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The Making of Female Scientific Legends: Career Narratives of the OWSD-Elsevier Award  
Winning Early-Career Research Scientists

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## ABSTRACT

Many nations have been resolute in their pursuit of gender parity in science, technology, engineering, and mathematics (STEM). Yet, the underrepresentation of women in STEM careers continues to pose significant global challenges. ‘How’ and ‘why’ women experience work differently in such male-dominated environments has been the subject of extensive research in recent times. This thesis offers new, original, and fresh perspectives to move forward the conversation on how women in ‘masculine’ careers experience work by throwing the spotlight on a peculiar group of people who, despite their immense contribution to science, are often side-lined in contemporary discourse on careers in management research. Drawing on career construction theory and intersectionality scholarship as a lens, and ‘microstoria’ as an interpretive frame, the study explores contemporaneous scientific career stories as narrated by female early career researchers (ECRs) from developing countries where resource paucity tends to stymie the ‘doing’ of cutting-edge scientific research.

In doing this, the thesis investigates how the often-invisible identities of positionality and situatedness of these ECRs intersect with their highly visible gender identity as females to shape how they experience work as early career scientific researchers from and based in developing countries. Adopting a constructionist approach and an exploratory qualitative research design, the main data for the empirical inquiry was collected using semi-structured interviews with thirty-five (35) past recipients of the Organization for Women in Science for the Developing World (OWSD)-Elsevier award for female ECRs from the developing world. This was supplemented with publicly available documents on the award, and the websites and social media pages (LinkedIn, YouTube, ResearchGate) of the award winners. With emphasis placed on their call to fame and their journeys to worldmaking in male-dominated scientific fields, the study explored and analysed how these ‘successful’ female ECR scientists make sense of their identities as scientists, experience scientific work in a context characterised by resource paucity, and craft their scientific careers

The study presents three main findings. First, it suggests that the intersectionality of multiple identities allows ECRs to construct three distinct career identities: a relational career identity based on the concept of familial influence (family, mentors, role models), an altruistic career based on the concept of ‘calling’, and a fluke career orientation based on the concept of luck and chance. Second, the study addresses social inequities for female ECRs by examining the

unique enablers and barriers faced by this group at the intersection of gender, positionality, and situatedness. Third, the study identifies several agentic ways in which female ECRs could both survive and thrive in STEM by highlighting the daily practices, strategies and coping behaviours that are utilized consistently to self-manage a career under such contexts of underdevelopment, weak institutions, and patriarchy; and sheds light on seemingly intractable patterns of strategies (passing and revealing), which constitutively help them to counter their feelings of (in)visibility and struggles in their everyday situated practices. Shedding light on the interaction between the self and societal agents and how these influence the career construction narratives of females at the early stages of their scientific research career lives, the study calls attention to several interventions that could be useful in mitigating the occurrences of bottlenecks in organisational career development.



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## CHAPTER 1

### Introduction

Around the time when I won the OWSD-Elsevier award, I had a colleague come up to me and he told me point blank that I won the award because there was no man to compete with me, so I should stop making a big deal out of it and rather focus on getting a more competitive award. To be honest, his words upset me, and I remember asking myself at some point if all of this was even worth it. It was like the harder I worked, the more I needed to prove myself

*Herty, Physicist*

In the story above, Herty (pseudonym), a physicist and one of the past recipients of the OWSD-Elsevier award for female early career research scientists (ECRs) from developing countries, narrates, albeit with great despair, how she is seen and perceived by a colleague. Herty was not recognized as the prototypical scientist and was rebuffed for her many victories despite her credentials and good standing as an award-winning, internationally renowned research scientist. Her misrecognition is triggered by the hyper-visibility of her femininity, which paradoxically renders her invisible in her role, and further exacerbates a perceived lack of belonging among the scientific research community. This scenario, like the stories of many other participants of the current study, present a sombre reflection of the many challenges experienced by women in male-dominated industries, particularly those in the early stages of their careers, in negotiating the tensions between ‘fitting in’ and ‘standing out’, especially at the workplace and in the wider society, where significant aspects of their individuality are discounted (McCluney and Rabelo, 2019).

Narratives of female ECRs from developing countries thus present a career trajectory that may at best be described as an iceberg of success. Superficially, their careers appear all glitz and glamour: scientists in their own right and women who have become somewhat ‘known’ for breaking the societal stereotype to do what ‘men can do’. Many young girls aspire to be like

them. Even colleagues look at them with an iota of admiration. They are mentors, role models, and quite simply phenomenal women. Yet, underneath this veneer of what appears to be a successful career is an ocean of life-changing experiences, setbacks, and everyday hardships that almost never make it past their ever-so-private, well-guarded, and somewhat lonely lives. The current study attempts to open this door and walks down memory lane to explore the career lives of these outstanding women, baring it all from that single decision to pursue science to becoming an international award winner for doing science.

An exploration of the careers of female ECRs is thus more psychologically oriented, with an emphasis on the individual and the gender-specific ways she perceives and makes sense of her career world. Generally, ECRs represent the phase between PhD and senior-level positions (Christian et al., 2021) and while definitions tend to differ by country, this study aligned with the definition used by the UK research council, which tends to define them by the number of years since completing a PhD – typically 10 years – which is effectively a definition based on relative ‘newness’ (Nicholas et al., 2019). They are frequently regarded as being amongst the most innovative and active pool of researchers in the scientific research community (Friesenhahn and Beaudry, 2014; Jones, 2014). Yet, they are frequently classified as “the most vulnerable group in the science system” and the first to suffer when the scientific research sector comes under strain (Laudel and Glaser, 2008, p. 387).

Many reasons could account for this. First, ECRs are unquestionably at the early stages of their careers and consequently have less experience in conducting research and writing for publication. Again, in the arguments of Hemming and Hill (2009), they are assigned greater responsibilities and are expected to prioritise research over other obligations. Furthermore, they have less access to resources and are frequently subjected to intense scrutiny from senior colleagues, some of whom may even attempt to claim their work. Ultimately, they must overcome the concerns and demands connected with probation, tenure, and promotion (Laudel

and Glaser, 2008). For women in early career scientific research, the obstacles of being an ECR are further exacerbated by the continued existence of gendered inequities within the scientific career community (Huang et al., 2020).

For instance, empirical evidence reveals that promotion of early career researchers (ECRs) is frequently connected to the number of publications and that men publish more than women throughout their careers (Davies and Healey, 2019). Further analyses of the effect of publication numbers on the ability of faculty to achieve tenure have concluded that the more papers a researcher publishes, the more likely he or she is to receive tenure, with the implication that male researchers are more likely to receive tenure than their female counterparts (Roper, 2019). These findings have prompted a multitude of potential explanations, including differences in family responsibilities, resource allocation, the role of peer review, collaboration, role stereotypes, academic rank, specialisation, and work climate (Eagly et al., 2020; Jadidi et al., 2018; Van den Besselaar and Sandstrom, 2017; Uhly, Visser and Zippel, 2017). Such empirical findings demonstrate that gender disparities continue to exist in the scientific career arena, which has frequently promoted itself as universalistic in accordance with the Mertonian code (Schröder, Lutter, and Habicht, 2021).

According to this code, when a scientist contributes to scientific knowledge, the community's evaluation of the claim's validity should not be influenced by the scientist's personal or social characteristics, but rather by “pre-established impersonal criteria” (Merton [1942] 1973, p. 270). Again, universalism necessitates that a scientist's contributions to the body of scientific knowledge be compensated equally. This is aptly summed up by Merton's statement that “careers should be accessible to talent” (Merton, 1973, p. 272). Nevertheless, this productivity paradox phenomenon suggests that particularism, which involves the use of functionally irrelevant qualities such as race and sex as a basis for making claims and receiving rewards in scientific careers, persists (Jiang, Mok, and Shen, 2020). Thus, while the discussion regarding

the scientific community's commitment to Merton's scientific ethos persists, it is undeniable that the scientific sector is rife with disparities in career advancement. As with the majority of minority groups, women have lower participation, status, production, and recognition rates (Gaines, 2017; Roper, 2019). Per the 2019 UNESCO report on women in science, only 29.3 percent of actively employed researchers worldwide are female. In developing nations, the gender gap in science, technology, engineering, and mathematics (STEM) is a complex phenomenon involving familial, social, cultural, and institutional elements that cannot be ignored or disregarded (Fathima et al., 2020).

Thus, while it is objectively true that female researchers publish less than males, it is also true that ECRs publish less than more experienced researchers and that academics from developing countries publish less than those from affluent nations (Huang et al., 2020; Sarabipour et al., 2021). Given that advancement, recognition, and the ultimate success of a researcher's career are all assessed using this singular concept of publication counts, female ECRs from underdeveloped nations will be at the bottom of this hierarchy. For these women, their identities as women, ECRs, and citizens of third-world countries intersect to create a far harsher reality of marginalisation than, for example, a female scientist from a prosperous nation (Atewologun, 2018). Studies on the number of females in top positions in academic institutions, for instance, suggest that unintended and subconscious gender bias is common and can result in barriers preventing women from being promoted, credited for their achievements, nominated for leadership positions, or viewed as leaders (Fathima et al., 2020).

Based on a qualitative investigation of the career narratives of 35 women scientists from 13 developing countries, the study draws on Crenshaw's (1991a) intersectionality theory to provide nuanced insights into successful ECRs' lived experiences as they analyse, unpack, and make sense of their professions. The concept of intersectionality provides a framework for gaining a comprehensive understanding of the constraints female scientists experience and how

they are shaped by other intersecting identities in order to guide the tactics required to address the attrition of such women in science. The study employs a feminist perspective and transcends the binary conception of gender by examining how other intersectional characteristics, such as ethnicity, race, age, number of children, marital status, and disability, among others, influence the scientific career outcomes of female scientists. Theoretically, the study contributes novel perspectives to the current literature on career studies and intersectionality scholarship by examining how the multiple marginalities faced by female scientists from developing countries interact to shape their career experiences, identity, and strategies for pursuing their careers. Focusing on developing countries as the empirical research context, the study will also be one of the first to investigate how successful women in such contexts make sense of their careers, and what this implies for the ‘Women in STEM’ development agenda.

### **1.1 Careers of women in STEM: Past contributions and current agenda**

Given this normative backdrop, the fields of vocational behaviour have seen a reinvention over time by shifting their focus from studying career development to investigating how people manage and make meaning through work and careers. Recent theoretical advances suggest a turn to constructionist and contextual perspectives, necessitating a reliance on self-construction and the need for people to construct their own meanings of work through the unification of past experiences and future dispositions (Akkermans and Tims, 2017; Duffy et al., 2016; Jiang et al., 2019). In this context, the self offers a unifying construct that may help to link these fields with other social and behavioural science disciplines toward the collective goal of a unified science and practice of the self (Savickas and Baker, 2005). An understanding of the self is the first step in understanding how careers are experienced over time. In this sense, there is a need to understand how individuals learn to deal with their own identity in order to consciously define that part of the world of work that fits in with this identity (Meijers, 1998).

In light of this, career construction theory offers a medium through which individuals construct representations of reality, although they do not construct this reality itself, but rather co-construct it with the support of the social world (Savickas, 2005). As noted by Little et al. (2015), individuals possess multiple social identities, all of which come together to form the meanings that are attached to a person by the self and others. Regrettably, extant career literature is saturated with single axis analysis (Tomlinson et al., 2019) of individuals, with immaterial embodiment to the complex, multiple and often intersecting social characteristics that make up the self. In this study, I take particular interest in female ECRs from developing countries, focusing on how their multiple identities intersect with their gender as females to shape their subjective meaning of their career identities as ECRs. The current research thus focuses on the role of intersectionality in career construction due to the applicability of these theories to female ECRs from developing countries.

Extant research on the career trajectories of women in STEM has relied on interviews and observations, surveys, and mixed methods. These studies have identified facets related to women's experiences in STEM careers, such as:

1. Motivations to enter into STEM careers;
2. Barriers and impediments to STEM careers;
3. Enablers of STEM careers.

Within the first area of research, scholars have focused on examining women's motivations to enter into STEM careers. While some evidence suggests that gender differences in STEM motivation often emerge prior to university (Cheryan et al., 2017), others have argued that gender variations in STEM competencies are inconsequential (Tyler-Wood et al., 2011). Within this stream of research, literature has examined: i) the career choice and career decision-

making process involved in STEM careers; ii) major factors influencing the gender disparity in STEM; and iii) the 'leaky pipeline' model and why this occurs.

Career decision-making has been identified as one of the most challenging and often stressful decisions people have to make in their lifetime, often having the potential to lead to career inaction (Argyropoulou, Sidiropoulou-Dimakakou, and Besevegis, 2007). In their works, Cheryan et al. (2017), Dasgupta and Stout (2014), Leaper (2015) and Lewis et al. (2017) all called attention to the various ways that instructors, peers, and families can influence girls' and women's motivation or sense of belonging in STEM fields. Scholars who have proposed the idea to delve deeper into the role of these significant figures in the decision-making process regarding career choices in STEM argue that experiencing encouragement for STEM from family and friends may help to bolster women's STEM motivation and encouragement to pursue STEM careers, and empower them to deal with the discrimination and biases that they are likely to encounter (Leaper and Starr, 2018).

Moreover, a number of studies have established that exposure to female role models can improve girls' and women's performance and interest in STEM fields, but results have been mixed, with some studies demonstrating the benefits of female role models (e.g., Stout et al., 2011), and others finding that role model gender does not make a difference (e.g., Cheryan et al., 2013). Lawner et al. (2019), for instance, argue that while ingroup role models may be effective, the effect size is small and the presence of a role model by itself is not enough. The role of society and institutions in the career decision-making process is another area of interest for scholars. In this area of research, several studies have investigated the role of society and institutions in the career decision-making process of women in STEM careers. Here, the impact of the masculine image on students' aspirations in STEM fields is an area that has received significant attention (Makarova, Aeschlimann, and Hezog, 2019). Scholars have thus found that with respect to gender differences, female students' attribution of masculinity to science



subjects does not differ significantly from that of male students (Makarova, Aeschlimann, and Hezog, 2019).

While the issue of females' attrition from STEM subjects may not be significantly different from that of males, scholars have, however, found that the effect of gender and ethnicity on career decision-making among adolescents may be underestimated (Gottfredson, 2005; Wang and Degol, 2013). Furthermore, research on STEM enrolment typically highlights the fact that students who initially had an interest are leaving out of STEM (Witteveen and Attewell, 2020). Research shows that women are more likely to leave their STEM careers than their male peers (38% vs. 26%) (Frank, 2019). In science, for instance, while women are significantly over-represented at the bachelor's and master's degree levels (representing 53% of total enrolments), their representation declines to 43% at the PhD level, and even further to 28% of post-doctoral scientific research personnel (UNESCO, 2019). As a result, issues such as 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 impede and lower the percentage of women at each step of the scientific career (UNESCO, 2020).

Within the second stream of literature, research has focused on structural participation impediments and has established that social background influences STEM engagement, specifically high school students' beliefs about how gender and race affect their compatibility with STEM pursuits, "at a developmental time when many adolescents make important decisions about future academic and career pathways" in the school environment (Grossman and Porche, 2014, p. 722). Other research reveals that women face an informal culture that considers them as outsiders, a lack of role models, and academic work that prevents them from having children (De Welde and Laursen, 2011). It has been established that those structural impediments continue to prevent women from entering the workforce. There is a correlation between motherhood and the possibility that women's engagement in STEM disciplines will

be viewed as just symbolic, as opposed to significant and influential (Glass et al., 2013; Heilbronn, 2013). Women are expected to dedicate more time to family problems than are men, according to Ceci, Williams, and Barnett (2009). In comparison to other professional sectors, family considerations have been found to be insufficient for women in STEM contexts, while facilitators such as advanced training, high job satisfaction, and a supportive atmosphere have also been found to be lacking (Glass et al., 2013).

Isolation is also considered a barrier: the “lack of a critical mass of women in STEM fields, especially at higher levels of authority” makes women “vulnerable to the ideologies of gender-conservative men” (Glass et al., 2013, p. 727), and loneliness at work discourages women from sticking with STEM careers (Heilbronn, 2013). Other obstacles, such as employers' views of gendered competence, make it less likely that women will be promoted as rapidly or paid as much as their male colleagues (Glass et al., 2013). Field segregation, salary discrepancies when compared to men, and “persistent difficulties in achieving the same levels of support and recognition for their work as men” have been cited as ongoing barriers (Fassinger and Asay, 2006, p. 432).

The third stream of research has focused on the enablers of women in STEM careers. In this sphere, research has focused on the individual development for career growth, work-life balance programmes, gender bias awareness, employee engagement, and mentoring relationships, which are suggested by Dagorn (2018) and Gaspar and Dubertrand (2019) as career advancement strategies that organisations should implement to attract and retain more women in male-dominated careers. According to research, mentoring can be an effective way to increase women's leadership qualities in organisations; however, the mentoring relationship must be properly built to achieve social change rather than merely transactional change (Murphy, Gibson, and Kram, 2017). Mentoring has long been recognised as an essential instrument not just for individual development and advancement, but also for the success of

organisations (Locke and Williams, 2000; Martin-Chua, 2009; McKeen and Bujaki, 2007).

While mentoring has been widely utilised by men, an increasing number of women are utilising it to achieve success in male-dominated fields (Ramaswami et al., 2010).

Indeed, recent studies have highlighted the significance and effectiveness of mentoring in increasing women's professional performance (Woolnough and Davidson, 2007; Abalkhail and Allan, 2015). The majority of research, however, has been conducted in Western societies (Van den Brink and Benschop, 2012). Collectively, extant literature on the experiences of women in STEM has provided useful explanations for the gender gap in STEM, barriers, and enablers. While these studies have been extremely relevant in opening our understanding on the matter, a thorough understanding is required to grasp the experiences of those in the global south, as these studies are predominantly situated in western contexts. Specifically, it would be beneficial to know the nuanced experiences of these women and the meanings that are contextualized within the cultural value system of the women's various social milieus. In sum, while further reflection on knowledge provided by extant literature has been greatly beneficial, much work is needed in various areas to better understand how women in STEM careers experience work.

First, within each of the three identified streams are areas for further development in the provision of more conceptual clarity on the subject. Within the first stream of research, the leaky pipeline metaphor is unidirectional, as it only considers students who abandon STEM fields and disregards the potential of those who switch to STEM after declaring non-STEM majors. Students who change their major typically declare a new major unless they withdraw from college or university. Consequently, it is normal for students not only to abandon one major but also to switch majors (Lykkegaard and Ulriksen, 2019).

Simply put, the image of a leaking pipe does not sufficiently reflect the variety of career options available to students. Young adults in university usually struggle to choose a major and regularly change their minds when making significant decisions (Arnett, 2004). Therefore, selecting and completing a college major involves not only deciding what will be studied, but also committing to one's identity (Erikson, 1968). Choosing a college major is the first step toward choosing a career for many college students, making this decision vital to the formation of one's identity. It would therefore be interesting to understand individuals' career decision-making processes, as these are crucial in shaping their future careers and professional identities. Again, cross-cultural variations in socialization and gender-role processes that influence choices of occupational pathways indicate that more comparative studies in more diverse settings are needed to advance our understanding of career choices (Guo et al., 2018).

Within the second research stream, Morley (2013, p. 543) uses the concept of micropolitics, which focuses on "how power is transmitted in everyday practices", to argue that academia as a whole is "male terrain" and leadership in higher education is perceived as a masculine domain, whereas femaleness is frequently viewed as incompatible with intellectual and managerial ability. Women are frequently perceived as the 'other', and in order to achieve success, women must address this perception (Acker, 2012). Thus, a more coherent understanding of the distinctiveness and 'otherness' of females in such contexts is needed to truly understand which particular practices contribute to this this problem.

Within the third aspect of research, further research is needed to investigate the interpersonal experiences of underrepresented women in literature, such as women from the global south in STEM academic contexts. Examinations of how gender intersects with other markers, such as social class, experience in the academy, situatedness and other dimensions of inequality that affect the experiences for STEM women faculty, would also be beneficial.

Notwithstanding the above, there is also a dearth of literature on the career self-management (CSM) strategies upon which women in STEM draw to cope with their careers. As such, there is a need to refocus attention on the coping behaviours in which women in STEM careers subjectively engage to manage their careers. This study therefore seeks to answer the call for more research to understand how women's intersecting social locations influence their work, particularly among women belonging to multiple marginalized groups (Flores et al., 2021). The study thus makes a significant contribution to knowledge through the use of career construction theory and intersectionality scholarship to shed light on the experiences of those whose perspectives have been largely overlooked in existing management and organisational research (Chrispal, Bapuji, and Zietsma, 2021). The study demonstrates the intersectional identities of participants and how these coalesce to ground and empower female ECRs from developing countries.

It is against this background that this study seeks to explore how gender, positionality, and situatedness merge to shape the lived experiences of female ECRs from low-income countries.

The study asks:

1. How do gender, situatedness, and positionality shape career identity perception in the early career discourse of women scientists from developing countries?
2. What are the practices that enable/impede the careers of female ECRs from developing countries?
3. What strategies are drawn on by female ECRs from developing countries in self-managing their careers?

The three research questions provide the basis for an in-depth exploration of the narratives of the career trajectories of female ECRs from developing countries. The first research question allows for the understanding of how careers are formed by throwing the spotlight on the

decision-making process involved in choosing a career in scientific research. By showing how careers are perceived and identified, this research provides valuable insights in answering the call for more studies in more diverse settings to advance our understanding of career choices and career decision-making (Guo et al., 2018). The second research question moves forward the conversation on barriers and enablers of careers for women in STEM (Banerjee et al., 2018) by addressing the social inequities and also the privileges that are present for female ECRs, and further explores the unique barriers and enablers faced by this group at the intersection of gender, positionality and situatedness. The third and final research question provides in-depth knowledge on the strategies and coping mechanisms for self-managing a scientific research career as a female ECR scientist from a developing nation. This is important, given that studies focusing on the CSM behaviours of women in STEM are rather scant.

## **1.2 Methodology and methods**

The study adopts a constructionist approach, common to intersectionality research and career studies (Atewologun, 2018; Else-Quest and Hyde, 2016; Savickas, 2020), and is based on 35 semi-structured interviews conducted over a six-month period with some past recipients of the OWSD-Elsevier award for women scientists from the developing world. This data was supplemented with secondary data from archival sources and participants' digital footprints to gain a better understanding of their first-hand lived experiences to unravel how their intersecting identities impact the shaping of their careers. All interviewees were identified *a priori*, and although these women scientists were scattered all over the world (13 countries), interviews were conducted remotely in the UK via zoom. The analysis followed a constructionist thematic analysis approach (Byrne, 2021) to analyse and report key themes and categories (Clarke and Braun, 2013). To the constructionist, the social world is constructed through social processes and relational practices (Young and Collin, 2004), and allows for the

examination of realities, meanings, and experiences of participants in relation to their careers as affected by social structures, processes, and relations (Burr, 1995). The data analysis thus followed three key stages.

