

An **up to date version** of the bibliography and further relevant resources can be found under the following address:

http://www.genderportal.eu/tags/research-synthesis-2-academic-and-science-careers

For the second and final update of each thematic Research Synthesis, GenPORT requested and incorported comments of experts from outside Europe. The descriptions and reflections on the current situation in South Africa concerning Academic and Science Careers have been kindly provided by Lieketseng Mohlakoana-Motopi (University of Pretoria) and Sabrina Liccardo (Rhodes University).

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