First, the transcribed data was read and re-read to develop familiarity with the dataset and ensure that it provided an accurate representation of participants' accounts (Corbin and Strauss, 2008). Iteratively, transcripts were reviewed for common words, phrases, and sentences that could form prospective first-order codes (Creswell and Poth, 2016). After the initial identification of first-order codes, the next stage moved into a more conceptual level that involved the generation of second-order theoretical categories (Corbin and Strauss, 2008). The goal of this stage was to condense the number of first-order concepts into comprehensive higher-order categories. Here, a constant comparison technique was undertaken (Corbin and Strauss, 2008) by comparing first-order codes and grouping similar codes into a single category. The recurring first-order codes were thus clustered into more theoretical second-order categories. The third stage involved a re-evaluation of the first- and second-order categories and subsequent consolidation into a refined overarching theme that encapsulated the processes assumed by the female scientists in making sense of their careers. Overall, the study followed an iterative process of refining categories while ensuring that they remained true to the underlying data collected (Onu and Oats, 2018). This resulted ultimately in the generation of broad themes and sub-themes that echoed the interpretation of the analysed data.

### **1.3 Main research findings**

Through an intersectional lens, the study produced three overarching themes, each serving as a corresponding answer to one of the three research questions. In answering the research questions, narratives centred on the motivation behind such career decisions, experiences within the gendered scientific career society, and the significance of the career trajectory of

these ECRs. First, the study found that the decision to enter into scientific research careers involves several acts of resilience, change, faith, optimism, and persistence, manifested in three ways: getting in, getting on, and defining their identity as ECRs. The ECRs' otherwise invisible positionalities as early career research scientists and their situatedness as citizens of poor nations intersect with their highly visible gender as females to impact how they make meaning of their careers.

The study found that for those who entered into science through 'guidance', four temporal themes were uncovered. These were emboldening (entry into science and eventually into scientific research careers came as a result of the encouragement and motivation of parents, guardians, and mentors), *faits accomplis* (these were individuals who had their 'careers' decided for them mostly by parents and were 'told' quite simply to do their parents bidding), collateral damage (they entered into science because they were from 'scientific homes' and science was inherent in their family 'bloodline') and idolization (entry into science was influenced by people other than their parents, whose lives and activities inspired their decisions in some way to do science). Although the above supports prior research on the role of family in career decision-making (Agger, Meece and Byun, 2018; Akosah-Twumasi et al., 2018), the four sub-themes proved a rather interesting find, as albeit entry into science was a result of guidance and familial influence, there was not one universal blueprint to which participants could subscribe.

The study also found a second stream of participants, who got into science by chance. Their narratives revealed that although they were already into science, their mobility into their present careers had a stroke of randomness, luck and chance elements attached. Another interesting finding was the decision to enter into science for affirmative action. Overall, in answering research question one, intersectionality allowed the construction of a career-identity in three distinct, yet somewhat interconnected scopes:



- A. Relational career identity (dependent on the opinions of others, especially family, mentors, and role models);
- B. Altruistic career identity (contingent on self-resilience);
- C. Fluke career identity (based on fate, luck, chance).

Taken as a whole, this aggregate dimension has helped to form a more concrete understanding of the career experiences of female early career research scientists from developing countries pertaining to how their career identities are formed. Thereby, this answers the research question of ‘How do gender, situatedness, and positionality shape career identity perception in the early career discourse of women scientists from developing countries?’

Second, findings suggested that the overlapping identities of female ECRs from developing countries enabled certain benefits while also acting as impediments to their careers, thus bestowing privileges and/or penalties to these ECRs, manifest at the individual, institutional, and national levels. Findings thus support prior studies on the experiences of women in STEM careers, reflecting on both the unique barriers and success factors (Banerjee et al., 2018; Guy and Boards, 2019; Elliott, Mavriplis, and Anis, 2020). At the individual level, the narratives of respondents revealed that, at the beginning of their careers, their intersecting identities as women, ECRs, and nationals of developing countries were, in various ways, both a privilege and a disadvantage. At the organisational level, female ECRs described themselves as fortunate to be among the few women making progress in their fields.

However, many felt as though they were being punished for having this privilege due to the numerous obstacles they confronted daily within their organisations. At the institutional level, participants recognized the effort that many developing countries were putting into place to support the ‘women in STEM’ agenda. However, they also explained that policies were mostly focused on how to recruit girls into science, with little attention paid to how to nurture and

develop their capacities once they were in science. The study found that embracing a new identity as a research scientist often came with conflicting identities in the transition from student to professional. Overall, the study has been able to answer the second research question – ‘What practices enable/impede careers of female ECRs from developing countries?’ – by demonstrating the unique barriers and impediments that manifest to influence the career trajectories of female ECRs from developing countries, taking cognisance of the intersecting identities which enable certain privileges while also inhibiting some aspects of their career development. Importantly, this section has given insight on how institutional power dynamics interact with social structures and individual agency to confer distinct privileges and penalties on individuals and makes a case for institutional reforms and policy changes that are required to enable female ECRs to achieve sustainable transformation of the structural and systemic barriers to career advancement (Okeke et al., 2017).

Third, the study identifies a range of CSM behaviours, categorised under the broad themes of passing and revealing strategies, examining in great depth the strategies and coping mechanisms for self-managing a scientific research career as a female ECR from a developing nation. The study identified that the intersecting identities of gender, positionality, and situatedness enabled unusual methods of managing one’s career, such as impression management and career distancing. Additionally, it was observed that the pattern of career self-management behaviour in which a participant engaged was in some way related to the level of career satisfaction they were currently experiencing. Those who were dissatisfied with their careers were more likely to engage in tactics such as drawing exit plans, whereas those who appeared to be highly content with their careers engaged in strategies such as coping with career shocks and being highly adaptable.

The study findings reveal that the embodied experiences of precarity (e.g., unconscious bias and unfriendly work policies) disrupt any preconceived notion of a career in scientific research

(steady, rewarding, universalistic) that participants previously held, and instead trigger the process of formulating a CSM strategy in those individuals. In a rather interesting turn of events, findings from this section revealed that some participants – although a select few – were quite happy to ‘conform’ to unfavourable pre-existing conditions. They narrated doing science ‘for the love of it’ and described getting on with the job by working hard and going with the rules. By engaging in the ‘hard work rhetoric’ and keeping ‘a stiff upper lip’ to safeguard their careers from being cancelled, the findings are consistent with prior research on sensemaking which posits that people are unlikely to reconsider their own mindset unless they feel that their professional identity is at stake (Gregoire, 2003; Maitlis and Christianson, 2014). Moving on, the findings from all three overarching aggregates have been useful in explaining the construction of careers, highlighting how intersectionality of gender, positionality and situatedness shape the career construction of female ECRs from developing countries.

#### **1.4 Theoretical contributions**

The use of career construction theory (Savickas, 2013) and intersectionality scholarship has proposed an alternative theoretical framework for examining the construction of careers in developing country contexts. The study thus generates several important theoretical contributions in the areas of career construction, intersectionality, career choice and career decision-making, mentorship and network utilization, and in the areas of career self-management strategies. These contributions are summarised below:

- a) The study contributes to the understanding of how female early career researchers (ECRs) construct their careers, building on career construction theory (Savickas, 2013) and incorporating existing research on career choice (Holland, 1997), career adaptability (Savickas, 1997), and CSM (Lent and Brown, 2013). The study emphasizes how career construction enables the development of self-concept through

career identity formation and offers a possibility to explain the importance of career in developing and retaining a coherent, adaptable self-concept.

- b) By responding to calls to move beyond the favoured triumvirate of gender, race, class (Rodriguez, 2016) to explore other ways in which other social identities intersect with gender and race/ethnicity to shape career experiences, the study has highlighted the intersection of gender with occupational status (positionality) and situatedness on the experiences of women in non-traditional careers. Overall, the study contributes to the literature on intersectionality (Crenshaw, 1991a) by providing insights into the dynamics intrinsic to the scientific career field that impact the participants' sense of belonging (Morton, 2021).
- c) Further advancing the paradoxical implications of intersectional (in)visibility. While extant literature on the intersectional experiences of women tends to highlight the negative challenges women face (e.g., Tariq and Syed, 2018; McCluney and Rabelo, 2019; Morgan, 2020), the study builds on this to highlight these challenges while extending knowledge on intersectional (in)visibility (Purdie-Vaughns and Eibach, 2008) by emphasising a paradoxical viewpoint that illustrates the benefits and drawbacks of (in)visibility on the intersectional (in)visible group of female ECRs. The study offers a theoretical basis for how being an ECR, a woman, and a scientist is recognised as a significant triumph by one end of the spectrum (e.g., governments and advocates for women in STEM), allowing individuals to distance themselves from their stereotyped identifying group (Rosette et al., 2016) while also having to contend with the societal and institutional biases that confront their career advancement.
- d) This study proposes a new theoretical framework for understanding the career construction of female early career research scientists, incorporating career construction theory and intersectionality scholarship. The model highlights the

interactions between multiple identities and social structures that shape the meaning that female ECRs give to their careers. This new framework provides a more comprehensive theoretical foundation for understanding the unique challenges and opportunities that individuals from diverse backgrounds encounter in their career journeys.

### **1.5 Implications for policy and practice**

This study's theoretical contributions have implications for policy and practice on multiple levels, summarised below:

- a) The theoretical understanding of the development of the self-concept pertaining to the formation of the female ECRs' identity in the workplace can be useful for managers, and organisations seeking to promote diversity and inclusion. The study indicates that an inclusive workplace can help mitigate the identity paradox that arises among female ECRs and other minority groups while also fostering work satisfaction. Stevens, Plaut, and Sanchez-Burks (2008) propose the idea of an all-inclusive multiculturalism which challenges organizational institutions to cultivate inclusivity among their employees rather than taking a colourblind approach (e.g., ignoring race and racism). By applying the same logic to this situation, the study suggests that organisations in developing world contexts recognise that, in addition to the highly visible attribute of gender, an otherwise invisible and ignored characteristic such as being a 'newbie' can promote segregation and dissent in the workplace if measures are not taken to strategically orient and absorb these talented, yet frequently bemused newcomers, transitioning from students into their careers, into the organisation.
- b) Findings from this study provides guidance for career counsellors, educators, and policymakers on how to better support individuals from diverse backgrounds in navigating their career pathways. The application of the final model (Fig.7.1)

emphasizes the importance of taking a holistic and context-specific approach to career development that considers intersecting identities, cultural values, and socio-economic factors. This suggests that career development interventions and policies should be tailored to the individual's unique circumstances to better support their career journeys. For instance, career counsellors may need to consider the impact of cultural values and socio-economic factors on career decision-making for individuals from diverse backgrounds. Similarly, educators and policymakers may need to provide tailored resources and support to address career development barriers and enablers faced by individuals from different social identities and backgrounds.

- c) Educational institutions in developing countries must take career counselling more seriously and incorporate counselling resources into their mainstream activities, and must subsequently take it upon themselves to encourage students who are having difficulty navigating the social aspects of their educational environments or having problems making the right career decisions to utilise these services. Developing nations can incorporate career guidance and counselling into their education systems by making the necessary structural and systemic modifications, and where funding and resources are scarce, teachers can be professionally trained to assume additional responsibilities in career guidance and counselling.
- d) Women's performance and accomplishments in STEM need to be publicly recognized to address misperceptions that women are less capable, skilled, or have less expertise, as awareness of other women's success has the potential to retain women in STEM who might instead pursue other fields of study (Bloodhart et al., 2020). International agencies and institutions that support the 'Women in STEM' agenda may emulate the steps taken by the OWSD and Elsevier to shine light on the work on these phenomenal women, by coming together to create an academic mobility fund, and making it

available to early career female researchers and specialists from developing countries. Due to limited access to resources and grants for research, these targeted mobility funds could enable them to fund their projects and also accommodate the costs involved in travelling to conferences and other important functions that could benefit their career advancement.

### **1.6 Definitions of key terms**

**Career** – A set of occupational experiences and roles that makes up a person’s working life

**Career Choice** – Using Super’s (1957) definition, career choices are implementations of attempts to actualize the skills, talents, and interests reflective of one’s self-concept and are based on the completion of developmentally appropriate vocational tasks between the ages of 15 and 25 years.

**Career decision-making process** – The process of making a choice between particular career alternatives. The career decision-making process is ongoing throughout one’s professional life and as one’s career progresses.

**CCT** – Career construction theory (Savickas, 2013) explains the interpretive and interpersonal processes by which individuals organize their behavioural dispositions, impose direction on their vocational behaviour, and make meaning of their vocational development.

**Developing country** – In the current study context, one of the 66 scientifically and technologically lagging countries (STLCs) as listed by the Organisation for Women in Science from the Developing World (OWSD).

**ECR** – Early career research scientist: the transitional phase between PhD and senior-level positions (Christian et al., 2021). This study is aligned with the definition used by the UK research council, which tends to define ECRs by the number of years since completing a PhD, typically 10 years post-PhD.

**Gender** – refers to socially constructed roles, relationships, and behaviours, repeatedly performed based on societal norms (Morgenroth and Ryan, 2018). Gender is “culturally and historically specific, internally contradictory, and amenable to change” (Hegarty, Ansara, and Barker, 2018, p. 59).

**Intersectionality** – This is a theoretical and analytical tool for exploring, understanding, and addressing the ways in which gender intersects with other identities and how those intersections contribute to specific experiences of privilege and oppression (Crenshaw, 1991b).

**Microstoria** – Narrative inquiry that privileges the use of contemporaneous storylines to illuminate social life (Boje, 2001). Microstoria aims to explore the hidden stories of ‘little people’ and calls into question the grand narratives of macro-history, particularly elite ‘great man’ histories (Sarpong and Maclean, 2021).

**STEM** – Science, Technology, Engineering and Mathematics.

### **1.5 Structure of thesis**

The study is composed of seven chapters. The overall structure and description of key components of each chapter is summarised in Table 1 below. Table was adapted from the model originally created by Professor Charles Harvey.



**Table 1. Thesis Structure**

Chapter	Chapter Contents	Elements
2	Understanding careers, and the experiences of women in STEM	Theories – Previous studies – Gaps in literature
3	Research methodology	Methodology – Semi-structured interviews – Thematic Analysis
4	Issues and Findings <i>How do gender, situatedness, and positionality shape career identity perception in the early career discourse of women scientists from developing countries?</i>	Answers first research question
5	Issues and Findings <i>What are the practices that enable/impede careers of female ECRs from developing countries?</i>	Answers second research question
6	Issues and Findings <i>What strategies are drawn on by female ECRs from developing countries in self-managing their careers?</i>	Answers third research question
7	Conclusion	Review of main findings – Contribution to knowledge – Implications for policy and practice – Limitations and directions for future research

Chapter 2 begins with a general overview of careers, focusing on the old and modern notions of career and how career is formed over time. This is followed by a more critical review of the main themes in the literature in the areas of careers of women in STEM. This includes the motivations to enter into STEM, barriers and impediments to STEM careers, and enablers of STEM careers. An explanation of the theoretical lens is then offered.

Chapter 3 focuses on the empirical processes, choices, and activities undertaken to explore the career narratives of female ECRs from developing countries. The chapter begins by highlighting the context within which the study is conducted. It then moves further into the interpretive framework guiding the study and examines in depth the study's research methodology. Furthermore, it throws light on the ethical considerations involved in the study, before moving on to talk about data collection and its subsequent analysis. The obstacles encountered in data gathering and the criteria for evaluating the research follow, and the chapter concludes with a discussion of the methodological reflections and a summary.

Chapter 4 presents the first part of the three-part research findings and provides an understanding of how female ECRs typically begin their careers in science. The chapter demonstrates how intersectionality plays out in the labelling and identification of careers and presents its through three key themes: (1) getting in, (2) getting on, and (3) labelling and identification of scientific careers. The chapter ends with a summary and a model of how female ECRs label and identify their careers within the context of underdevelopment.

Chapter 5 presents the second part of the research findings and seeks to identify the advantages and disadvantages of participants' identities, which ultimately facilitate or hinder their careers as female ECRs. The chapter begins by shedding light on the career enablers, before moving on to career barriers. Moving on, an overview of how the various levels – individual, organisational, and national – intersect to confer privileges and/or penalties on early-career female scientists will be presented. The chapter will culminate with a model that illustrates how the overlapping identities of female ECRs from poor nations are both advantageous and detrimental to their careers.

Chapter 6, the last of the research findings chapters, examines in depth the strategies and coping mechanisms for self-managing a scientific career as a female ECR. The chapter begins with a

thorough examination of the revealing adaptive behaviours in which that participants engage to help manage or cope with their careers. The part that follows further examines the passing behaviours that participants have employed to manage their careers. A summary then concludes the chapter.

Chapter 7 provides an overview of the key findings of the study, followed by its main theoretical contributions. The implications for policy and practice are presented before moving on to highlight some of the limitations of the study, which also open new doors for further future research. The chapter ends with a summary.

## **CHAPTER 2**

### **Literature Review**

This chapter presents a review of the existing literature on careers and the experience of women in STEM, with the goal of providing a comprehensive and critical interpretation of what is already known in the literature about the subject matter, as a prelude for framing and justifying the study's research questions. The literature review is divided into three parts. Part one focuses on providing a narrative review of some of the foundational theories of career that will be utilised throughout the study. To understand the careers of females in Science, Technology, Engineering and Mathematics (STEM), there is a need to understand what really is meant by career and why its study is important. As such, the study commences with a historical synopsis of the concept of career within the management and organisation studies literature. Particular attention is paid to how career has been defined over time, focusing on what constitutes and what does not constitute career in contemporary discourse. It then moves on to explain other theories in the career literature, such as career identity, career self-management theories, as well as chance elements in career studies. The second part of the literature review provides a more critical review of extant literature on the experiences of women in STEM careers by highlighting what the literature has to say about their motivations to enter into STEM careers, and the barriers and enablers to their scientific career development. The third and last part of the literature review introduces the theoretical lenses that will guide the study and presents a conceptual framework that will ultimately steer the remainder of the study. A summary section concludes the chapter.

## PART I

### 2.1 Defining ‘Career’ in Organization and Management Studies

#### *2.1.1 Past Progress – What is career?*

Historically, careers have been viewed differently under various disciplines, before a concerted effort was made toward the development of career theory as a discipline in its own right in the mid-1970s (e.g., Hall, 1976; Schein, 1978; Van Maanen and Schein, 1979). For instance, economists fundamentally viewed career as a vehicle through which human capital is accrued through a lifetime of education and experience (Becker, 1975), while political science perspectives viewed career as a sequence of endeavours to maximize self-interest through successive attempts to gain power, status, or influence (Kaufman, 1960). In the area of sociology, career has been viewed as the unfolding of social roles, emphasizing individuals’ contributions to the maintenance of social order (Van Maanen and Barley, 1984), while psychologists have tended to view career in one of three ways: first, career as vocation, focusing on personality–occupation matching in ways which are mutually beneficial to the individual and the organization (Holland, 1985); second, career as a vehicle for self-realization and individual growth (Shepard, 1984); and third, career as a component of the individual’s life structure (Levinson, 1984).

Thus, when individuals use the term ‘career’ in ordinary parlance, it is generally perceived that they are referring to their ‘work’ career: that is, what they do for a livelihood, who they work for, or the jobs they list on their curriculum vitae (Adamson, Doherty and Viney, 1998). This notion of what a career may be is not entirely false, as the concept of career has come to mean different things to different people (Coupland, 2004). In spite of the extensive attention it has received in scholarship, it remains difficult for both scholars and practitioners to define career in a way that is compatible with the ever-changing organisational context (Adamson, Doherty and Viney, 1998). The paucity of scholarly work addressing the subject of ‘what is a career’,

coupled with the lack of consensus on what precisely a career is, has led to myriad definitions in the literature. After an extensive search, numerous definitions were identified, spanning a timeframe of about three decades, as illustrated below in Table 2.1.

**Table 2.1. Career definitions****Career definitions**

<b>Author</b>	<b>Definition</b>
Guan et al. (2019)	A series of work opportunities that go beyond the boundaries of a single employment environment
Greenhaus, Callanan, and Godshalk (2010)	A mobility path within a single organisation or multiple employers
Coupland (2004)	A residual trace of the individual's relationship with work
Olsson (2003)	A set of occupational experiences and roles that makes up a person's working life.
Savickas (2001)	The sequence of occupational positions that a person holds during their life.
Arnold (1997)	The sequence of employment-related positions, roles, activities, and experiences encountered by a person.
Jackson et al. (1996)	The steady ascent of a hierarchy, the accumulation of expertise in a profession, or movement through positions towards mature stability.
Arthur, Hall and Lawrence (1989)	An evolving sequence of a person's work experiences over time.
London and Stumpf (1982)	The sequence of work-related positions occupied throughout a person's life.
Guralnik (1978)	Progress through life in a particular vocation.
Van Maanen and Schein (1977)	A series of separate but related experiences and adventures through which a person passes during a lifetime.

As can be seen from the preceding chronology, the definition of career has experienced a major transformation since a precise definition first appeared in scholarly discourse around the 1970s, until the late 1990s when this definition began to take a different turn. The result is the emergence of two constructs of career: the traditional notion and the contemporary notions.

Traditional definitions of career, emphasizing hierarchical progression and development, have viewed it as a steady and linear process, in which progression typically occurs inside one or two organisations over the course of a lifetime (Fahmi and Siragi, 2021). Consequently, a number of theories have evolved to incorporate the study of careers and career counselling under this lens, including person-environment fit models such as Holland's theory (Holland, 1977, 1997; Zainudin et al., 2020) and developmental stage theories such as those of Levinson (1978) and Super (1990). A traditional career within the boundaries of an organisation is characterised by formal, upward changes, and all responsibilities, development, and training are closely tied to the organisational context, with managers acquiring knowledge of a specific company's traditions and culture (Nester and Buford, 2018).

This school of thought viewed career as a privilege for a select few, the majority of whom were typically men, and the external indicators of success were titles, salary, and climbing up the hierarchical corporate ladder (Arthur and McMahon, 2018). The employer-employee relationship was characterised by worker loyalty in exchange for the firm's implicit promise of job security (Davey, 2020). This conservative definition placed a great deal of responsibility on the organisation to provide careers for brilliant and ambitious individuals; and if a person was loyal, played by the company's rules, and associated with the right people, they were well on their way to a lifetime career in that organisation (Young and Valach, 2019).

The restrictive nature of the traditional definition of career, which placed a great deal of responsibility on the organisation and equated career to professional work (Young and Valach,



2019), combined with the economic, technological, and social changes over the years, has led to the near collapse of the traditional, linear, organization-driven career characterised by continuous, full-time employment with a single employer (Arthur and Rousseau, 1996). Employees pursuing contemporary careers, according to Greenhaus and Kossek (2014), are less likely to spend their careers in a small number of companies, experience frequent upward mobility within a company, and have substantial job security, while they are more likely to adjust their retirement timing to meet lifestyle needs, seek reduced-workload arrangements, telework, and make career decisions that accommodate their families.

Organisations' penchant for short-term commitments to employees has increased interorganizational mobility and fostered the need for those pursuing relatively traditional careers to manage their careers and remain employable (Cicek, 2020; Akkermans, Seibert, and Mol, 2018). Additionally, the combination of organisations' human-resources cost-cutting strategies and employees' desires to balance work and home responsibilities has made part-time employment an essential or appealing option for many individuals, with the percentage of part-time workers in some career fields reaching all-time highs (Cappelli and Keller, 2013; Jackson, 2018). Nevertheless, the traditional organisational career has not entirely vanished; rather, it has been supplemented by an increasingly diverse set of career patterns, recognising the socio-economic context from which understandings of 'new' careers, such as boundaryless (Arthur and Rousseau, 1996) and protean (Hall, 1976) careers, which are dynamic, individual goal-oriented and independent of organizational boundaries (Lyons et al., 2015), have emerged.

### ***2.1.2 What career is not***

The traditional definition of career laid significant emphasis on attempting to predict the fit of the individual to the suitability of specific work roles and to explain the dynamic social exchange processes defined by individual – organization interaction. In this vein, Van Maanen and Schein (1977/2016) found that there is a prevalent propensity to frequently equate career with what is commonly seen as professional activity. In their argument, prostitutes, plumbers, doctors, factory employees, managers, housewives, bartenders, waitresses, attorneys, criminals, and police officers all have careers, in their own right (Van Maanen and Schein, 2016). Therefore, to restrict the meaning of career to a vocational choice, professional status, social criteria for success, paid labour, or to any one organisation, as the conventional understanding of career has advocated, is to disregard the originality of the term and the role it might play in scholarship (Arthur, 2014; Arthur and McMahon, 2018).

Adamson, Doherty and Viney (1996) follow this logic and further argue that a career is distinct from a vocation, an occupation or simply a job, as a career paints a picture of a steady progression in organisational hierarchies. It is not simply about what one does for a living, but about what one has done, does now and might do in the future: the notion of career therefore embraces the dimension of time. Thus, the embracing of notions of development and progression cannot limit a career to one vocation or job that an individual takes up. Another subject of contention is the notion that career is determined by the organisation. As argued by Adamson, Doherty, and Viney (1996), first, the career fundamentally belongs to the individual. It is not something which is, or indeed could be, ‘owned’ by organizations. Neither is it something which organizations necessarily have the right to ‘manage’. In this sense, the career becomes highly subjective (Haenggli et al., 2022) and may be further theorized as a lifelong vehicle for the continuous realization of self (Adamson, 1997).

### ***2.1.3 Defining today's career***

Having reviewed what career used to be and what it is now, this study identifies *career as a set of occupational experiences and roles that makes up a person's working life*. Defining career in this way is plausible because it reflects the needs of today, as people choose to engage in various occupational roles within single organisations (for instance, entrepreneurs building and managing their venture) or multiple employers (the boundaryless career). This is also true in the sense that the term 'career' implies a 'route' that one is following – a route which has both direction and purpose (Adamson, Doherty, and Viney, 1996). Without some ordering of work experiences over time, and without some logic to the linkages between successive positions occupied over time, the career 'journey' ceases to have meaning.

It is well established that traditional definitions of career, emphasizing hierarchical progression and development, therefore no longer provide us with the explanatory vocabulary to understand the apparently changing reality of managerial careers in the post-bureaucratic organization. Our definitions should embrace the notion that the career performs a fundamental function in the continuous construction and maintenance of a healthy self-concept, congruent with individuals' changing strengths and weaknesses, shifting beliefs and attitudes and future aspirations. Viewing a career as the evolution of work experiences over the life course implies that all individuals who are engaged in work-related activities have a career, thereby rejecting the overly restrictive constraints that have historically equated a career with a high level of work commitment, professional status, rapid upward mobility, or stability in an occupation (Greenhaus et al., 2010).

## 2.2 Career Identity Construction

Identity refers to the various meanings that an individual and others attach to themselves (Gecas and Burke, 1995; Clarke and Ravenswood, 2019). These meanings might be derived from a person's social roles (social identity) or their own characteristics and qualities (personal identity) (Ashforth and Mael, 1989). Prior research has demonstrated that individuals have multiple identities (Brown et al., 2009), some of which are more dominant than others, and that these identities are likely to change over time (Savickas et al., 2009) as individuals engage and relate with different social groups, particularly in work-related roles and activities (Wrzesniewski and Dutton, 2001). Individuals can use the social context of work to investigate the meaning of work and their work identities, which support fundamental ideas about who they are and why their work is significant (Clarke and Ravenswood, 2018).

Marcia (1993) perceives adolescence as a period in which the young go through an identity crisis, which they solve by making choices for their own future in a number of areas. The key tenets here are commitment and exploration (Kusuma and Suwarjo, 2019; Wendling and Sagas, 2019). Commitment refers to the ability to care about certain values and norms. According to Marcia, this particularly concerns values and norms relating to career, gender role and political ideologies. Exploration refers to the ability to step outside the frame of reference that was used until then. Marcia's identity statuses model is often interpreted as a development model (Xu and Lee, 2019). Developing an identity is then regarded as a hierarchically layered development process: a development that starts with lower forms of identity and leads to higher ones. Empirical research only partly supports the view that identity statuses can be interpreted in terms of a development model (Meijers et al., 2017).

However, the identity indeed develops through a succession of phases. No one ever jumps from identity diffusion to identity achievement (Meijers et al., 2017; Meijers and Lengelle, 2012). In brief, it can be said that the identity is an 'I-structure' which the individual himself constructs

by exploring and experiencing his environment, and by then choosing specific values and norms that determine his behaviour (Marcia, 1993). The 'I-structure' must be seen as a more or less coherent but at the same time continually changing whole of identifying, idealising, and social views about the self. These views about the self do not spring up in a vacuum, but evolve from the individual's interaction with his environment. The individual not only reacts but also anticipates and idealises (Wendling and Sagas, 2019). We do not have one undivided 'I-structure' here, but several identities.

Depending on the role demands made by a particular society on adults, the young on their way towards adulthood feel forced to develop an identity in certain areas (to explore and choose). It is therefore quite justifiable to speak of a career identity as a (more or less autonomous) part of the entire personality (Kusuma and Suwarjo, 2019). Considering the changes in the nature and organisation of the work (increased social and work-related insecurity, diminished importance of specific skills, and growing emphasis on personality traits), taking this responsibility means that they have to develop a career identity and, on the basis of that identity, determine their direction in life (Draaisma, Meijers, and Kuijpers, 2018). The study of career identity is thus embedded in the study of personal identity (Clarke and Ravenswood, 2019). Boyatzis and Dhar (2021) highlight the significance of identity in determining a person's position in society based on the ties implied by the meanings they select for themselves.

London (1983) developed one of the first conceptualizations of career identity. He defined career identity as a measure of the importance of the career in the individual's personal identity, consisting of two sub-domains: (1) work involvement; and (2) the desire for upward mobility. Opsata (2020) proposed that persons with a strong career identity are more inclined to value career fulfilment over other types of satisfaction. For Brewer and Gardner (1996), career identity is organized as a tripartite entity of levels of self-representations that make up identity: (a) the individuated or personal self, which refers to the traits people ascribe to themselves as

part of their self-definition (for instance: 'I am energetic'); (b) the relational self, in which dyadic relationships are incorporated into someone's identity (for instance: 'I am a team leader'); and (c) the collective levels of self that refer to an extended sense of self (for instance: 'I am a textile worker'). As observed by Nazar and Van der Heijden (2012), this notion of an enlarged identity is in line with Social Identity Theory and refers to the expansion in the way individuals think about themselves, by including larger sets of social objects which, in the context of work, tend to refer to teams, professional groups, and organizations, among others.

Consequently, career identity is best defined as the career objectives, attitudes, and beliefs that inform our self-concept and enable us to answer the question of 'Who am I?' (Lysova et al., 2015), which describes the way an individual thinks about his or her interests and abilities in relation to career goals; and once there is clarity and consistency around what constitutes the self, occupational decisions can be made (Savickas, 2007). According to Meijers (1998), career identity also refers to a "structure of meanings in which the individual links his [sic] own motivation, interests and competencies with acceptable career roles" (p. 191). Meijers (1998) further states that as individuals are constantly exposed to new life experiences, structure is brought about by achieving balance between cognition, will, and emotion by revising old meanings for potentially new ones in a work-related environment.

Rosso, Dekas and Wrzesniewski (2010) observe that career identity provides a sense of meaning through which one can approach, enact, and experience one's work and workplace behaviour. Therefore, in line with the psycho-sociological theories of the self-outlined above, career identity can be primarily defined as an aggregate of self-representations that people ascribe to themselves in the work context that includes characteristics derived from different referents of social identification (Nazar and Van der Heijden, 2012). Career identity is viewed as a subjective phenomenon that individuals possess. It comprises individual dispositions such as traits, beliefs, values, intentions, and experiences (Schein, 1996) and can be measured by its

content, clarity, or intensity (Fugate, Kinicki and Ashforth, 2004; McArdle et al., 2007). Based on developmental theories in psychology (e.g., Erikson, 1968; Super, 1957), identity is also seen to form in stages, achieving stability over time (Sullivan and Al Ariss, 2021). Despite the growing recognition of its social impacts (Ibarra and Deshpande, 2007; Dobrow and Higgins, 2005) and the questioning of its unitary character (Ibarra, 1999), professional identity is typically viewed as an internal variable with normative assumptions of clarity. Yet, according to discourse-based identity theory, identities are produced and given meaning within social and cultural practices through discourse (Gergen and Williams, 2014).

LaPointe elucidates this viewpoint by positioning career identity as a socially situated discursive phenomenon (LaPointe, 2010). Further, he believes that (contrary to the constructivist perspective) a career identity can only form and exist as a result of engagement with others (a constructionist approach). Thus, rather than residing in the individual, identity manifests in discourse. In comparison to organizational and professional identity, career identity is not tied to a particular role or place, but derives its meanings from the sequences of work-related experiences (Fugate, Kinicki and Ashforth, 2004). A career identity is therefore the result of a co-construction (Cohen, 2006). From this perspective, identities emerge as a result of interaction and negotiation on the basis of a reflective capacity concerning the available positions and the particularities of a given time and place (Meijers and Lengelle, 2012; Meijers, 2018). In this way, it can provide a more adaptable foundation for identity creation (Ashforth, Harrison, and Corley, 2008) and assist in defining who one is and how one should act in the context of a changing career (Fugate, Kinicki and Ashforth, 2004).

Adding the element of time, the concept of a career identity is one that is dynamic and always changing. This is supported by the longitudinal character of career identity, which involves making sense of one's past, present, and future (Fugate, Kinicki, and Ashforth, 2004). This relates to the fact that during the course of a person's lifetime, the importance of their past,

present, and future continues to evolve (Plunkett, 2001). Meijers (1998) contends that career identity is not simply a collection of work-related events, but rather the integration of these experiences into meaningful structures. Because of their dynamic character, career identities are also susceptible to changes in the employment environment, which can occur when people move between organisations and stages of life. Each of these situations requires the individual to adapt to the demands of a fundamentally different occupational standard and work culture, which may or may not be consistent with his or her current career identity (Rastogi, 2018).

In sum, there is increasing consensus that career cannot be understood as separate from one's personal life experiences (Collin and Young, 2000). Extant literature on career identity construction suggests that self-views are shaped in three primary ways. First, career identity is the result of the socialization process and rhetoric where one is provided with information regarding the meanings associated with a profession (Rosso, Dekas and Wrzesniewski, 2010). Second, researchers suggest that individuals adjust and adapt their career identity during periods of career transition (Nicholson, 1984; Ibarra, 1999). Finally, Schein (2021) suggested that life as well as work experiences influence career identity by clarifying one's priorities and self-understanding. However, Wendling and Sagas (2022) observe that although this adds immensely to the body of knowledge in the field, the voice of the minority professionals, who often face stigma and discrimination as they enter career fields, is often absent.

In the words of Piore and Safford (2006, p. 319), "It is impossible in today's world to imagine one's career without incorporating one's social context into it, such aspects of lives as the social stigma that may attach to one's race, religion, or gender." Therefore, the existing literature may offer faulty generalization (Kusuma and Suwarjo, 2019) by failing to consider the career identity construction processes of women scientists from developing countries, as the focus of recent studies on scientific careers is predominantly situated in highly developed countries such



as the UK (Duberley and Cohen, 2010; Bornat, Henry and Raghuram, 2011), Germany (Pizzorno, Benozzo and Carey, 2015) and the US (Farland-Smith, 2012).

### ***2.2.1 Career identity as a narrative discourse***

Narrative approaches in the context of career studies explore how crucial turning points and career decisions are framed to cope with past or present changes and to motivate potential future changes (Gabriel and Connell, 2010; Fraher and Gabriel, 2014; Hoyer and Steyaert, 2015). Narratives as the site for identity construction are not free-standing, self-contained units but are always embedded in the local conditions and emerge as a result of interaction, as argued by LaPointe (2010, p. 3). Past concepts of career identity as internal to the individual can be traced all the way to the philosophical ideas of 16<sup>th</sup> century humanism and 17<sup>th</sup> century enlightenment and the Romantic movement (LaPointe, 2010). Identity became a goal of the self and was regarded as an innate, genuine self, requiring exploration and expression (Taylor and Whittier, 1992). In the 20<sup>th</sup>-century theories of George Herbert Mead (symbolic interactionism) and Erving Goffman, identities were increasingly considered as social creations, although they were still viewed as living in the individual (Holstein and Gubrium, 2000).

The narrative identity approach outlined in this study, however, is based on the philosophies of identity as a discursive and performative phenomenon (Gergen, 1991; Benwell and Stokoe, 2006; LaPointe, 2010; Butler, 2011). These reinterpretations are the outcome of the linguistic turn, which evolved from philosophical views of the role of language as actively producing reality rather than just reflecting or representing it. Consequently, discursive methods consider identity as a product of language and culture, calling into question the modernist concept of a pre-discursive, essential identity or a genuine inner self (Benwell and Stokoe, 2006). In other words, rather than residing in the individual, identity manifests in discourse (LaPointe, 2010).

By incorporating elements from narrative and discourse theories, career narratives are enhanced because they become more engrossing, intense, and authentic. According to narrative theory, a narrative text has at least two parts: the ‘what’ (what is communicated) and the ‘how’ (how is it told) (Chatman, 2022).

#### **2.4 Career self-management theory (CSM)**

The social-cognitive model of career self-management (CSM) tries to comprehend the adaptive behaviours that individuals employ to anticipate and adjust to a variety of educational and professional problems in their lives (Lent and Brown, 2013). The CSM model focuses on how individuals attempt to influence their own professional growth, regardless of the exact career categories towards which they are inclined (e.g., to seek work, juggle several duties, or adjust to transitions). The CSM model emphasises the interaction between self-efficacy, outcome expectations, and goals, as well as contextual supports and barriers, individual inputs such as personality traits and abilities, and learning experiences that either promote or inhibit the development of self-efficacy and outcome expectations. The CSM concept, which emphasises personal agency, highlights individuals’ commitment to career advancement (Runhaar, Bouwmans, and Vermeulen, 2019).

Wilhelm and Hirschi (2019, p. 119) define CSM as “the process of developing, managing, and deploying many personal and contextual resources in a manner that yields positive professional outcomes.” This procedure involves a range of actions, from the meticulously planned and proactive to the routine, impulsive, and reactive. The existence of some form of individual human activity in the driver’s seat of career management is a common denominator throughout this diverse collection of variables (Emirbayer and Mische, 1998). This does not imply that social and cultural aspects of work, workers, and workplaces have no influence on the agency

of individuals in CSM. CSM, on the other hand, emphasises the various ways in which agency reveals itself in people's behavioural patterns in response to various settings. Researchers have identified a range of CSM techniques up to this point. Lent and Brown (2013) proposed an early classification of CSM techniques, dividing them into two categories: developmental and coping. Developmental CSM refers to actions that assist people in realising their full potential. Coping CSM, on the other hand, refers to the steps people take to adapt to their work environment and overcome – or at the very least, endure – obstacles.

Wilhelm and Hirschi (2019) categorised CSM techniques based on their behaviour orientation as self-directed, context-directed, or CSM process control-directed. Self-directed CSM techniques apply, preserve, or cultivate personal resources such as knowledge or prestige. Context-specific CSM strategies are those that apply, maintain, or increase contextual resources such as influence and mentorship. CSM techniques designed to regulate the CSM process regulate the boundary between the workplace and other living domains. As shown by the aforementioned instances, there are numerous ways of identifying CSM processes in the literature, each of which is appropriate to the specific objectives of a given investigation. The majority of distinctions between types of CSM within these groups are predetermined (based on theoretical speculation rather than empirical investigation).

As a result, determining whether a classification is appropriate for organisational members has proven challenging, especially outside the scope of the original study. Moreover, even empirical studies that uncover CSM approaches are usually snapshots that fail to demonstrate how and why individuals adopted particular CSMs. This study argues for a new approach to classifying CSM strategies by focusing on one type of work environment (scientific research) and empirically identifying CSM strategies by prioritising the pragmatic link between these strategies and how individuals understand and react to peculiar work contexts.

## **2.4 The role of chance in careers**

Career development may not always be the outcome of rational planning and action. As noted by Bornat, Henry and Raghuram (2011), there is always more to the story of successful people than hard work. Significant attention ought to be paid to the constructive part played by luck and chance (Bright, Pryor and Harpham, 2005). Luck is an important factor in life, and serendipity plays a crucial role in the way life unfolds, including working life (Grimland, Vigoda-Gadot and Baruch, 2012). In the arguments of Mitchell, Levin and Krumboltz (1999), chance plays an important role in everyone's career. No one can accurately foretell the future. On any given day, it is impossible to predict who will be encountered, who will call, or what letters or e-mails will arrive. If it is impossible to anticipate a single day, what are the chances that future plans covering 2, 5, or even 20 years can be executed accurately? (Mitchell, Levin, and Krumboltz, 1999, p. 116).

Various terms are employed in the research on chance events. These terms include chance (Roe and Baruch, 1967), happenstance (Miller, 1983; Mitchell, Levin and Krumboltz, 1999), fortuity (Bandura, 1998), and serendipity (Merton and Barber, 2011). According to Marshall and Symonds (2021), the common position of all these terminologies is that chance events are unanticipated and potentially affect a person's vocational choices, behaviours, and successes. In establishing his social cognitive theory, Bandura (2005) hypothesised that unanticipated events can have an influence on individuals, creating a potential chance effect on cognitive functioning and social learning experience. Chance events are commonly defined as "unplanned, inadvertent, or otherwise situational, unpredictable, or unintentional events or interactions that influence career development and behaviour" (Rojewski, 1990, p. 262).

Chance events have an impact on the workplace and frequently coincide with an individual's attempts to shape his or her career (Chen, 2005). However, in the majority of professional development theories and practices, chance is rarely explored and examined (Mitchell, Levin,

and Krumboltz, 1999; Chen, 2005). According to Chen, this is acceptable, since academics and practitioners do not wish to portray life career growth as pre-set and unavoidable. Learning how to control one's own personal factors (values, opinions, interests, and abilities) and how they interact with the real world of work is the objective of career development training (workplace requirements and labour market situation). Greater ideal control can be reached through the promotion and execution of individual agency (Lent, Brown, and Hackett, 2002), the improvement of cognitive information processing (Sampson Jr et al., 2014), and contextual action (Young, Valach and Collins, 2002).

The role of chance in people's careers and working lives is an essential topic that is rarely mentioned in this context. Chen (2005) makes the case that the concept of chance and its distinctive role in the exercise of human control must be considered. Chen continues by stating that when exercising human control, it is essential to consider the frequency of random occurrences in the lives of individuals. According to Hotchkiss and Borow (1996), a variety of social, economic, cultural, and family factors can either facilitate or impede a person's professional development. These components include the makeup of the labour market, the influence of race and gender, the significance of education, and the impact of the family, particularly the family's socioeconomic status. In this regard, the status attainment theory, which asserts that a person's parents' social status determines their child's degree of education, which in turn affects their occupational level, is typical (Hotchkiss and Borow, 1996).

In other words, a person's family background frequently influences whether or not their environment is favourable to their professional achievement. Numerous examples from research investigations provide proof that this claim is plausible (Hotchkiss and Borow, 1996). The likelihood of psychological and physical health is higher for children from middle-class and upper-middle-class households because they have more access to benefits, including more financial assistance and better living and educational surroundings. It is not unexpected that

children from wealthy households eventually attain a higher occupational level that correlates to their families' greater socioeconomic standing because of this blatant element of chance (Hotchkiss and Borow, 1996). In tandem with this actuality, children from families of lower socioeconomic class usually lack resources, which reduces their chances of attaining higher levels of occupational attainment or heightens barriers to their future career success (Hotchkiss and Borow, 1996). Even at the level of schooling, the prevailing organisations and structures appear to sustain social inequality, affording some individuals better opportunities for success and advancement while diminishing those of others.

According to a 2002 study by Johnson and Mortimer, the 'ability grouping' and 'tracking' systems in North America can have a major impact on students' career accomplishments. It is understandable why students in the 'academic stream' are more likely to pursue further education than their counterparts in the 'vocational stream' and the 'general stream' because such a system is regularly implemented at the elementary level. At the organisational level, comparable random events are readily observable in the broader social structure, especially in the macro- and micro-economic systems and their associated labour market structure. Sociologists' description of the 'two-tier', 'core', and 'periphery' structure serves as a prime illustration (Chen, 2005). Larger organisations in the core sector provide greater employment stability, financial and other perks, and professional progression opportunities.

In contrast, firms in the periphery offer less security, lower income, and fewer chances for professional and career advancement (Hotchkiss and Borow, 1996; Johnson and Mortimer, 2002). Therefore, workers in the former sector have higher professional progression chances than those in the latter. The theory of intentional happenstance, presented by Mitchell, Levin, and Krumboltz (1999), is a considerably more recent paradigm that directly addresses the role of chance. According to these authors, this theory is a modification of the learning theory of career counselling (Krumboltz, 1996), which was an enlargement of the social learning theory

of profession choice (Krumboltz, Becker-Haven and Burnett, 1979). The primary assumption of this conceptual framework is that individuals must capitalise on life's occurrences. Planned happenstance is the human effort to utilise these life circumstances in the most advantageous manner. According to Krumboltz, Foley, and Cotter (2013), job opportunities frequently exceed human expectations. Nonetheless, with a good outlook and a set of creative talents, one can learn to manage and use these opportunities.

Planned happenstance theory as a conceptual framework replaces ambivalence with open-mindedness to tolerate ambiguity and establish an adventurous mindset (Mitchell, Levin, and Krumboltz, 1999). Blustein referred to this as exploratory attitude, defined as an open and flexible style of interacting with the environment that enables an individual to address the large number of new events and changes that they encounter in a way that fosters personal development and self-definition (Blustein, 1997). Thus, individuals should not passively rely on luck to solve difficulties, but rather should remain open to new and unexpected opportunities while actively searching (Mitchell, Levin, and Krumboltz, 1999). Planned happenstance theory posits that individuals can be aided, for example through career counselling, in developing five abilities to perceive, generate, and utilise chance as career possibilities. According to Mitchell, Levin, and Krumboltz (1999), these five competencies are as follows:

1. Curiosity (exploring new learning opportunities)
2. Perseverance (exerting effort despite setbacks)
3. Adaptability (changing attitudes and circumstances)
4. Optimism (viewing new opportunities as possible and attainable)
5. Risk-Taking (taking action in the face of uncertain outcomes).

To master the chance factor in careering, a person must normalise intended happenstance in life career experiences, translate curiosity into learning and exploration opportunities, generate desirable chance events, and overcome impediments to action (Mitchell, Al Levin and Krumboltz, 1999). By doing so, a person can maximise the positives and minimise the negatives associated with a chance occurrence in his or her life and profession (Chen, 2005). In accordance with the contextualist definition of career provided by Young, Valach, and Collin (2002), a person's career encompasses a variety of settings and circumstances that serve as the context for their experiences and interpretations. In light of this context definition, it is acceptable to believe that not all contexts are predictable. Thus, the element of chance can play a role in creating a person's life and career setting.

## **Part II**

### **2.5 Experiences of females in STEM careers**

Extant literature on scientific careers provides key insights into how scientists enact their careers in light of dynamic contextual circumstances, focusing on such issues as increasing managerialism, the changing relationships with stakeholders and the gendering of scientific careers (Cohen and Duberley, 2013). As a result, the past two decades have seen a shift in the gendered nature of scientific careers, particularly women's underrepresentation in STEM disciplines (Kanny, Sax, and Riggers-Piehl, 2014).

#### ***2.5.1 Motivation to pursuing a career in STEM***

Motivation plays a crucial role when it comes to learning behaviours and career choice, as well as persistence (Ihsen et al., 2013). Motivation describes the combination of a trait-like preference and a positively experienced, situation-specific state when working on a task (Macher et al., 2013). Motivation explains the degree to which an individual tries to achieve a



particular goal (Luttenberger, Paechter, and Ertl, 2019). While some evidence suggests that gender differences in STEM motivation often emerge prior to university (Cheryan et al., 2017), others have argued that gender variations in STEM competencies are inconsequential (Tyler-Wood et al., 2012). Within this stream of research, literature has examined: i) the career choice and career decision making process involved in STEM careers; ii) major factors influencing the gender disparity in STEM; and iii) the leaky pipeline model and why this occurs.

### ***2.5.1.1 Career Choice and Career Decision-Making Process***

Over the years, a rich body of research about women's career choices and career decision-making (Holland, 1997; Lent and Brown, 2020) in STEM careers has emerged (Cheryan et al., 2017; Dasgupta and Stout, 2014; Leaper, 2015; Lewis et al., 2017). Career decision-making has been identified as one of the most challenging and often stressful decisions people have to make in their lifetime, often having the potential to lead to career inaction (Argyropoulou et al., 2007). A common thread under this stream of literature is the primary focus on three distinct, yet interrelated facets, namely the role of family, peers, and exposure to role models; the role of society and institutions; and the role of individual agency in career decision-making.

#### ***Role of Family, Peers, and Exposure to Role Models***

In their works, Cheryan et al. (2017), Dasgupta and Stout (2014), Leaper (2015), Lewis et al. (2017) all called attention to the various ways in which instructors, peers, and families can influence girls' and women's motivation or sense of belonging in STEM fields. Scholars who have proposed the idea delve deeper into the role of these significant figures in the decision-making process for making career choices in STEM and argue that experiencing encouragement for STEM from family and friends may help to bolster women's motivation

and encouragement to pursue STEM careers and empower them to deal with the discrimination and biases that are likely to exist (Leaper and Starr, 2018).

Leaper, Farkas, and Brown (2012) found that parental and peer support for maths and science predicted adolescent girls' motivation in these subjects while controlling for grades. Robnett and Leaper (2013) further emphasised that experiencing friends' support for maths and science predicted high school students' science career aspirations, although girls were less likely than boys to report this kind of support. The authors proposed that having a friendship group that supports science (or STEM) may foster a sense of belonging in the subject. A more in-depth approach to understand the influence of family on career decision-making for girls in STEM careers for women is provided in Wang, Degol and Henry's (2019) systematic literature review.

Based on a developmental contextual approach, this coherent review sheds light on the embeddedness of families within the larger structural contexts (e.g., cultural values, sociodemographic factors) that are likely to shape engagement directly and indirectly through parental beliefs about and expectations for their children's success (Reschly and Christenson, 2019; Wigfield et al., 2006). Lareau (2011) found that families with low socioeconomic status tend to adopt a more authoritarian parenting style and prioritize safety, obedience, and natural development as child-rearing goals. In contrast, families with higher socioeconomic status are more likely to expose their children to intellectually enriching activities and to better comprehend how to intercede within the school system. Multiple lines of research have all pointed to the fact that, irrespective of racial, ethnic, and socioeconomic background, parental involvement in education matters for children's engagement (Melby et al., 2008; Murray, 2009; Wilder, 2014; Agger, Meece and Byun, 2018; Akosah-Twumasi et al., 2018).

In another spectrum, a number of studies have established that exposure to female role models can improve girls' and women's performance and interest in STEM fields, but results have

been mixed, with some studies demonstrating the benefits of female role models (e.g., Stout et al., 2011), and others finding that role model gender does not make a difference (e.g., Cheryan et al. 2013). Lawner et al. (2019), for instance, argued that while ingroup role models may be effective, the effect size is small and the presence of a role model by itself is not enough. However, as argued by González-Pérez, Mateos de Cabo and Sáinz (2020), the optimal way to encourage young girls to pursue emerging high-growth roles, particularly those requiring STEM math skills, is to expose them to the professional and personal experiences of actual female role models with a successful professional trajectory in STEM fields.

Olsson and Martiny (2018) talked about counter-stereotypical role models (e.g., mothers in non-traditional work, female politicians, and female faculty) in role aspirants' natural environment and how these are positively correlated with their aspiration toward, and engagement with, counter-stereotypical roles. Moreover, Robnett (2016) observed a similar relation between peer support for STEM and motivation in a sample of undergraduate women majoring in STEM (Leaper and Starr, 2018). The authors hypothesized that both friends' and family's support of STEM would positively predict women's motivation (competence beliefs, value, and perceived costs) and STEM career aspirations (Leaper and Starr, 2018).

Despite these empirical results about the role of family, peers, and role models on the career decision-making of women in STEM, some studies have further shown the difference in family support between male and female STEM students but no significant difference in most variables like motivation, STEM course self-efficacy, and STEM career aspirations. This indicates that a gender difference still existed in family support between male and female STEM students, even though they had similar academic ability and self-efficacy on STEM courses. These results revealed that female students who had already studied a STEM discipline at the same selective research university (thereby possessing similar academic ability to the male students) still perceived lower family support during their experiences of learning STEM

courses (Tzu-Ling, 2019). In a nutshell, research has highlighted the role of family, peers, and exposure to role models in women's career choice and career decision-making in STEM. While this has been very useful, it would be prudent to move the conversation further by including additional studies to reinforce the impact and implication of these markers.

### *Role of Society and Institutions*

The role of society and institutions on the career decision-making process is another area of interest for scholars. In this area of research, several studies have investigated the role of society and institutions in the career decision-making process of women in STEM careers. Here, the impact of the masculine image on students' aspirations in STEM fields is an area that has received significant attention (Makarova, Aeschlimann and Hezog, 2019). Scholars have found that with respect to gender differences, female students' attribution of masculinity to science subjects does not differ significantly from that of male students (Makarova, Aeschlimann and Hezog, 2019). While the issue of female's attrition to STEM subjects may not be significantly different from that of males, scholars have found that the effect of gender and ethnicity on career decision-making among adolescents may be underestimated (Gottfredson et al., 2005; Wang and Degol, 2013). For instance, it has been found that underrepresented minority students are more likely to face institutional and individual level discrimination and stereotyping that may impede the STEM decision-making process (Brown et al., 2011).

Grossman and Porche (2014) suggest that sustained exposure to negative biases can deprive individuals of the necessary resources (such as skills and attitudes) for STEM career development and subsequent success. Nonetheless, extant research has documented that the processes of career decision-making are more complex and restrictive for women than for men in STEM (Blustein et al., 2008; Hüttges and Fay, 2015), and many researchers have noted the need for career interventions to specifically address the effects of gender on career development

(Penick and Jepson, 1992; Langowitz, Allen, and Godwyn, 2013). As Blustein (2011) firmly echoes, career development is understood as occurring within a network of relationships, with the emergence of vocational interests, choices, decisions, and opportunities to access and advance in the workplace deeply entrenched in culture and relationships. In sum, these studies point to the need for further investigation into the impact of society and institutions in different contexts to evaluate their unique impacts on the career decision-making process of women in STEM.

### *Role of Individual Agency*

The role of individual agency over one's career decision-making is another area that has been explored by researchers. There seems to be consensus among career development scholars that strong self-efficacy beliefs are critical for the pursuit of a career. Falco and Summers (2019), for instance, used Bandura's (1989, 1997) social cognitive theory to analyse the role of self-efficacy on students' likelihood to engage in self-regulation (e.g., set goals, use effective learning strategies, and evaluate their goal progress) and create adaptive learning environments for themselves (e.g., eliminate or minimize distractions, find effective study partners). It was discovered that self-efficacy can be influenced by the outcomes of behaviours (e.g., goal progress, achievement) and by input from the environment (e.g., feedback from teachers, social comparisons with peers).

Other studies have looked at the role of values in making career choices. Altruistic values were observed as a predictor to STEM choices as strongly as prior grades and ability self-concepts (Wang, 2012; Wang and Degol, 2013). Wigfield et al. (2015) and Wigfield and Eccles (2002) both posit that the choice of university studies is most directly influenced psychologically by ability, perceptions of competence (expectations for success), and the task value attached to the different available options. Individuals will therefore choose those studies they believe they

can master and that are of value to them (Eccles, 2009). That is, values and ability beliefs (expectancy for success) are the most important predictors of academic choices and behaviours (Sáinz et al., 2018). However, in recent times, goal-congruity theory has emerged as a framework to explain gender differences in STEM career paths (Diekman et al., 2010, 2017; Eagly and Wood, 2011). There are two central components to the theory, both of which have been supported by a number of empirical studies. First, women are more likely than men to hold ‘communal goals’, defined by collaborating with others or helping others (Diekman et al., 2011). Second, stereotypes portray many STEM careers as uncommunal, and the resulting mismatch between communal goals and perceptions of STEM fields leads to decreased STEM career interest (Diekman et al., 2010). Feminine gender self-schema is linked to career aspirations (Weisgram, Dinella, and Fulcher, 2011). It is implied that perceptions of a STEM field may not be primarily defined by associations with maths or science, but rather with afforded opportunities to express personal characteristics, such as altruism or femininity (Wegemer and Eccles, 2019).

The motivation to enrol in a STEM major and stay on a chosen STEM career path usually results from a combination of both high intrinsic and extrinsic motivations (Aeschlimann et al., 2016), with male STEM students’ motivation mostly exceeding that of female students (Ihsen et al., 2013). Gendered values, identities, and beliefs are interrelated components of a motivational system that may influence STEM career choices in ways that contribute to uneven female representation (Wegemer and Eccles, 2019). In STEM subjects, women often have a more negative self-concept than males, even if they actually have the same grades and achievements (Watt, 2004; Frenzel et al., 2010; Watt et al., 2012). Girls are more likely to attribute success to external factors and failure to internal factors such as a lack of mathematical ability (Seo, Shen, and Alfaro, 2019). These studies, however, all appear to be concerned with numbers and therefore take on a strong quantitative front. Further studies are therefore needed,

taking more qualitative and mixed-method approaches, to understand the nuanced implications of personal agency over career decision-making.

### ***2.5.1.2 Major Factors Influencing Gender Disparity in STEM***

Various schools of thought have come up with their own explanations of the factors influencing the gender disparity that exists in STEM careers, the most common ones being between micro- and macro-level factors that affect gender inequality in STEM (Thébaud and Charles, 2018; Wong and Charles, 2018). Micro-level explanations are often grouped into ‘supply-side’ and ‘demand-side’ factors to account for why this disparity exist. Studies on supply-side explanations are not recent and have tended to focus primarily on differences between men and women in terms of aptitudes, preferences, or workplace productivity (Becker, 1975; Mincer and Polachek, 1974). These arguments tend to attribute women’s underrepresentation to fundamental gender differences in abilities and preferences, with women expressing stronger orientation toward interpersonal relations and care, or to men’s greater investment in the requisite human capital or greater capacity for analytical thinking (Thébaud and Charles, 2018).

Demand-side explanations, on the other hand, switch the focus from attributes of men and women workers to actions and attributes of employers. The simplest demand-side explanation for labour market inequality is that employers with ‘tastes for discrimination’ are willing to pay a wage premium to hire members of preferred groups (Becker, 1957). Some of the most compelling evidence of discrimination in STEM hiring has been gathered through experiments and audit studies. One double-blind audit study demonstrated, for example, that STEM faculty members were less likely to hire female than male candidates for a lab manager position, because women were perceived to be less competent (Moss-Racusin et al., 2012; Goldin and Rouse, 2000). Other research has shown that faculty are more likely to respond to email requests for graduate mentoring from persons with male, white-sounding names (Milkman et al., 2015) and that scientific papers are judged to be of higher quality when attributed to a male

author (Knobloch-Westerwick et al., 2013). Blair-Loy et al. (2017) provide new evidence of unequal treatment in the STEM hiring process in the form of videotaped job talks that show more interruptions of female than male candidates for faculty engineering positions.

Macro-level explanations of the gender disparity in STEM, however, focus on societies or countries as the unit of analysis (Thébaud, 2015; Ecklund and Lincoln, 2016). Although most countries have been resolute in incorporating women into their labour forces, ‘women’s work’ for a rather long time did not include most STEM occupations (Gornick and Meyers, 2003; Charles and Cech, 2010; Thébaud, 2015; Ecklund and Lincoln, 2016). On the contrary, identity-based motivation theory has been used to suggest that the STEM gender gap is particularly problematic, as female students are less likely than their male counterparts to find STEM careers compatible with their gender identity (Solanki and Xu, 2018). However, contemporary scholars have identified the need to change the dominant narratives from explanations that rely on individual ability differences in favour of social cognitive factors and structural barriers (Fouad and Santana, 2017; Kanny, Sax, and Riggers-Piehl, 2014). The significance of cultural gender stereotypes, which have an effect on females’ motivation to pursue STEM careers, has long been a significant contributor to the underrepresentation of women in STEM (Ganley et al., 2018; Master and Meltzoff, 2020). According to a recent study, gender discrimination still occurs in affluent nations such as Sweden, even if it is not overt (Tokbaeva and Achtenhagen, 2021).

However, in a developing country with a strong patriarchal culture like Ghana, women lack the support to go to school and have a career in STEM. Consequently, women who succeed in STEM disciplines face a great deal of gender bias during their careers (Boateng, 2017). Although parental encouragement has been identified as crucial in shaping the career interest of young adults (Savickas, 2013), parents’ evaluation of their children’s abilities differs by gender in most cases, with this translating to differences by child gender in parents’ perceptions



and encouragement of their child's interest in STEM fields (Bhanot and Jovanovic, 2009). Bleeker and Jacobs (2004) found that families purchased more STEM games or manipulative materials for boys than for girls, and parents of boys believe that their children like science more than parents of girls, more often overestimating their child's science ability than do parents of girls (Bhanot and Jovanovic, 2009). Nonetheless, Moss-Racusin et al. (2018) contend that the evidence of bias does not necessarily suggest that it underlies the underrepresentation of women in STEM subjects and, ultimately, in STEM careers. This is further exacerbated by Williams and Ceci (2015), who found in their experiment that there are some situations in which women benefit from gender bias, although certain methodological aspects of these experiments may constrain their generalizability.

However, the existing research suggests that women are preferentially selected only when situations are particularly dire and when women are viewed as offering the potential for change, suggesting that evidence of gender biases favouring women is particularly limited (Moss-Racusin et al., 2018). Authors within this stream of thought have advocated for a greater body of research on the uniquely gendered cultural elements of STEM disciplines and work environments in Western societies and organizations (Ridgeway, 2011). There is also a need to engage in much research to throw light on this phenomenon from a non-western context. Again, it is necessary to better understand the experiences of women at work to present the most suitable intervention services. Furthermore, more research is needed to further explore the nature and limits of STEM gender bias among women. Although burgeoning, there remains a dearth of research examining the reasons why the gender gap exists in STEM.

### ***2.5.1.3 The Leaky Pipeline Model***

Research on STEM enrolment typically highlights the fact that students who initially had an interest are leaking out of STEM (Witteveen and Attewell, 2020). Research shows that women

are more likely to leave their STEM careers than their male peers (38% vs. 26%) (Frank, 2019). For instance, while women are significantly over-represented at the bachelor's and master's degree levels (representing 53% of total enrolments), their representation declines to 43% at the PhD level, and even further to 28% of scientific research personnel post-doctorate (UNESCO, 2020). Only an average of 29% of researchers in the world are women (UNESCO Institute for Statistics, 2019). Again, nearly half of female engineers leave their career path after graduating (Fouad et al., 2016). This so-called leaking STEM pipeline phenomenon of women leaving STEM despite their initial interest in the field has been the subject of many studies (Blickenstaff, 2005). This decline has been shown to be progressive (i.e., the further along the pipeline one goes, the fewer women one encounters) and chronic (i.e., the problem has not disappeared) (Schroeder et al., 2013; Dasgupta and Stout, 2014; White and Massiha, 2016).

These leaks have been identified at various career stages, including the bachelor's-to-PhD pipeline, and at the employment stages of selection (Morgan, Gelbgiser, and Weeden, 2013), promotion (Ong, Smith, and Ko, 2018) and retention (Turner, 2002). So far, the research on the causes of this leaky pipeline out of STEM is decidedly thin (Rury, 2022). Explanations for STEM attrition that are already prominent in the literature include studies of students' demographic characteristics, educational preparation, previous course trajectories, college momentum and performance, and competition with other majors (Xie, Fang, and Shauman, 2015). Lack of role models, gender stereotypes, restricted possibilities to foster STEM interests in early stages, and unfavourable gender-socialization experiences also appear to be among the obstacles women face as they advance through the stages of the STEM pipeline (Wang, 2013; Ceci et al., 2014; Meadows, 2016). Most studies, however, concentrate on the reverse perspective: the determinants of STEM completion (Sadler et al., 2014; Redmond-Sanogo, Angle and Davis, 2016).

Some authors conclude that beliefs about ability are likely to be relevant in studying the leaky pipeline, as STEM fields are often considered some of the most academically demanding subjects (Stinebrickner, Stinebrickner and Sullivan, 2018; Rury, 2022). Stinebrickner and Stinebrickner (2013) argue that aspiring STEM students fail to graduate with a degree in the STEM fields because they enter universities with incorrect beliefs about their ability. The authors argue that, as students progress through the science curriculum, they receive negative shocks to their beliefs via grades in science courses, which tend to be lower compared to non-science fields, ultimately leading them to switch majors. While the metaphor of a leaking pipeline has been beneficial in framing and highlighting the STEM skills gap, it has limitations. First, it suggests that STEM disciplines are more susceptible to leaking than other fields, which may be an exaggeration (Chen and Soldner, 2013). Again, the leaky pipeline metaphor is unidirectional, as it only considers students who abandon STEM fields and disregards the potential of those who switch to STEM after declaring non-STEM programmes (Lykkegaard and Ulriksen, 2019).

Simply put, the image of a leaking pipe does not sufficiently reflect the variety of career options available to students. Çelik and Watson (2021) contend that if the problem is embedded in a system, the solution should also be at a system level. They propose a systems social marketing approach (Seward, Truong, and Kapadia, 2019) and more specifically a behavioural ecological perspective (Brennan et al., 2016) to tackling the leaking of women in STEM at the national level. Generally, opinions about the causes of this leak of women at various stages of the STEM pipeline remain extremely scant. While some scholars have shed light on the causes, more research is needed to address why this happens under different contexts.

## **2.5.2 Barriers to female STEM career development**

Another important strand of scholarship on women in STEM careers examines the barriers that impede the development of women in STEM (Glass et al., 2013; Bird and Rhoton, 2021; Liani, Nyamongo, and Tolhurst, 2021). These can be categorised as follows: i) barriers at the individual level; ii) barriers at the organisational level, and iii) barriers at the national level.

### ***2.5.2.1 Individual Level Barriers***

Over the years, a rich body of research about the barriers to women's career development in STEM has emerged (Glass et al., 2013; Collins et al., 2020; O'Connell and McKinnon, 2021). A common thread is the driving force of individual factors which have been identified as external variables based on women's agency: that is, their ability to interpret, assimilate, redefine, and/or reproduce (Jaeger et al., 2017; Wieselmann, Roehrig, and Kim, 2020). In their work on isolation as a barrier to career development, Glass et al. (2013, p. 727) found that the "lack of a critical mass of women in STEM fields, especially at higher levels of authority" makes women "vulnerable to the ideologies of gender-conservative men". Heilbronner (2013) stressed this further by positioning that loneliness at work discourages women from sticking with STEM careers, with the majority dropping out to pursue other opportunities elsewhere.

This lack of confidence was often reinforced by personal negative experiences of bias, but also by how they witnessed other women in STEM being treated (O'Connell and McKinnon, 2021). Again, lack of support networks contributes to women usually feeling isolated and out of place in STEM fields. These growing feelings of misfit or 'imposter syndrome' are highly demoralising and result in women questioning their abilities, and, on occasion, lead to thoughts of leaving the field altogether. Imposter syndrome – the feeling that one is not worthy or competent despite evidence to the contrary – has been well documented in the literature as one of the personal factors that inhibit career growth (Collins et al., 2020; Simon, 2020; King,

2021). This 'syndrome' has been found to be more common in women than in men and is also associated with attributions that women place on their successes (Howe-Walsh and Turnbull, 2016). While it has been found that women often attribute their success to temporary causes such as luck, men, on the other hand, more often than not attribute their success to stable qualities within themselves (Clance and Imes, 1978). Various authors have highlighted the impact of caring responsibilities and unpaid domestic work as a major inhibitor to career development (Resmini, 2016; Coleman et al., 2019).

All of these authors reach a mutual conclusion that there is indeed a correlation between motherhood and the possibility that women's engagement in STEM disciplines will be viewed as just symbolic as opposed to significant and influential (Glass et al., 2013; Heilbronn, 2013). Women are expected to dedicate more time to family problems than are men, according to Ceci, Williams, and Barnett (2009), and are often tasked with the primary carer responsibilities not only for young children but also for ill or aging members of their families. Balancing work and carer responsibilities could be even more challenging for scientists in single-parent scenarios (Hansen, 2020). It has been reported that married women with young children are less likely to get a tenure-track position than married men with young children, and are still less likely to achieve this position than are single women without young children (Goulden et al., 2011). Martinez et al. (2007) contend that a critical time for women facing such barriers is during the early stages of their career when personal life changes and professional ambitions often collide.

Not surprisingly, such challenges and inequalities, which are sometimes compounded over time, can consequently take a toll on women's mental health and perceived control over their career and life trajectories (Kinman, 2016). All of these barriers have several ramifications, leading to the unavoidable drop in productivity that women experience during these years, and for women in scientific research careers whose productivity levels are usually measured in

terms of the number of papers published and their impact, this has an inexorable detrimental impact on grant success rates, which largely depend on a strong publication record in unforgiving funding environments. These extensive studies suggest that women who choose careers in STEM exercise some degree of agency, among three key cognitive-person variables: self-efficacy beliefs, outcome expectations, and personal goals, the interplay amongst which presents some barriers obstructing their career development as research scientists.

### ***2.5.2.2 Organisational Level Barriers***

The second dimension of the barriers to women's career development in STEM occurs at the organisational level, where obstacles, such as employers' views of gendered competence, make it less likely that women will be promoted as rapidly or paid as much as their male colleagues (Glass et al., 2013; Savigny, 2014; Kohout and Singh, 2018). Field segregation, salary discrepancies when compared to men, and "persistent difficulties in achieving the same levels of support and recognition for their work as men" are cited as ongoing barriers (Fassinger and Asay, 2006, p. 432). This form of gender discrimination starts at entry-level jobs and later metamorphoses to managerial levels where women need to deliver more and prove more than men to reach their deserved roles in the hierarchy (Savigny, 2014; Patterson, Varadarajan, and Salim, 2020).

For example, when presented with two identical Curricula Vitae (CVs) with gender-identifying information included, 127 professors from various fields (physics, chemistry, and biology) considered those belonging to men to be better; however, when the CVs were gender-blind, women were evaluated as better (Moss-Racusin et al., 2012). These findings lay bare the fact that sexism continues to be a barrier to workplace equality that women in STEM (and beyond) regularly face. Other barriers identified at the organisational level include a lack of opportunities and recognition, which manifests in the form of inadequate funding and

opportunities to conduct research (Nash et al., 2019). Research shows that women tend to submit fewer grant applications and are also funded significantly less often in the UK, the US, and Australia (Boyle et al., 2015), while men tend to be favoured in funding applications in relation to quality of the researcher and track records (van der Lee and Ellemers, 2018).

Researchers have again established the beneficial career outcomes of mentoring experiences, demonstrating that mentoring is associated with the mentees' commitment to a science career (Chemers et al., 2011; Amaechi, 2018). Furthermore, working conditions and job insecurity have also been identified as having a strong negative impact on women maintaining careers in science. The vast majority of appointments are grant-dependent short-term contracts, with unclear pathways to promotion. Whilst this also impacts male researchers, career disruptions due to caring responsibilities and the impact on their track records make these uncertain scenarios more challenging for women, encouraging them to seek alternative positions outside the academic sector (Hansen, 2016).

This masculine work culture and hostile workplaces force women in STEM to 'act like a man' to survive in science. Extant research has expanded on this notion, commenting that 'acting like a man' can backfire because they are not adhering to common gendered stereotypes (Coleman et al., 2019). A more in-depth approach to understand the meaning of STEM careers for women is O'Connell and McKinnon's (2021) focus group study. A theme that surfaced in all of the focus groups was the idea that 'being a girl' carried different societal expectations (e.g., girls are not good at maths), and how that surfaced throughout a female scientist's career in terms of being disregarded or underestimated, and given different, more administrative tasks than male colleagues (O'Connell and McKinnon, 2021). Recent research studies, such as those undertaken by Burkinshaw (2015) and O'Connor (2018), suggest that the masculine work culture continues to be entrenched. Patterson, Varadarajan, and Salim (2020) argue that one

reason why these organisational barriers persist is because companies merely pay lip-service to gender diversity and do not put in the necessary actions required to close the gender gap.

### *2.5.2.3 Socio-cultural level barriers*

In the STEM fields, research on socio-cultural barriers to women's development has been conducted for decades. Initially, the research suggested cultural issues such as bias and stereotypes (Kaatz et al., 2014; Carli et al., 2016), including the notions that men are better than women for STEM fields and women are not interested in careers in science (Hansen, 2020). However, this narrative has moved on, since there is not enough evidence to back this claim. The latest research suggests that many of the problems women face are embedded in the lack of equitable policies for women (Lundine et al., 2018). The glass ceiling phenomenon, defined as a barrier that results from gender or race and prevents one from moving past a certain point in one's career (e.g., promotion or hiring) (Cotter et al., 2011; Bruckmüller et al., 2014) undoubtedly also affect the development of women in STEM.

Further to the glass ceiling, the glass cliff phenomenon may also set women up in precarious leadership roles where they are more likely to fail (Ryan and Haslam, 2007). Scientists from minority groups face additional challenges, including reduced access to resources and technology as well as negative perceptions of their own career success, in part due to reduced networking opportunities and role models (Murugesu and Vaughan, 2020). Other factors include extended family, friends, and society at large. Mozahem et al. (2019), for instance, found that the extended family and friends of the family tend to strongly oppose the idea of females getting into certain STEM careers such as engineering, even when close family members were supportive. The literature on the socio-cultural impact on career development tends to be scant, and most of these studies are quantitative in nature (Sheu et al., 2010; Deemer et al., 2014), thus opening the door for a qualitative understanding of these phenomena.



### **2.5.3 Enablers of female STEM career development**

Previous studies have addressed the factors that impede the career development of women in science from different perspectives at the individual, organisational and societal level. Career enablers are thus the positive ways through which these barriers can be mitigated to enhance the development of the careers of women in STEM (Prieto-Rodriguez et al., 2022). Faulkner and Lie (2007, p. 157), however, are quick to highlight that correcting the inequity created by structural barriers cannot be achieved by simply removing existing barriers: “to achieve inclusion, it is not sufficient to curb exclusion mechanisms but to enhance positive measures of inclusion”. Solutions and interventions aimed at the individual have been considered as “wholly inadequate” (Fassinger and Asay, 2006, p. 450) in addressing these entrenched structural barriers, and instead the burden has shifted on to the institutions and broader society to accept that change is required.

The literature on enablers to women’s STEM career development shows that women’s experiences in STEM fields are enhanced when they have strong mentors and facilitators to support their work (Jensen et al., 2017). Mate, McDonald, and Do (2019), in their cross-cultural analysis, found that in a developed country like Australia, the main enabler to career development in STEM was mentoring and the building of professional networks that provided their careers with direction and support. They also found, however, that in developing countries such as Vietnam, the story was different, as the main enablers to developing careers of females had more to do with having a sponsor or person with power in their respective organisation who would be willing to support their career advancement and gaining recognition from colleagues and peers. As Aschbacher, Li, and Roth (2010) put it, encouragement from teachers, family and peers will act as drivers to help set a young woman on the STEM path. Networking

and mentorship help women to stay the course (Gorman et al., 2019). Sponsorship and advocacy help progression in the field (Huston et al., 2019).

The evidence is clear that traditional models of mentoring, such as institutionally enforced mentoring programs, are less successful for women, as measured by retention, professional success, and self-stated professional satisfaction (Diekman et al., 2010). Instead, models designed to specifically and intentionally match mentors with students and women in the profession were found to be effective in supporting their engagement and achievement (Beck et al., 2022). In addition, mentoring models using a variety of approaches – such as symposia featuring strong women role models in the STEM workforce, graduate and undergraduate mentoring, online forums, peer mentoring of cohorts with similar career goals, and peer mentoring including senior faculty facilitators – provide a larger spectrum and network for supporting women in the field (Chesler and Chesler, 2002). Extensive studies suggest also that women in STEM aspiring to higher positions will benefit greatly from a workplace culture that is supportive and values diversity and inclusion (O'Connor, 2015). Such a culture would be one where training was tailored for women, where there was an understanding of work–family balance for both men and women, rather than women being seen as the responsible carers, and where there was an awareness of second-generation gender bias, which could then be countered by unconscious bias training (Burkinshaw, Cahill, and Ford, 2018; Coleman, 2019).

Van den Brink and Benschop (2012) further iterate this when they suggest that equal opportunity interventions are not enough to change workplace cultures and structures that discriminate against women. They recommend gender awareness training that highlights the rationale, or quest for gender change, as a way to prevent ‘old’ culturally engrained structures from continuing to constrain female career and leadership development. Faulkner and Lie (2007) emphasise that women are heterogeneous and that factors which might enable their

engagement with STEM are therefore varied. However, they conclude that the support of local experts – that is, those who operate in the same context as the women being encouraged into the field – is important. One study noted that women are more likely to be resilient and feel that they belong, despite being in a gender minority, when they have professional experiences indicating that they are valued and accepted in the engineering profession (Richman, Vandellen, and Wood, 2011). Another study explored the ways in which career counselling might support women in finding strategies to thrive (Fassinger and Asay, 2006). Based on the work of Schiebinger (1999), the current shift in the European approach (EC 2012) from ‘fix the women’ to ‘fix the system’ (i.e., the strategy of cultural and institutional transformation) demonstrates that individual support alone is insufficient and must be complemented by systemic interventions. The focus must be transferred from the individual level, where women’s professional talents are emphasised, to reforms in scientific research as a whole.

## **2.6 Section Summary**

Overall, extant literature on the experiences of women in STEM careers has provided significant insights into the motivation to enter STEM, and the barriers and enablers to developing a career as a female scientific researcher. The literature has highlighted the role of family, mentors, organisations, and the wider society in how careers are formed and developed over time with respect to females in STEM. While these studies have been extremely useful in improving our understanding of the experiences of females in STEM careers, they also open many doors through which to shed further light on the phenomenon. First, research has highlighted the role of family, peers, and exposure to role models on women’s career choice and career decision-making in STEM. While this has been very useful, it would be prudent to move the conversation further by including additional studies to reinforce the impact and implication of these markers. Again, these studies point to the need for further investigation

into the impact of society and institutions in different contexts to evaluate their unique impacts on the career decision-making process of women in STEM.

Furthermore, these studies all appear to be concerned with the numbers and therefore take on a strong quantitative front. Further studies are therefore needed, taking more qualitative and mixed-method approaches to understand the nuanced implications of personal agency over career decision-making. Such research areas can be confronted using the following research questions: *What are the differences in familial, academic, and personal characteristics as a function of STEM career decision-making? How do the relationships between familial, academic, and personal factors affect students who are pursuing a STEM career? What are the differences between the career decision-making process of adolescents from a cross-cultural perspective? What are the unique barriers and enablers of careers of women in STEM from developing countries? What strategies do women from developing countries draw on to manage their careers as female scientists in light of the existing barriers that hinder their career development?*

Again, the existing literature in management and organisation studies is very limited in the areas of scientific careers, especially female scientific careers. Save a few studies (e.g., Wilkins-Yel, Hyman and Zounlome, 2019; Block et al., 2019), studies on STEM careers in the management literature have predominantly focused on adolescents and college students regarding their STEM career intentions and career decision-making (e.g., Kim and Beier, 2020; Wegener and Eccles, 2019; Schelfhout et al., 2021). It was also observed that literature on career barriers and enablers focused on the individual, organisation, and the society without a specific emphasis on the role of governments and how their interventions and policies can go a long way to mitigate some of the barriers that prevent women in science from advancing in their careers. As such, future research could look into the area of government policies on women's career development and how this affects organisations to tackle the issues of gender

inequality in STEM careers. Lastly, several studies in this area have relied heavily on Social Cognitive Career Theory (SCCT) to identify barriers and other impeding factors to women in STEM careers. Again, while this theory has been extremely useful in explaining the experiences of women in science, it would be interesting to test new models and incorporate new theories to explain the situation in much clearer contexts.

## **PART III**

### **Theoretical lens**

#### **2.7 Career construction theory**

Career Construction Theory (CCT) investigates the importance individuals place on their professional advancement (Taylor et al., 2018). CCT emphasises the use of narratives to explore what, how, and why individuals develop their professions as they move their storied identities into professional roles (Del Corso and Rehfuss, 2011). CCT provides a framework for analysing why and how individuals choose particular vocations. According to Savickas (2005), CCT focuses on a person's vocational personality and behaviour, as well as how their personalities enable them to adapt to work changes over their careers. In an attempt to be exhaustive, CCT incorporates the following facets: career adaptability, vocational characteristics, and life themes (Hancock and Hums, 2016). According to Savickas, personal meaning, previous memories, present experiences, and future ambitions affect the career pathways of individuals. Thus, the development of a career is analogous to the shedding of one layer of the self in order to unveil another (Savickas, 2005, 2013, 2020). Consequently, a career begins in infancy, when individuals learn to comprehend the world of family by absorbing existing cultural discourses.

The first component of CCT is career adaptability, which refers to a person's ability to deal with developmental challenges such as learning new skills and dealing with changing circumstances (Savickas, 2005). These factors may have an impact on a person's work aims and expectations. The relationship between cultural expectations and professional choices, an individual's talents and abilities, perceived as well as actual opportunities, and peers' acceptance of a certain occupation is highlighted by career adaptability (Hancock and Hums, 2016). The individual is effectively an 'actor' in a family 'play' at this time, and it is here that the individual's biological endowments, such as colour, gender, class, and so on, are utilised to carefully form a character (Savickas, 2013).

The second element of CCT is vocational personality, which is defined as "career-related qualities, requirements, values, and interests" (Savickas, 2005, p. 47). These abilities, needs, values, and interests are enhanced by qualities such as self-efficacy, gender, personality, and human capital (Burke, 2007). The socialisation of gender roles and cultural norms may have a considerable impact on the career ambitions and expectations of women. Frequently, career decisions (e.g., choosing a career, accepting a job, determining whether to switch jobs, and balancing work and family) are made concurrently with other life decisions (Eccles, 1994). The third component of CCT is life themes, which attempt to provide individuals with a feeling of purpose and assist them in making meaningful decisions at work (Savickas, 2005). The interconnected nature of professional development and other life decisions may aid in determining why individuals choose diverse career paths (Savickas, 2005).

A second layer of this self begins to emerge as children mature and develop an internal sense of agency (McAdams and Olson, 2010). This second layer of the self necessitates the creation of aspirational goals that ultimately lead to a job. At this moment, the self must adjust to transitions, shocks, and trauma by establishing a balance between inner wants and external opportunity (Savickas, 2013). These adaptation results must derive from what Savickas (2005,

2013) terms adaptivity (readiness), adaptability (resources and responses), and adaption (results). Thus, the agentic self has greater results when they are willing and able to engage in coping behaviours in response to their changing circumstances. As individuals learn more about themselves as actors and motivated agents, they are able to design their collection of objectives and purposeful undertakings into a coherent and credible narrative as ‘writers’ (Savickas, 2013).

By articulating goals, controlling adaptive behaviour, and imbuing tasks with meaning, the individual employs this self-sustaining narrative to give their job and its building processes significance. In conclusion, there is a growing understanding that a career cannot be separated from an individual’s personal life experiences (Young and Collin, 2004). Career construction provides clarity by first recognising that one’s current professional circumstance is the result of prior experiences and then connecting these experiences to a desired future (Savickas, 2013).

## **2.8 Intersectionality**

Primarily, intersectionality can be understood as a theoretical and methodological framework for analysing how systemically crafted socially constructed archetypes, such as gender, ethnic background, race, class, sexual orientation, age, (dis)ability, nationality, and native language, interact and produce various types of societies (Lykke, 2010). As a critical theory, intersectionality conceptualises knowledge as situated, contextual, relational, and reflective of political and economic power. Intersectionality is frequently associated with qualitative research approaches due to the critical role of voice extracted through focus groups, narrative interviews, action research, and observations (Atewologun, 2018). Often exploited as a framework for analysing positions and experiences within the “gendered and ethnicised occupational hierarchy” (Bradley and Healy, 2008, p. 40), intersectionality fundamentally

emphasises individual subjectiveness and intersectional locations (Atewologun, 2018) to underline the “texture and consequence of inequalities experienced by individuals and groups given their social membership” (Rodriguez et al., 2016, p. 202). This intra-categorical approach (McCall, 2005) – that is, an emphasis on individual experiences and within group-differences – allows for the understanding of how categories of difference are not experienced uniformly within the same occupation (Bowman et al., 2017).

This social theory begins with the intersections of gender with other characteristics of social identity (at the micro level of the family and community, as well as the person or ‘self’) (Crenshaw, 1991). At the meso level, these exchanges occur in the context of institutions’ interrelated networks and power structures (e.g., state laws, policies, bureaucracies, religious institutions, media). Such dynamics establish interdependent forms of privilege and oppression, which are formed by macro-level historical pressures such as colonialism, imperialism, racism, homophobia, ableism, and patriarchy (Hankivsky et al., 2014). Using an intersectionality lens needs a multi-level approach in order to appreciate the effects between and across the micro, meso, and macro societal levels. As part of this multi-level dimension of intersectionality, addressing processes of inequity and differentiation across levels of structure, identity, and representation requires recognising that social inequalities are context-specific and emerge through the process of intersectional research and discovery (Hankivsky et al., 2014).

Intersectionality theory examines how institutionalised systems of oppression interconnect to produce discrimination, disadvantages, and privileges, sometimes simultaneously with privilege and advantages, for specific individuals or groups of people based on their socio-demographic characteristics, also known as their social ‘location’. There is dispute regarding the extent to which an intersectional approach adds to gender social relations studies and the legitimacy of defining gender as a priority within intersectional analyses (Hancock, 2007). A

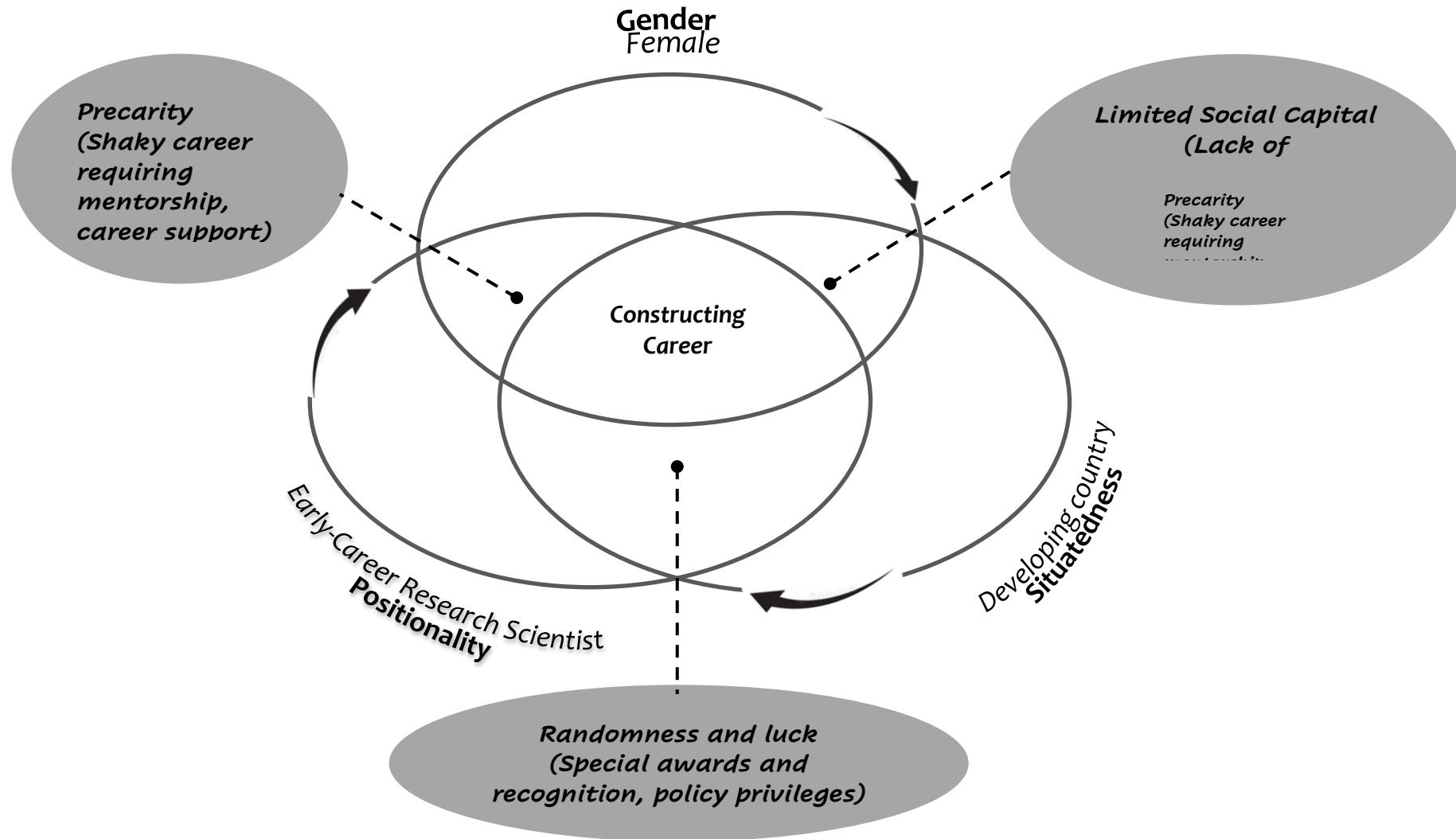


key argument is that social categories carry privileges or penalties, and their intersection causes a push or pull effect on the life chances of particular groups or individuals (Tomlinson et al., 2018). Thus, intersectionality scholars contend that lived experiences of individuals and communities cannot be adequately captured by analysis of one social characteristic, an approach termed ‘single axis’ analysis (Collins, 1993). Instead, they strive to comprehend the complexity that emerges as the subject of analysis grows to encompass numerous facets of social activity (McCall, 2005). Thus, constructing careers of female scientists from the developing world through an intersectional lens means recognizing that career construction is subjective, contextual, and reflective of the multiple socio-cultural norms that coalesce to prescribe the experiences of the careerist.

### **2.8.1 Towards an intersectional approach to constructing the careers of female ECRs from the developing world**

As depicted in Figure 2.1, a framework was developed by synthesising findings from the studied literature and employing intersectionality as a lens.

Figure 2.1 An intersectional model of constructing careers of female ECRs from the developing world



As presented, the model demonstrates, through an intersectional lens, how relational power dynamics converge to shape the careers of early-career female researchers from poor nations. Positionality and gender intersect to determine how early-career female researchers perceive their careers. The absence of mentorship, professional advice, and promotion challenges promotes a dubious perception of one's career. Positionality and situatedness also result in randomization and luck, as evidenced by unique award schemes, recognition, and legislative initiatives focused exclusively on ECRs from underdeveloped nations. Lastly, situatedness and gender intersect to influence their career development through a deficiency of social capital. As women and citizens of underdeveloped countries, access to finance has been noted as a significant obstacle, causing high anxiety, the loss of networking opportunities, and the development of a scarcity mindset. In such situations, the construction of a scientific research career requires the intersection of all three meaning-making frameworks.

## **2.9 Chapter summary**

A critical review of the literature on the various career theories, as well as women in scientific research careers, demonstrates that the lack of women in scientific career disciplines is both progressive (fewer women as the pipeline progresses) and persistent (the problem has not gone away in spite of treatments). Understanding career dynamics is therefore vital, not simply because everyone has a career, but also because career has significant effects on organisational success, personal and professional identity, health, and well-being. Understanding the constructed nature of the term 'career' has made empirical research on the role of the concept of career in interpersonal interactions possible. The individual and the environment are no longer viewed as mutually exclusive as a result of a greater emphasis on contextualism and constructionism. In addition, because careers are enacted in social contexts that include

people's families, employers, and national culture, knowing how careers emerge provides insight into the relationships between individuals and their wider societies.

Notwithstanding the profuse literature on the careers of women in STEM, there is still a great deal to learn about women in disadvantaged areas and nations, whose voices are rarely heard in mainstream literature. This study covers the void left by previous research, which has failed to consider the career construction processes from developing nation perspectives. Subsequently, the next chapter will go deeper into the study setting, the rationale for selecting a qualitative method, and the sample strategy for theoretical research. The chapter will then provide an overview of the full process of research methodology and data analysis.

## CHAPTER 3

### Research Methodology

Researching the experiences of marginalised, underrepresented, or hidden groups within the larger society poses a great challenge to researchers, due in part to the sensitive, often controversial nature of such topics, which either makes it difficult to recruit participants or deters people from coming forward to share their experiences. Yet, a methodological approach that gives meaning to the phenomena is required to undertake such studies. This chapter focuses on the empirical processes, choices, and activities undertaken to explore the career narratives of female early career research scientists (ECRs) from developing countries.

Designed as exploratory research, the study pays attention to the ‘little stories’ of female ECRs, to advance insight into their lived experiences as female researchers from developing countries (Sarpong and Maclean, 2021). The study takes on an interpretivist epistemology with a social constructionist ontological stance. Throughout the study, the main research questions act as the directional devices under which the data collection and analysis procedures are approached. The structure of this chapter is as follows: it will first illuminate the context within which the study is conducted. Before moving further into the interpretive framework guiding the study, the study's research methodology will be examined in depth. The focus will then shift to ethical considerations, the collecting of data, and its subsequent analysis. The obstacles related to data gathering and the criteria for evaluating the research will be discussed. The chapter will conclude with a discussion of the methodological reflections and a brief summary.

### **3.1 Research context and setting**

#### ***3.1.1 Female Scientists from Developing Countries***

In recent years, women have made significant strides in the social and life sciences (Ceci, Ginther, Kahn, and Williams, 2014), yet they continue to be underrepresented in other fields such as engineering and the physical sciences (Stoet and Geary, 2018). Increasing the representation of women and minorities in scientific careers is not only a matter of equality, but also essential for meeting the demands of the workforce (Gabster et al., 2020). Generally, developing countries are known to be particularly lacking in data pertaining to this gender equity phenomena, although these regions have been identified as having the lowest numbers of women in science careers (Beintema, 2017). The United Nations Educational, Scientific, and Cultural Organization (UNESCO) reports that only around 30% of the world's researchers are women, and this number is even lower in developing countries. In Sub-Saharan Africa, women make up just 20% of the STEM workforce. In Latin America and the Caribbean, the number is slightly higher at around 35% (UNESCO, 2021).

In their cross-cultural studies on 66 different countries, Miller, Eagly and Linn (2015) concluded that women's representation in science predicted national gender stereotypes. They found that the lower the gender gap in science for women, the higher those women were at the receiving end of gender-based stereotypes. Thus, notwithstanding the fact that women in non-traditional careers such as scientific research face enormous challenges, women from developing countries must content not only with the everyday gender-based stereotypes, but they must also grapple with the lack of resources that are needed to support their research. Women's slow advancement and attrition at each level of the scientific career ladder are due to career processes that are influenced by complex social forces at the individual, familial, and societal levels (Miller and Wai, 2015). These barriers to women's career advancement tend to be more pronounced in low- and middle-income countries (Sarwar and Imran, 2019). However,

there is significant variation between contexts due to disparities in religion, socioculture, politics, and the economy, among other factors (Liani, 2021). In South-Saharan Africa, for instance, positions in science are dominated by men (Mama and Barnes, 2007), particularly in terms of leadership, decision-making, and representation (FAWE, 2015). While decision-making cultures are frequently conservative and restrictive (Onsongo, 2006), power hierarchies are typically rigid (Johnson, 2014), limiting influence options outside of male-dominated leadership roles.

Even though these obstacles are well-known, there are still insufficient data on how female scientists in these settings perceive their professional lives. In developing nations, there is a lack of data on how the interaction of multiple social identities affects women's scientific career advancement. This study investigates how occupational status as early career scientist intersect with developing country specifics and gender to shape careers of females in science.

### ***3.1.2 Female Early Career Research Scientists from the developing world***

ECRs represent the transition stage between PhD and senior positions, often being recognized as being amongst the most creative and energetic pool of researchers (Jones, 2014). Nonetheless, they are notably “the most vulnerable group in the science system” and the first to suffer when the sector comes under strain (Laudel and Glaser, 2008 p. 387). Undoubtedly, ECRs are only starting off their careers and therefore possess less experience in terms of conducting research and writing for publication. Again, as noted by Hemming and Hill (2009), they are assigned higher responsibilities and expected to prioritise research over other obligations, they have less access to resources, and they often encounter heavy scrutiny from their more senior colleagues, some of whom may even attempt to claim their work. Ultimately,

they have to overcome the pressures and anxiety associated with probation, tenure, and promotion (Laudel and Glaser, 2008; Rodríguez-Bravo et al., 2017).

Women in early career scientific research must face the underscored challenges of being ECRs amidst the gendered inequalities that continue to persist within the scientific career community (Huang et al., 2020). For instance, empirical evidence suggests that promotion of ECRs is often tied to the number of publications and that men publish more than women over the course of their career (Davies and Healey, 2019). Further studies to analyse the effect of publication numbers on the ability of faculty to achieve tenure have concluded that the more papers published, the more likely a researcher is to receive tenure, with the implication that men are more likely to receive tenure than their female colleagues (Roper, 2019). These findings have stimulated a plethora of possible explanations, from differences in family responsibilities to resource allocation, the role of peer review, collaboration, role stereotypes, academic rank, specialization, and work climate (Eagly et al., 2020; Jadidi et al., 2018; Van den Besselaar and Sandström, 2017; Uhly, Visser and Zippel, 2017).

Such empirical findings prove that gender disparities exist to this day within the scientific career arena, which has often touted itself as being universalistic, following the Mertonian code of universalism (Schröder, Lutter, and Habicht, 2021). Per this code, when a scientist offers a contribution to scientific knowledge, the community's assessment of the validity of that claim should not be influenced by personal or social attributes of the scientist and should be subject to “pre-established impersonal criteria” (Merton [1942] 1973, p. 270). Again, universalism requires that a scientist be fairly rewarded for contributions to the body of scientific knowledge. This is summarized agreeably in Merton's phrase that “careers should be open to talent” (Merton, 1973, p. 272). However, this productivity puzzle phenomenon suggests that particularism, which involves the use of functionally irrelevant characteristics such as race and



sex as a basis for making claims and gaining rewards in scientific careers, persists (Jiang, Mok, and Shen, 2020).

Thus, while the debate continues about the scientific community's adherence to Merton's ethos of science, it is undoubtedly true that the scientific field is immersed with inequalities in career attainments. Women, like most minority groups, have lower levels of participation, position, productivity, and recognition (Gaines, 2017; Roper, 2019). According to the 2019 UNESCO report on women in science, women account for a mere 29.3% of persons actively employed as researchers globally. Notwithstanding the fact that many countries have been relentless in their efforts to achieve gender parity (Fathima et al., 2020), disparities remain in several areas and fields in scientific careers (Larivière et al., 2013). In developing countries, the gender disparity in STEM is a multifactorial issue that includes familial, social, cultural, and institutional factors that cannot be ignored or overlooked (Fathima et al., 2020). Thus, while it is empirically true that in general, women researchers publish less than men, it is also true that ECRs publish less than more experienced researchers, and researchers from developing countries publish less than those from developed countries (Huang et al., 2020; Sarabipour et al., 2021). Given that promotion, recognition, and the ultimate success of a researcher's career are measured by this single construct of publication numbers, female ECRs from developing countries will find themselves at the bottom of this hierarchy. For these women, their identities first as women, second as ECRs and third as citizens of third-world countries intersect to create a much harsher reality to this marginalisation than, say, a female scientist from a developed country (Atewologun, 2018). In the words of Prof. Jennifer Thompson, president of the Organisation for Women in Science for the Developing World (OWSD), succeeding in the competitive world of science is challenging under the best of circumstances, but women scientists in countries with scarce resources and competing cultural expectations face significant additional obstacles as they strive to excel at careers in science. Thus, to project and

give voice to the amazing women from this minority group who are breaking the glass ceiling and excelling in their scientific fields, the OWSD and Elsevier have put together an award scheme that seeks to celebrate female ECRs making a real-life impact in their communities through cutting-edge research.

### ***3.1.3 The OWSD-Elsevier award for women scientists from developing countries***

Formally started in 2012, The OWSD-Elsevier Foundation awards for Early-Career Women Scientists in the Developing World is an award scheme aimed at recognizing the achievements of women researchers who have made significant contributions to the advancement of scientific knowledge. The programme initially began as the Elsevier Foundation-OWSD Awards for Young Women Scientists in the Developing World, which ran between 2010 and 2011 before metamorphosing into what it has come to be known and recognized for today. The award scheme represents an established and long-lasting partnership between the OWSD and the Elsevier Foundation. It therefore takes those factors into account by recognizing the research excellence of early-career women scientists from developing countries. Prizes are awarded annually on a rotating basis among the disciplines of Biological Sciences, Engineering Sciences and Physical Sciences. Each of the five winners wins prize money (US\$5,000 in 2021) and also receives the opportunity to present their papers at the annual conference of the American Association for the Advancement of Science (AAAS), which is attended by leading scientists, engineers, educators, and policymakers from around the world. Each year, a total of five winners are selected from the following regions: Arab region, Central and South Asia, East and Southeast Asia and the Pacific, Latin America and the Caribbean, and Sub-Saharan Africa

### ***3.1.4 Eligibility***

To be eligible for the OWSD-Elsevier awards for Early-Career Women Scientists in the Developing World, the applicant must be a woman who has received her PhD in a scientific discipline over the last 10 years from the date of application, and whose current research is related to a specified area of science made available for that particular year. For instance, from 2022 to 2026, the award will respond to the call for action set forth by the United Nations Sustainable Development Goals (SDGs). As such, all applicants who hope to apply from 2022 to 2026, for example, must be currently researching on an area that is related to climate action and the environment in response to SDG13 (climate change), SDG 14 (life below water) and SDG15 (life on land). Eligible scientific fields must therefore include the areas of: Agricultural science, Astronomy, Space and Earth Sciences, Biological Systems and Organisms, Chemical Sciences, Computing and Information Technology, Engineering Sciences, Mathematical Sciences, Medical and Health Sciences (including Neurosciences), Physics, and Structural, Cell and Molecular Biology. While a combination of these fields is acceptable, women in the social sciences, humanities, arts, and others that are not in the aforementioned groups are not eligible to apply. In addition to this criterion, an applicant must have lived and worked for at least five years in any one of the 66 scientifically and technologically lagging countries (STLCs) as listed on the OWSD website (<https://owsd.net/awards/awards>).

### ***3.1.5 Selection***

The call for applications is announced and opened on the OWSD and Elsevier websites in about the middle of July in each year. Applicants must, in addition to filling out an application form, include a certificate to demonstrate that they have indeed finished their PhD within the last ten years before applying for the award. In addition, they must include two references, a CV, and a list of all publications. They must also establish how their research is or has been beneficial

to their communities. All entries are judged by a distinguished panel of specialists in the appropriate fields: persons who are aware of the challenges facing women scientists from developing countries. According to the publicly available information available from the OWSD's website, the selection committee conventionally meets each year at the OWSD secretariat in Trieste, Italy to deliberate and draw on a broad range of expertise to finally decide on who receives the award. However, the COVID-19 pandemic and the disruptions that came with it regarding holding face-to-face meetings have allowed the secretariat to draw on an even broader pool of experts, many of whom are based in developing countries, for the selection panel.

The panel is chaired by the OWSD coordinator, with full administrative support from the OWSD secretariats. Assessment is based strictly on the applicant's achievement in their scientific field, with additional attention paid to evidence of leadership, initiative, and innovation as well as the candidate's involvement in capacity-building, outreach, and civic responsibilities. Research that demonstrates the use of innovative techniques, especially with regard to sustainable development, and an awareness of the importance of sex and/or gender consideration in research methodology and content and/or interdisciplinary collaboration may be prioritised. Successful candidates are informed of their selection by 31<sup>st</sup> December of every year and the award ceremony is held in February the following year. Figure 3.1, below, shows an extract from a call for applications for the award, as advertised on the OWSD website.

## Figure 3.1 OWSD call for applicants

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Figure 3.1 OWSD call for applicants

Organization for Women in Science for the Developing World

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Orig. for Women in Science for the Developing World

### Call for Applications is opened for 2021 OWSD-Elsevier Foundation Awards

July 15, 2020

The 2021 Awards will be given in the physical sciences: chemistry, mathematics, and physics.

OWSD invites applications for the 2021 OWSD-Elsevier Foundation Awards.

These awards reward and encourage women working and living in eligible developing countries who are in the early stages of their scientific careers, having often overcome great challenges to achieve research excellence. Awardees must have made a demonstrable impact on the research environment and must have received their PhD in the last ten years.

The award has an important impact on local research cultures. Previous winners say the awards have had a powerful effect, enhancing the visibility of their past work and creating new opportunities for the future. The awardees are also powerful role models for girls and young women on their countries. You can read more about past awardees here.

In the past years, each winner received a cash prize of USD 5,000 and an all-expenses-paid trip to attend the annual meeting of the American Association for the Advancement of Science (AAAS) in the U.S.A., where the Awards Ceremony took place. However, due to the COVID-19 pandemic, the 2021 annual meeting of the AAAS will be held entirely online. OWSD and the Elsevier Foundation are currently evaluating other international scientific events and the trip will be confirmed in the coming months.

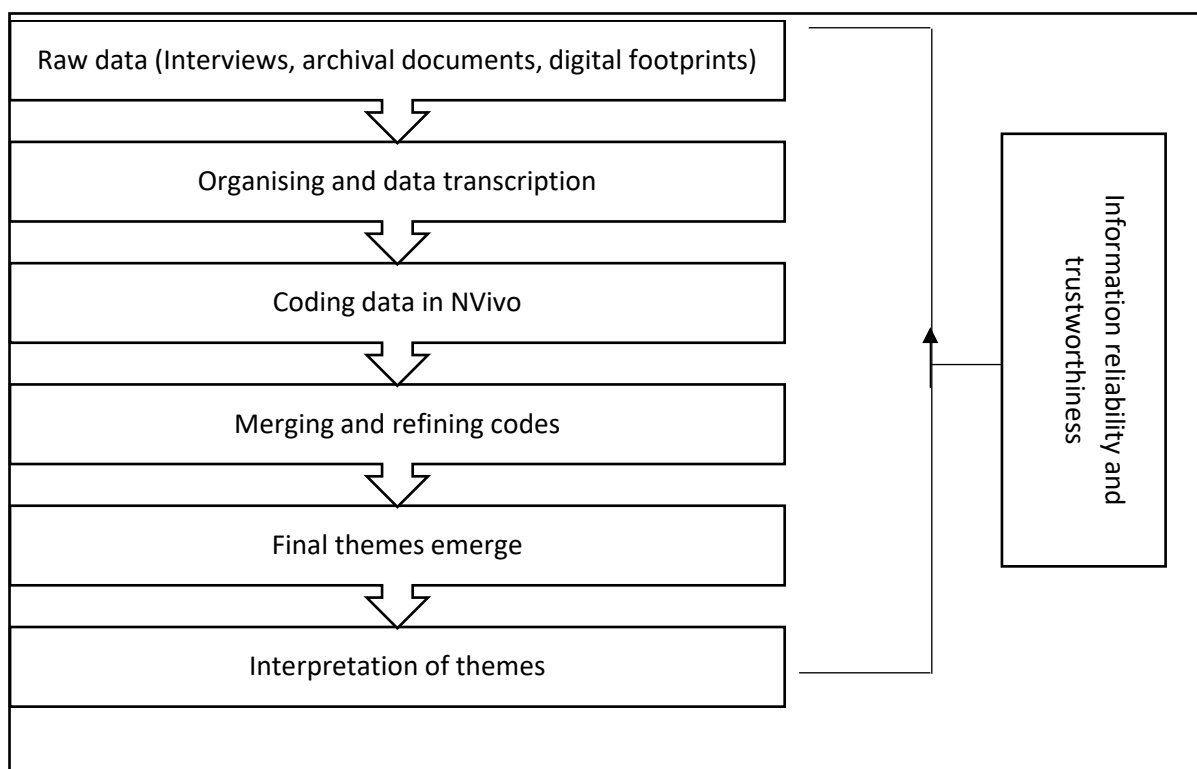
## 3.2 Research Approach

### 3.2.1 Qualitative exploratory research approach

Although studies examining how female scientific careers are enacted are burgeoning (e.g., Block et al., 2019; Cadaret et al., 2017; Castro and van der Heijden, 2020; Wilkins-Yel, Hyman, and Zounlome, 2019), what has yet to be fully appreciated is a turn to how female ECRs embedded in developing countries enact their careers under such contexts of patriarchy, underdevelopment, and weak institutions. Owing to this paucity of research under these contexts, an exploratory qualitative approach was deemed appropriate to advance scholarly knowledge of the lived experiences of women from developing countries who find themselves in the fascinating yet challenging and often daunting world of scientific research. Such an approach was considered appropriate for this study, as it allows for the complete submersion

into the viewpoints and perspectives of participants (Saunders, Lewis, and Thornhill, 2019). Such studies are particularly useful in examining the depth and meaning of phenomena.

Again, such an approach envisages the discovery of variances amongst participants' responses and allows for such richness in data as may not have been provided by quantitative means (Creswell and Poth, 2016). The study follows an inductive, interview-based approach, common to qualitative studies, which involves moving iteratively between data collection, analysis, literature, and new emergent theoretical ideas (Locke, 2001; Miles and Huberman, 1994; Strauss and Corbin, 1990). This process begins with a focus on participants' lived experiences and eventually moves on to provide a "conceptual handle on the studied experiences" (Charmaz, 2006, p. 3). Taken together, the adopted qualitative research design uses semi-structured interviews to focus on the stories of female ECRs from developing countries as they identify, construct, and make sense of their careers, to meet the research aims and objectives. Figure 3.2, below, illustrates the methodological processes that the study adopts. These will be discussed in much greater detail in the ensuing sections.

**Figure 3.2 Methodological procedure**

### ***3.2.2 Participant recruitment***

#### ***3.2.2.1 Sampling strategy***

The study follows Patton's (1990) purposeful sampling strategies for qualitative research. Patton urges authors to carefully identify sampling strategies that are conceptually aligned with the purpose of the synthesis, that are credible, that sufficiently address the research objective, and that are feasible, ethical, and efficient. Therefore, the study follows the criterion sampling technique (Patton, 1990), as participants were purposefully selected because they met the criteria for the study. Participants could take part in the research if they met the following two sampling criteria:

- 1) Be a female early career scientist from, and based in, a developing country;

2) Be a past recipient of the OWSD-Elsevier Foundation Award for Early Career Women Scientists from the developing world.

The rationale for employing this purposive sampling strategy was based on an *a priori* theoretical understanding of the central theme under study, which is how careers are enacted by female early career research scientists under contexts of underdevelopment. According to Mason (2002), there are certain categories of individuals who may possess a unique, different, or important perspective on a phenomenon and whose presence offers nuanced perspectives on that phenomenon. Therefore, the justification for selecting the above criteria – for instance, that participants must be past recipients of the OWSD-Elsevier award for the developing world – was primarily based on the fact that they (past recipients) possess the unique characteristics that form the basis of the research aims and objectives.

These characteristics – first as women scientists, second as early career researchers, and third as citizens of developing countries – ostensibly establish that the selection criteria be limited to women scientists who are ECRs from developing countries. Finding participants from such a minority group that proves to be diverse and representative is by no means an easy task, and so the sample population was limited to past recipients of the OWSD-Elsevier award for early career scientists. This award scheme was chosen under the premise that the research is interested in how female ECRs from developing nations have been able to brace the odds and succeed in their respective fields. Empirical evidence suggests that one of the ways in which individuals view themselves as successful is through awards and recognitions (Ravago and Mapa, 2020). Therefore, settling on an award scheme that is globally recognized gives credence to the fact that these women, under these contexts of underdevelopment, have indeed made significant progress in their respective scientific careers to the extent of gaining international recognition.



The OWSD-Elsevier award for early career scientific researchers was predominantly chosen to establish the authenticity and genuineness of the data. Although other internationally recognised award schemes exist, such as the L'Oréal-UNESCO international award for women in science, the former was deemed a more appropriate choice for this research for the single reason that it was established exclusively for female ECRs from developing countries, as opposed to the latter, which is more extensive in nature, focusing on women scientists all over the world, without any limitation on the geographic location, circumstances, or relative newness to the scientific field, unlike the OWSD-Elsevier award. In addition to the above, this sampling criterion was utilised to ensure diversity in the data set. Rather than conducting the study within one geographical location like a single country or continent, recipients of the OWSD-Elsevier award represent a heterogeneous pool of participants, connoting varied stories and perspectives based on cultural, economic, and even geographical differences. Although generalisability is not the aim of this research, it is worth considering the related, unrelated, and varied insights that exists among these women, given their unique environments and circumstances.

### 3.2.2.2 Participant recruitment strategy

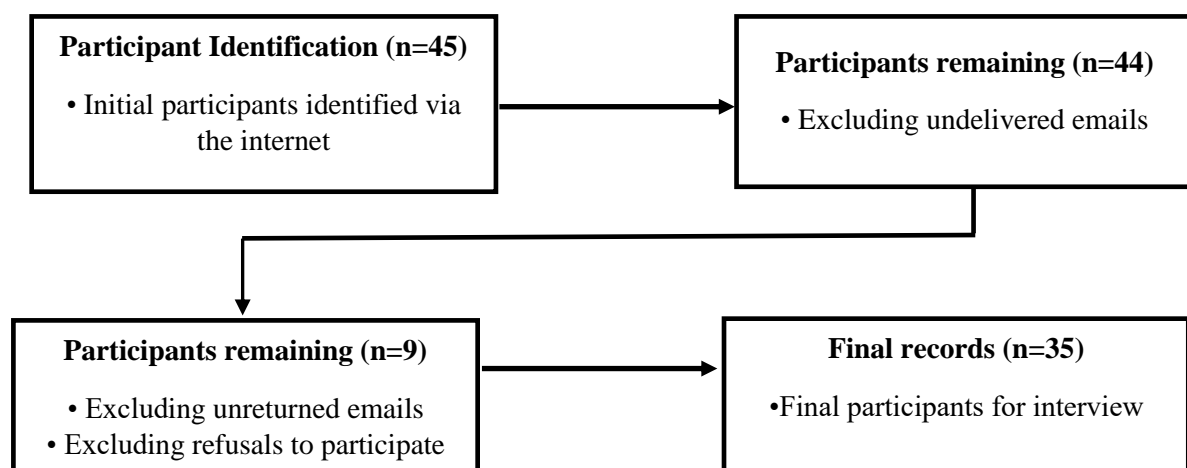
Participant recruitment officially began on August 2<sup>nd</sup>, 2021, and ended on February 28<sup>th</sup>, 2022.

The basic modus operandi utilised is summarised below:

#### *The gathering stages*

Participants were not recruited until ethical approval was granted by the research ethics committee for the collection of data. Having been given approval to officially commence data collection, the first step was to gather preliminary information about the participants. The place to go at this point was the OWSD-Elsevier award website (<https://owsd.net/awards/past-awardees>), where names and some basic information such as the institutions where recipients work are publicly available. However, it is noteworthy that although this website provided this information, it was limited only to their names and institutions and not personal data such as email addresses or telephone numbers.

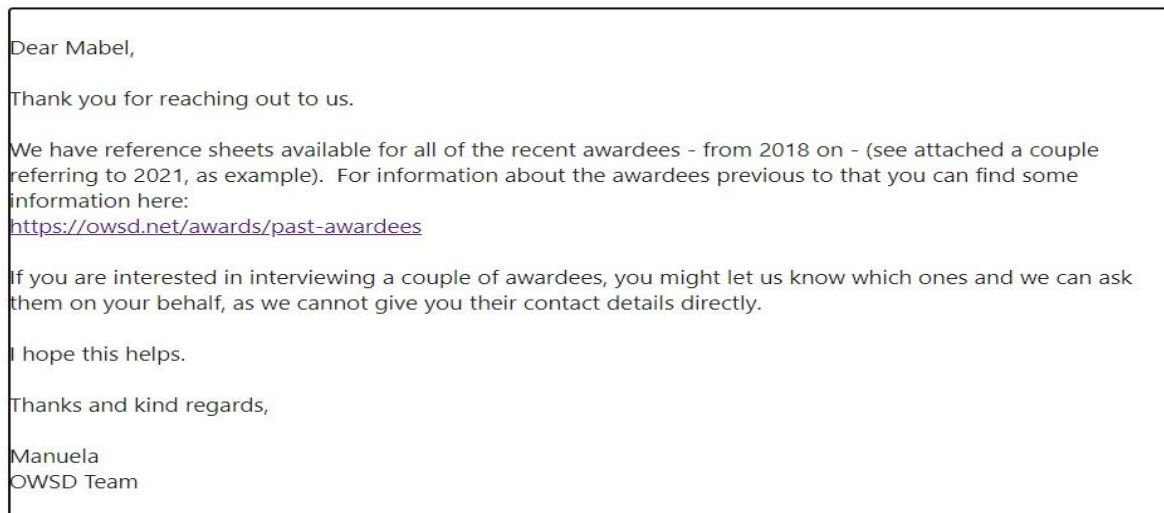
**Figure 3.3 Participant recruitment process**



The OWSD foundation was contacted at this point via email to inquire if they could furnish some information that would be relevant to the research. The feedback from them suggested that although they were happy to know about this research, they could not provide any personal

information from past awardees without their consent. As such, I had to find their contact details on my own. However, the OWSD foundation were happy to put in a word for me with the past award recipients prior to my contacting them. Figure 3.4, below, is an excerpt from the email reply from the OWSD.

### Figure 3.4 Email extract from OWSD

An email extract from the OWSD foundation. The text is enclosed in a rectangular border. It begins with a salutation 'Dear Mabel,' followed by a thank you message. The main body of the email provides information about reference sheets for recent awardees (2018 onwards) and offers to assist in finding contact details for those from 2012-2021. A URL is provided for more information. The email concludes with a closing and the sender's name, Manuela, from the OWSD Team.

Dear Mabel,

Thank you for reaching out to us.

We have reference sheets available for all of the recent awardees - from 2018 on - (see attached a couple referring to 2021, as example). For information about the awardees previous to that you can find some information here:  
<https://owsd.net/awards/past-awardees>

If you are interested in interviewing a couple of awardees, you might let us know which ones and we can ask them on your behalf, as we cannot give you their contact details directly.

I hope this helps.

Thanks and kind regards,

Manuela  
OWSD Team

Further emails with the OWSD concluded on the note that although they could assist with putting in a word for me with past awardees, I had to reach out to them first. Thus, with little success in obtaining contact details from the OWSD foundation, I had no choice than to go through the laborious process of inputting their names, one after the other, into the Google search engine, platforms such as ResearchGate as well as social media platforms like Facebook, Instagram, and LinkedIn, and in many instances going on to their institutional websites to search for basic information that could be used to establish the first contact. After this process, I was able to find email addresses, and in some cases, phone numbers, for all prospective participants.

The acquisition of this information made it possible to establish first contact with the participants. Overall, 45 names covering all award recipients between 2012 and 2021 were obtained (n=45). Thus, 45 invitation emails were sent out to participants inviting them to

partake in the study. This first email to invite participants had been screened and approved by the research ethics committee before it was sent out. It gave a brief overview of the study and why they had been selected. In addition to the email invitation, a more detailed participant information sheet (**Appendix A**), which added more in-depth information on the purpose of the study and data protection issues was attached to the email. Prospective participants were requested to respond, also via email, to indicate whether or not they wished to participate in the study.

### *The vacillating stage*

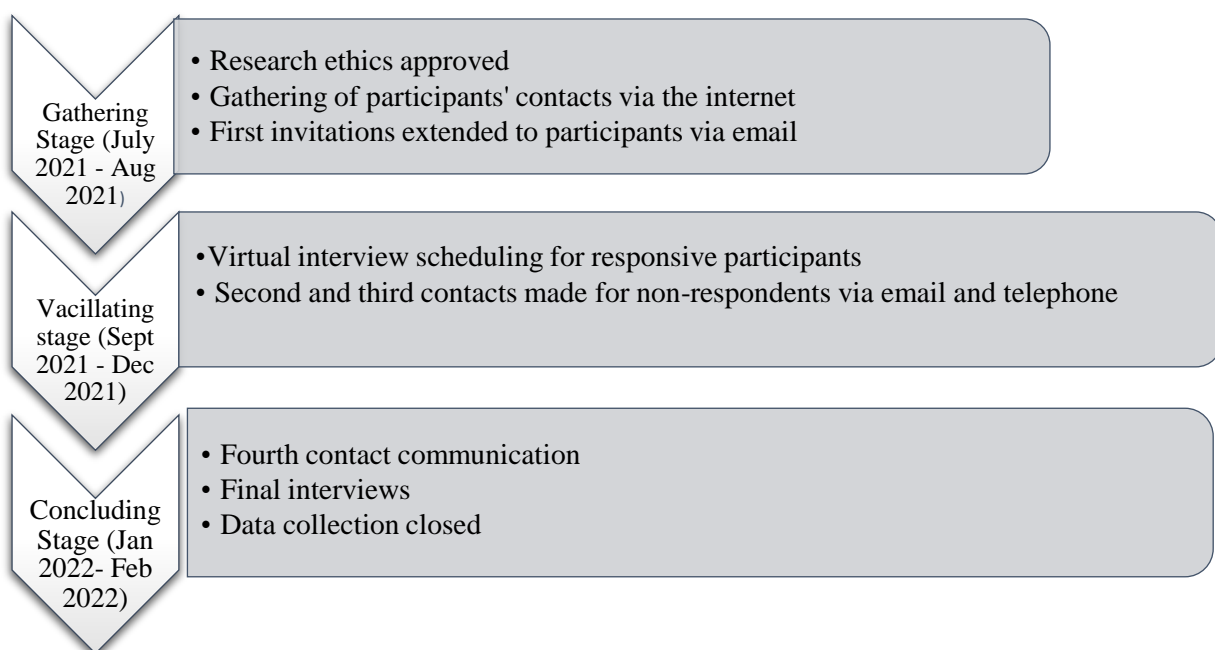
The second stage, between September 2021 and December 2021, was principally a vacillating or “back and forth” stage. This was the stage where participants began to respond to the invitation emails sent out earlier. Of the 45 emails initially sent out, one email came back as ‘undelivered’, meaning that the email address was either incorrect or no longer existed. All attempts to get the correct email address for this prospective participant proved futile. A further check at the institution where she had worked at the time of receiving the OWSD-Elsevier award revealed that she no longer worked there. Again, further attempts to find out where she currently worked were unsuccessful, as no information could be found about her on Google or other platforms. This reduced the population sample from 45 to 44 (n=44). Besides this, 12 positive responses were received in the first two weeks after sending out the initial email. Interviews were quickly scheduled, while reminder emails for non-respondents were sent out, since nobody had sent an email that directly stated that they did not wish to participate or be contacted again. After sending out the reminder emails, 10 more responses were obtained, and again, interviews were scheduled at the convenience of both participant and researcher. By the end of November, 22 interviews had been conducted. The initial input by the OWSD also

proved beneficial at this stage, as they managed to convince eight more people to participate in the study. Overall, the number of participants stood at 30 by the end of December.

### *The concluding stage*

The last stage, between January and February 2022, saw the conclusion of the entire participant recruitment and data collection process come to a final end. In January, five more winners were announced by Elsevier (the 2022 winners) and these women were contacted and invited to participate in the study. They all responded in the affirmative, and so once again, interviews were scheduled and conducted in late January and early February. The entire process was ended by the third week of February 2022. Figure 3.5 provides a summary of the data collection timelines.

**Figure 3.5. Data collection timeline**



The total number of participants now stood at 35, which, considering the number of participants contacted (44), brings the participation rate to an impressive 79.5%. See Tables 3.1 to 3.3 and Figure 3.6.

**Table 3.1: Biographical sketch of research participants**

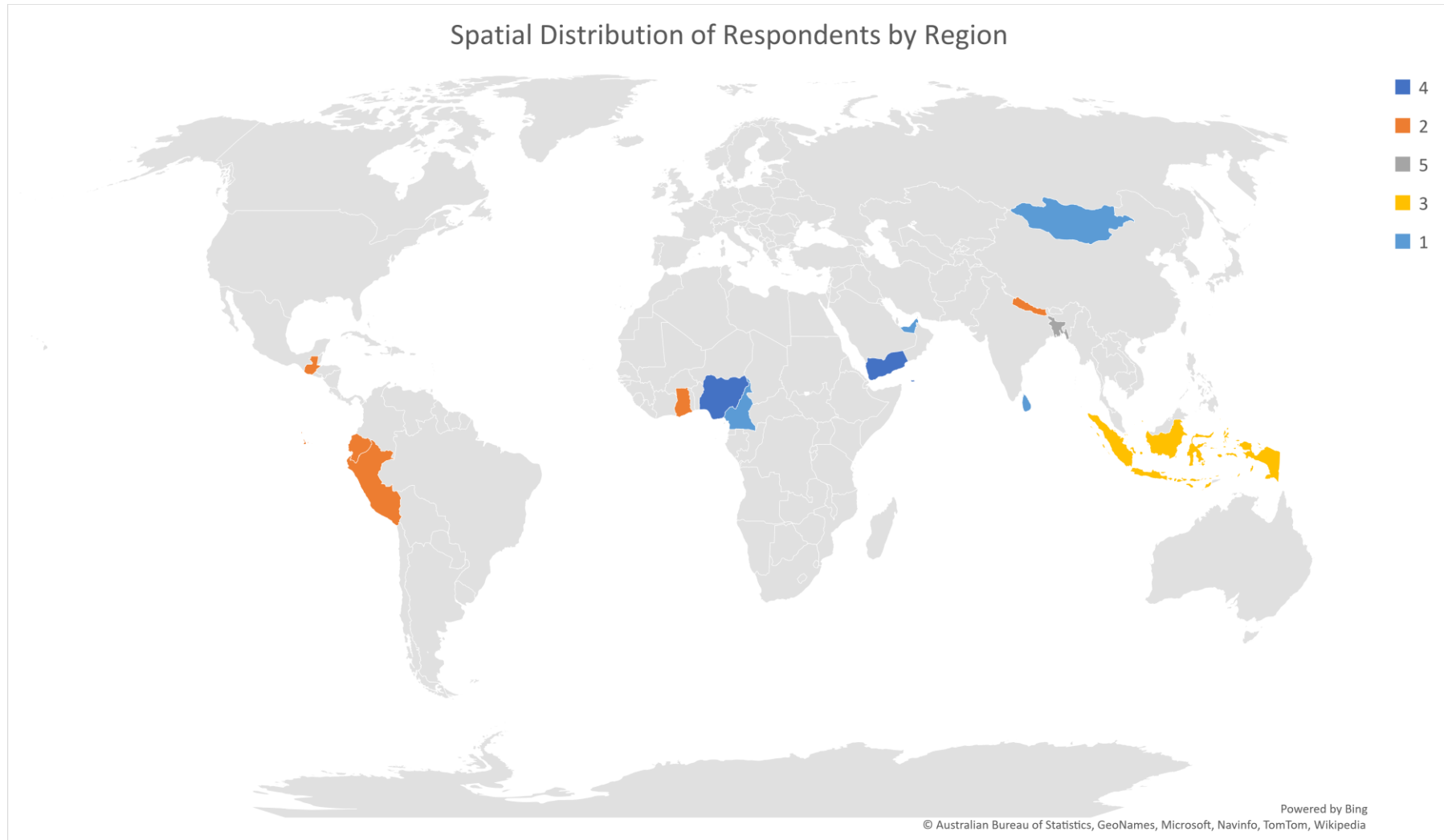
#	Name (Pseudonym)	Age	Marital status, parental status	Year of doctorate	Scientific discipline	Award Year	Area of expertise	Country of Origin
1	Leila	40	Single, childfree	2012	Biology	2022	Microbiology and Environmental Sciences	Yemen
2	Nila	36	Married, mother	2017	Engineering	2022	Geotechnical Engineering	Sri Lanka
3	Prila	42	Married, mother	2012	Biology	2022	Aquatic Ecology	Bangladesh
4	Tutu	38	Single, childfree	2014	Chemistry	2022	Hydrology	Nicaragua
5	Sarah	34	Single, childfree	2019	Engineering	2022	Environmental Engineering	Guatemala
6	Sophia	38	Divorced, mother	2011	Physics	2021	Particle physics.	Guatemala
7	Zana	34	Married, mother	2018	Mathematics	2021	Financial Mathematics and Mathematical Modelling	Mongolia
8	Emelda	34	Single, childfree	2017	Physics	2021	Applied Physics and Nanotechnology	United Arab Emirates
9	Maud	36	Married, mother	2015	Chemistry	2021	Synthetic and Nano- Chemistry	Sri Lanka;
10	Suzzy	Not declared	Not declared	2012	Chemistry	2021	Environmental Chemistry	Ghana
11	Barbara	42	Married, mother	2011	Engineering	2020	Electrical Engineering	Bangladesh
12	Anna	34	Mother	2015	Engineering	2020	Chemical Engineering	Guatemala
13	Dory	43	Married, mother	2012	Engineering	2020	Bioengineering and Microbiology	Yemen
14	Tyra	Not declared	Married, mother	2011	Physics	2020	Atomic Energy	Bangladesh
15	Kai	45	Married, mother	2017	Chemistry	2020	Science and Technology	Nepal

16	Julie	48	Married, mother	2014	Mathematics	2019	Applied Mathematics	Bangladesh
17	Herty	48	Married, mother	2007	Physics	2019	Physics	Cameroon
18	Yola	46	Single, mother	2007	Chemistry	2019	Theoretical and Computational Chemistry	Ecuador
19	Mira	Not declared	Mother	2012	Engineering	2019	Computer Science and Engineering	Bangladesh
20	Trudy	44	Mother	2013	Engineering	2018	Chemical Engineering	Indonesia
21	Mercy	46	Married, mother	2010	Engineering	2018	Minerals Engineering	Ghana
22	Anita	40	Single, childfree	2008	Engineering	2018	Environmental Engineering	Ecuador
23	Alexa	41	Married, mother	2011	Chemistry	2018	Bioenvironmental Sciences	Indonesia
24	Esther	40	Married, mother	2012	Biology	2017	Biochemistry and Biotechnology	Nepal
25	Regina	45	Mother	2008	Biology	2017	Epidemiology	Peru
26	Georgina	44	Married, mother	2009	Biochemistry	2016	Nutritional Sciences	Yemen
27	Victoria	51	Married, mother	2004	Physics	2016	Atmospheric Physics/Meteorological	Nigeria
28	Titi	58	Married, mother	2003	Physics	2015	Atmospheric Physics	Nigeria

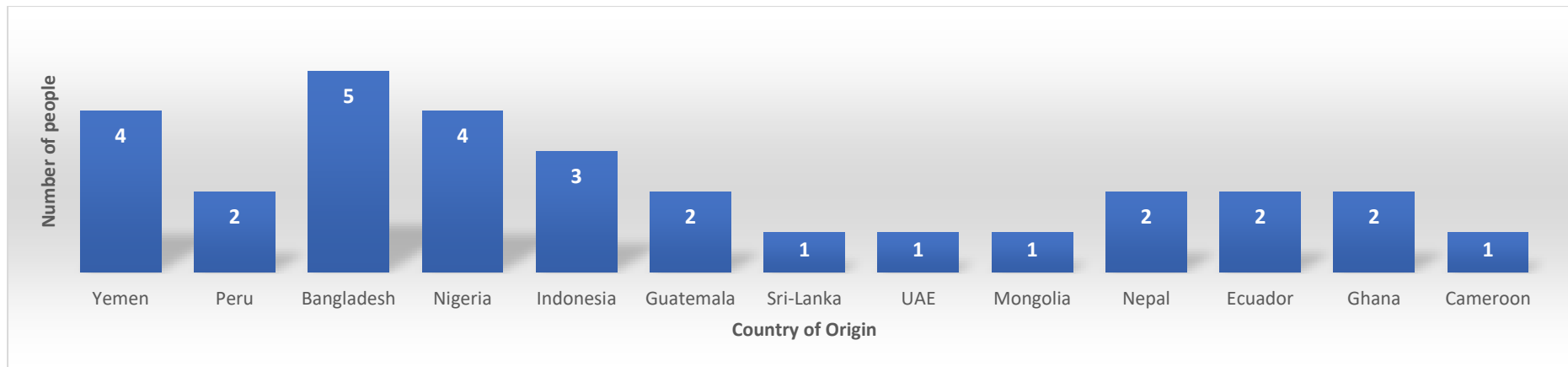


29	Rose	41	Married, mother	2004	Chemistry	2015	Pharmacy	Indonesia
30	Mary	41	Married, mother	2012	Biochemistry	2014	Biochemistry and Food Science	Yemen
31	Flora	48	Married, mother	2012	Pharmacy	2014	Pharmacognosy	Nigeria
32	Tina	Not declared	Married, mother	2007	Pharmacy	2013	Pharmacology	Nigeria
33	Freda	51	Married, mother	2008	Medicine	2013	Nuclear Medicine	Bangladesh
34	Dory	48	Unmarried, childfree	2008	Biochemistry	2012	Molecular Biology/Parasitology	Perú
35	Nadia	57	Married, mother,	2009	Public Health	2012	Community and Public Health	Yemen

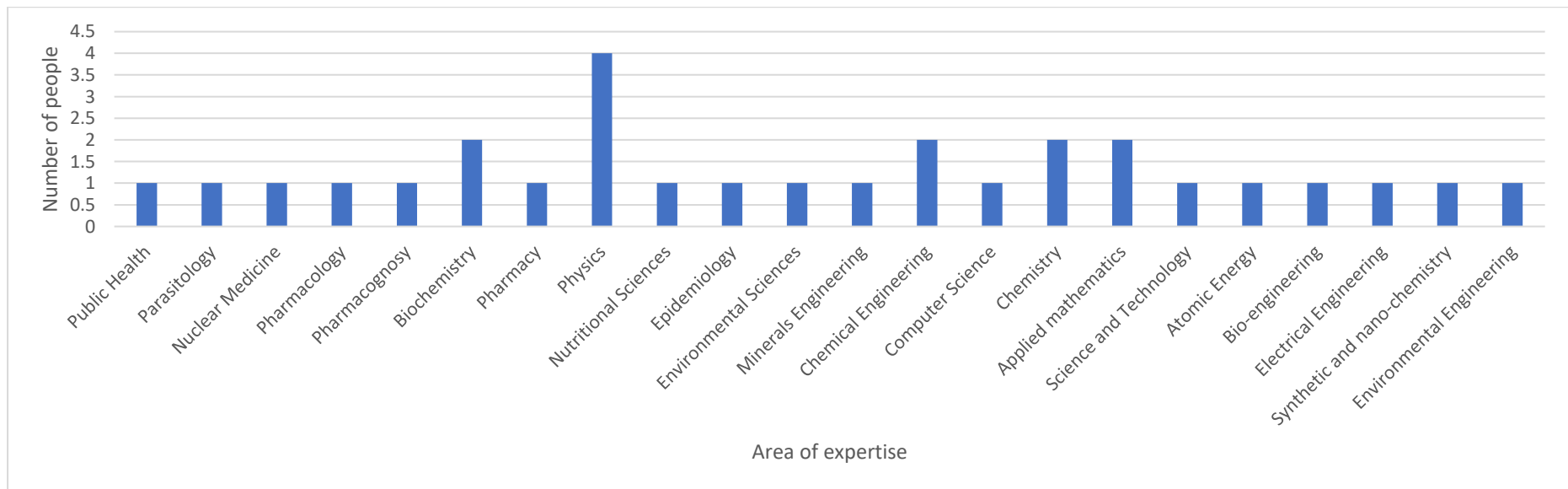
**Figure 3.6. Global spatial distribution of research participants**



**Table 3.2 Breakdown of participants by country**



**Table 3.3 Breakdown of participants by area of scientific expertise**



### **Descriptive characteristics**

The biodata obtained showed that the oldest participant was 58 years old and the youngest was 33 years old, with an overall average age of 44 years. Overall, 15 participants (42.8%) were married, 17 (48.5%) were mothers, two (5.7%) were unmarried and childfree, and 10 (28%) chose not to disclose either or both of their age, marital status, and whether or not they had children. Of the 35 participants, five hailed from the Arab region, eight from Central and South Asia, four from East and Southeast Asia and the Pacific, six from Latin America and the Caribbean, and seven from Sub-Saharan Africa. As depicted in the tables and figure above, respondents for the study capture a range of characteristics from a diversity of scientific research disciplines, race groups, ages, and family situations. This multi-faceted nature of the data set enables multiple perspectives to be considered (Gray, 2016) and further allows for the capture and recognition of variances in accounts and experiences resulting from differences in race, culture, economic conditions, and area of scientific expertise.

### **3.3 A narrative approach to understanding career construction**

Narrative approaches are among the several biographical methodologies being employed in various social science and history fields (Bornat, Henry and Raghuram, 2011). Narratives reveal a significant gap between how a person perceives significance in their career and a work history that only records the positions that a person has held (Modestino, Sugiyama and Ladge, 2019). Narrative approaches in the context of career studies explore how crucial turning points and career decisions are framed to cope with past or present changes and to motivate potential future changes (Fraher and Gabriel, 2014; Gabriel and Connell, 2010; Hoyer and Steyaert, 2015; Vough et al., 2015). Mallon and Cohen (2001) present narratives as a means to a more holistic view of career, arguing that this helps to return situated individuals to the centre of career theorizing, drawing on narrative theorists to make their point. Specifically, this study

draws on narrative identity theory as a specific narrative approach that places the focus of analysis on the stories that people create around their life trajectories (McAdams, 1993, 2011). Narrative identity is defined as “an internalized and evolving story of the self that provides a person’s life with some semblance of unity, purpose, and meaning ... [It] combines a person’s reconstruction of his or her personal past with an imagined future in order to provide a subjective historical account of one’s own development” (McAdams, 2011, p. 100).

The majority of narrative work in the subject of organisation studies is consequently based on the social constructionist premise (Hoyer and Steyaert, 2015) that narratives do not merely describe reality, but rather constitute it (Maitlis, 2009). We live in a ‘storytelling society’, according to Benwell and Stokoe (2010), where people arrange characters and events in meaningful ways to make sense of their lives. According to narrative theorists, “people's lives are experienced, given meaning, and identities are constructed through storytelling” (Stokoe and Edwards, 2009, p. 56). People use their narratives or stories to make sense of their own lives in order to create cogent tales that will support their perception of themselves as “goal-directed, driven, and purposeful” (McAdams, 1993, p. 68). It is crucial to highlight that these life stories focus on the significant life events over the course of an individual's entire lifetime that define that person's identity and include memories that go back many years before one begins work (Fraher and Gabriel, 2014; Ibarra and Lineback, 2005). When recounting the story of their career, individuals have the power to transform a negative occurrence, such as a denial of a promotion, into a positive event that provides opportunities for advancement (Vough and Caza, 2017).

People's self-narratives create a sense of continuity between who they have been in the past and who they aim to become in the future, and they also serve as a means of receiving external validation for their identities (Ibarra and Barbulescu, 2010). Chudzikowski, Gustafsson and Tams (2020) outline four dimensions to narrative approaches, highlighting their significance

to research. First, a narrative approach is central to studying individuals' meaning-making. For example, narrative approaches have been adopted in careers literature to examine how individuals make sense of career-related events and experiences (Cohen and Mallon, 2001). Thereby, narratives have a dual purpose. First, individuals make meaning through narration (through the telling of stories), and narratives are also the outcome of this meaning-making process. Second, time is a defining characteristic of narratives. The temporality of stories connects past, present, and future events in order to create coherence over time (Collin, 1998). Thirdly, narratives create chances for individuals to construct agency. The narratives of individuals interpret intentionality and deliberate actions in relation to events (McAdams, 2008; Bruner, 2004). This potential for narrative agency is even present when the organisational context appears to provide little room for self-directed action. Lastly, stories are always rooted in social space. The narratives of individuals position events, strategies, and acts within their respective relational and institutional settings. From a narrative perspective, identities are shaped by the localized tales that people tell about themselves, as well as by the larger cultural narratives, known as master narratives (Somers, 1994). Some theorists argue that narratives are identities because we develop who we are by telling stories about our lives and by living the tales we tell (Bruner, 1994).

Within this framework, it is interesting to note that most narrative approaches to identity construction fall within two distinct research orientations, highlighting either notions of 'coherence' and 'continuity' (Pals, 2006), or notions of 'ambiguity' and 'complexity' (Fraher and Gabriel, 2014; LaPointe, 2010). The coherence argument is predicated on the concept that open-ended, muddled, and ambiguous stories become 'readable' in the format of a cohesive and meaningful life story that is presented on multiple occasions (McAdams, 2001). Moreover, it is considered that the narrative order of people's life tales results from two key coherence principles: continuity and causation. While continuity is motivated by a desire for self-stability

over time, causality enables the development of a self whose past is significant to its present, since past events are perceived as initiating current states (Ashforth, 2000). Regarding ‘coherence’, individuals adapt to change with sensemaking mechanisms that provide plausibility and continuity across shifting environments (Brown, Gabriel and Gheradi, 2009; Maclean, Harvey and Chia, 2012). Studies that emphasise notions of ‘ambiguity’ and ‘complexity’ in identity-building, on the other hand, show narratives as continually being built, improved, and embellished (Weick, 1995).

Identity is thus reconceptualized as a potentially unstable, fragmented, and precarious construct that is open for repeated redefinition and revision (Fraher and Gabriel, 2014; Ibarra and Barbulescu, 2010; LaPointe, 2010). Studies with an emphasis on ambiguity explore ideas of ‘sensebreaking’, ‘senselosing’, and ‘sensegiving’ as ways to deal with identity change instead of emphasising notions of sensemaking during times of transition, pointing out that stories of the self may facilitate changes but also carry the risk of subverting or preventing them (Patriotta and Spedale, 2009). In addition to advocating the use of a narrative approach in career identity research, this study confirms the viewpoint of other scholars who have highlighted the importance of narratives in identity creation (LaPointe, 2010; Lengelle and Meijers, 2012).

One can build one’s identity by telling one’s life story. According to McAdams, as people organise the past and future into a narrative pattern and integrate their obligations, values, and talents, they come to understand who they are. The narrator’s personality and reality are shaped and constructed by the stories they tell: “we know or discover ourselves and disclose ourselves to others, by the stories we tell” (Lieblich, Tuval-Mashiach and Zilber, 1998, p. 7). By means of stories, people give coherence and continuity to the often multiple and ambiguous experiences at work, and through this identity work, they increase the coherence of the self. The narrative approach, emphasising the stories of people who are seldom studied in traditional research, has come to be known as *microstoria* (Imas, Wilson, and Weston, 201; Maclean,

2019), and appears to be valuable to extending our understanding of the micro practice driving the evolving nature of career identity, and has the potential to inform how one's past, present, and future shape identity in the context of work and career. In the next section, the microstoria narrative approach is presented as an interpretive frame for the inquiry.

### **3.4 Microstoria as an interpretive frame**

The contribution of the research was developed through the reflective gaze of what has come to be known as microstoria (Sarpong and Maclean, 2019): a narrative inquiry that privileges the use of contemporaneous storylines to illuminate social life (Boje, 2001; Imas, Wilson, and Weston, 2012). Microstoria aims to explore the hidden stories of 'little people', and calls into question the grand narratives of macro-history, particularly elite 'great man' histories (Sarpong and Maclean, 2021). Alternatively, it focuses on the narratives from the available stories of these hidden individuals, who fall outside of the traditional scholarly zone of research. Microstoria enables the projection of these otherwise subservient voices by projecting their views to help challenge orthodox social conventions on several dimensions (Ginzburg et al., 1993). The idea of science as a male-dominated field, with women underrepresented, persists to this day. Although much work has been done to give voice to women in science, the accounts of women scientists from the developing world is almost non-existent. Data gathered from the study participants will therefore encourage the inception of a close-knit research unit within the career literature, while calling into question some traditional macro-narratives that are widely accepted and which invariably do not explain all human actions (Boje, 2001). Thus, adopting a microstoria approach in the form of narratives allowed for the capture of lived experiences of the research participants in a meaningful way to generate relevant insights into their career journeys (Sarpong and Maclean, 2021).



Moreso, turning to microstoria permits the formation of close connections with participants (Sarpong and Maclean, 2017). For instance, by virtue of being a woman from a developing country myself, the microstoria approach facilitated the interview conversation by drawing on my personal experiences when discussing issues pertaining to socio-cultural factors that impede the career development of women. This encouraged research participants to express their thoughts and feelings more freely, without alarm. Thus, these underrepresented actors found their voices, and spoke openly about their lived experiences in enacting a scientific career under their peculiar contexts. Unlike grand narrative methods (Czarniawska, 2004), which have been widely used to test the veracity and relevance of current academic wisdom, particularly segmentation and human capital grand narratives, microstoria as a form of ante-narrative enables the examination of life stories beyond the confines of these grand narratives (Boje, 2001). It allows focus on diverse space and time frames between the epistemic and the ontologic, and aligns with critical discourse by privileging little stories (Boje, 2001, p.55).

Typically, traditional narratives require a plot to create a meaningful whole, which usually includes causally related episodes that ultimately lead to solving a problem (Czaniawkska, 1998): what Weick (1995, p. 128) refers to as “a history for an outcome.” The little stories that microstoria tells, on the other hand, are often non-linear, fragmented, polyphonic, incoherent and in most cases unplotted. This free flow of stories can then be refashioned with the retrospective sense and structure that a narrative would normally present. As Boje (2001) argues, a story provides the raw material for the narrative and thus comes before the narrative, rendering it ‘ante’ narrative. Research using microstoria does not aim for objectivity and generalizability; rather, subjective coding of multiple voices and hidden meanings becomes central to interpret interrelationships (Boje, Haley and Saylor, 2016). Ultimately, microstoria as an analytical framework enables the development of current theoretical insights on careers of women, and more specifically on careers of women in science from developing countries.

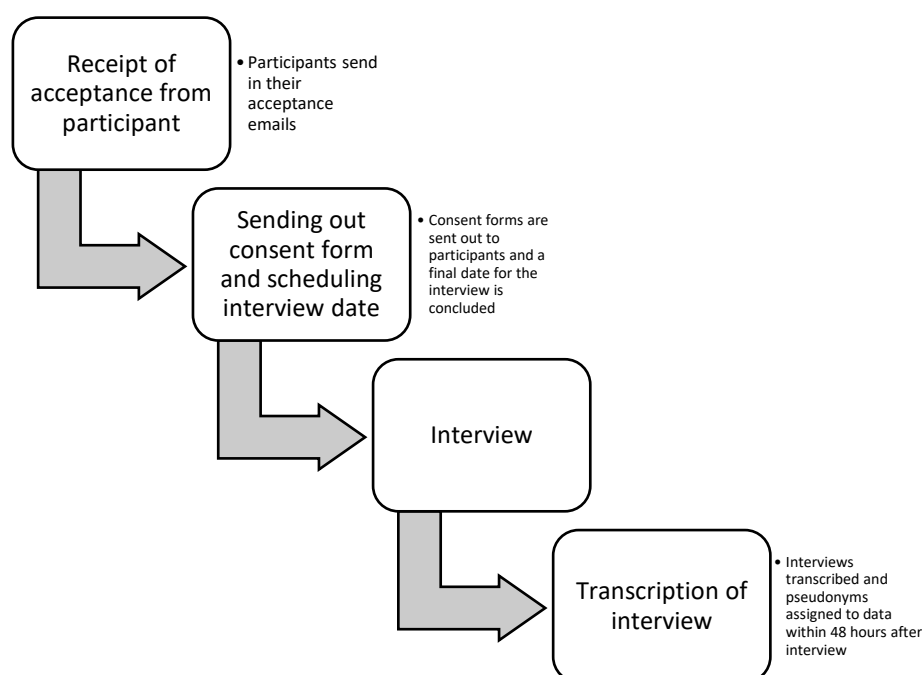
### 3.5 Data Collection

Data was collected primarily through semi-structured interviews and supplemented with secondary data from archival documents and digital footprints of participants to unravel how they identify and make sense of their careers, and also to gain a better understanding of their first-hand lived experiences. In all, 35 women scientists were interviewed. All interviewees were identified *a priori*, and although these women scientists were scattered all over the world, interviews were conducted remotely in the UK.

#### 3.5.1 Semi-structured interviews

The semi-structured interviews followed the sequence depicted in Figure 3.7 below.

**Figure 3.7. Interview procedures**



As illustrated above in Figure 3.7, the semi-structured interviews followed a procedure which began with the receipt of an acceptance email from a participant. Thus, when a participant sent an acceptance note, they were contacted to schedule a date that was appropriate and convenient

for both researcher and participant. They were sent a consent form (**Appendix B**), which they were required to sign and return to me on the day of the interview to acknowledge their approval and consent to have the interview conducted and recorded. When all of these steps had been concluded, a date was scheduled where the actual interview took place. In line with the information outlined in the participant information sheet, all interviews were transcribed within 48 hours after being conducted, with the help of the Microsoft word 'dictate' feature, and pseudonyms were immediately assigned to each data set to establish anonymity. All interviews took place remotely, partly due to the widespread locations of participants (who were resident in 13 different countries), and also as a result of COVID-19 restrictions on travel and face-to-face interactions, which made it impossible to conduct in-person interviews even if it had been viable to do so at the time. Thus, all interviews were conducted virtually – 29 on Zoom, two on WhatsApp Video and four over the telephone. The interviews covered a period of five months, with 30 interviews conducted between August 2021 and December 2021, and an additional five in February 2022.

Before each interview began, participants were briefed on the purpose of the research and their express verbal consent was obtained before recording commenced. Once recording officially began, this procedure was repeated once again, as participants were briefed once more on the purpose of the study, their rights as outlined in the participant information sheet, and issues relating to anonymity. Each interview lasted between 45 and 60 minutes, with the exception of two interviews that lasted for 30 minutes each, as participants had duly informed me before the scheduled date that they were able to spare only 30 minutes of their time. The interview protocol (Appendix F) was developed to address the core research question regarding how career narratives of women professionals are constructed and drew from prior research on career construction, career development and career self-management (Lent and Brown, 2013; Savickas, 2013; Sharf, 2016). The questions were split into seven main parts, encapsulating

about 30 questions, which captured the aims and objectives of the research. Questions were purposefully open-ended to guide the general discussion and allow for follow-up, and although each question was designed with the ultimate aim of obtaining information from participants, they were phrased in an agreeable manner to allow flow from participants.

The interview began by asking about participants' career trajectory. The first question asked was "Tell me how you got to your current position." This section sought to capture the career journey of participants from when they first realised that they wanted to be in science until their current status within their organisation. The aim at this point was to discover how participants got into science and eventually into their current careers by taking account of stakeholder attitudes and perceptions (parents, teachers, friends, community) towards their career formation. Here, the focus was to establish the influences that these stakeholder groups had on the formation of participants' careers, as well as participants' personal participation in the formation and subsequent development of their careers. This section set the tone for the interviews and delved into matters relating to career more broadly in terms of how participants defined success, what skills and experiences they had or needed to be successful, and times in their lives when they felt successful. Again, participants were asked broadly about their experiences with mentorship and whether they received any formal or informal mentorship during their training years. This section was imperative, as it helped to project a distinctive profile of participants in terms of how they viewed success and what motivates them to do what they do. It further created a congenial ambiance, as participants were happy to share in their successes, and facilitated in building ease into the next sections, which dug much deeper into biases, discrimination and general challenges faced by these women scientists from developing countries.

To provoke ample information from participants, topics moved from fairly easy questions to more controversial subjects as each interview progressed. Thus, the next stage of questioning

on challenges began by asking participants if they believed female scientists in 2021 suffered bias, whether conscious or unconscious, before delving into their personal experiences of some of the biases they had faced, both as student scientists and in their career as professional scientists. Questions were also asked about the challenges they had faced as female scientists that they believed to be peculiar to their country specifically and developing countries in general. Furthermore, questions were asked about their work-life balance and how pursuing their career had affected their family and social life. These questions gave insight into the everyday challenges that women scientists from developing countries encounter, as well as the coping mechanisms that they have developed to survive, manage, and thrive in their chosen careers. In the process of asking questions about participants' experiences, questions remained open-ended to allow participants the opportunity to share their stories without any disruptions. Nonetheless, there were instances where participants needed some prompting to further deduce and extract more information pertaining to the subject. In such situations, participants were asked questions like "How has this experience shaped your life?" or "What does this experience mean to you?" This stage of the questioning process was crucial, as it brought to light some of the everyday challenges that these women scientists experience and again illuminated the coping mechanisms that have been devised by participants to succeed under these challenges. The third section moved into questions about participants' decisions to work under the contexts in which they find themselves, despite the challenges that exist. Again, this stage sought to explore what they believed could be done to change the narrative about women in science, especially those from developing country contexts. The purpose of the section was to allow participants to air their opinions and offer recommendations on how the 'Women in STEM' agenda could be further sustained and made more appealing to the younger generation of women.

The fourth section then probed into the chance events and unplanned circumstances, if any, that had shaped, altered, and propelled participants' careers, including questions such as "Could you tell me about an unplanned circumstance that influenced your path to this career?" As career cannot be understood as separate from one's experiences (Young and Collin, 2000), this section sought to shed light on the unplanned conditions which have also influenced the careers of these women scientists. The fifth and final section of the interview focused on the sharing of fond memories in the pursuit of a scientific career as a woman from a developing country. The interview ended with the same question to each participant: "Do you have any advice for young women in developing countries aspiring to be like you?" Overall, it is worth noting that while the topics of each interview remained consistent, the questions varied depending on the insights gained from each particular individual. It is also worth bearing in mind that the semi-structured interview protocol was iteratively developed as the data collection went along. Thus, additional questions were added as the data collection progressed. In some circumstances, not all questions were asked: for instance, in situations where participants had already given an answer to a question while answering another. Also, there were instances where the interview questions did not follow the order of the protocol, but rather were made to flow with the direction of the conversation. This was done to ensure coherence in structure, and again to allow flow from participants. Steering the interviews in this manner it observations such as how participants felt or openly demonstrated emotions. All interviews were transcribed within 48 hours after they were conducted, and pseudonyms were immediately assigned to the transcribed data. The Microsoft transcription tool was used to convert the video or audio speech into text. Each interview was then replayed to ensure that what was said matched what was transcribed (Galletta, 2013). This was necessary because most speech-to text devices are unable to capture some words, especially when they are either inaudible or not in the English language. This process thus enabled all necessary corrections to be made regarding what was actually

said by participants. Again, this process increased the reliability of the data, as it ensured a precise and accurate depiction of the interviews. All interviews were transcribed in line with the naturalised or verbatim method (Schegloff, 1997), as such an approach was deemed appropriate, bearing in mind the level of analysis planned. Since the analysis follows an interpretivist approach where data interpretation is based on what participants said, as opposed to how they said it, this approach was considered suitable. The entire set of transcribed data amounted to 280 pages of single-spaced text.

In qualitative studies, there is much emphasis on meaning rather than distribution (Crouch and McKenzie, 2006). Thus, when there is ample data to provide diverse variables and more data might be repetitive, the researcher may decide to stop looking for new participants (Glaser and Strauss, 1967). According to Spencer, Ritchie, and O'Connor (2003), it is a generally accepted rule amongst many researchers that the maximum interview sample should be 50. Bryman and Bell (2015), however, found that in the UK, for instance, the average sample size is about 28. Sample size may also be affected by the point where saturation is reached and the research questions have been answered (Charmaz, 2008). The research thus followed the principles of saturation, or the collection of data until no new insights emerge, and theoretical sampling, which focuses upon obtaining an adequate sample size to facilitate saturation (Bowen, 2008).

### ***3.5.2 Supplementary data: Archival and digital footprints***

Secondary data, in the form of archival documents and digital footprints, were collected to supplement data obtained from the primary interviews. This is data covering the career profiles of the research participants as available in public domain websites such as the Elsevier webpage, YouTube, ResearchGate, LinkedIn, personal blogs of the respondents, and reference sheets made available to me by the OWSD foundation. This rich secondary data acted first as a guide in locating the email addresses and phone numbers of participants, which enabled first

contact communication to be established. Again, this archival data and digital footprints of participants allowed for the corroboration and substantiation of the primary semi-structured interview data to ensure trustworthiness of the data. This is because some previous documents were obtained where participants had given prior interviews to the OWSD-Elsevier foundation in line with receiving the award. Stories told, especially about their backgrounds and challenges faced, were checked and matched with stories told during the semi-structured interviews to ensure that they were similar accounts, which, to a large extent, aided in the reduction of bias often associated with retrospective accounts.

### **3.6 Data analysis**

#### ***3.6.1 Overview of analysis***

Qualitative data analysis involves a process of bringing order, structure and meaning to collected data (Bryman, 2016). The analysis for this study followed a constructionist thematic analysis approach (Byrne, 2021) to analyse and report key themes and categories (Clarke and Braun, 2013). A constructionist approach rejects the idea of objectively understanding the meaning and interpretations of our social world (Atewologun, 2018). On the contrary, it recognizes that meaning-making and interpretation of our world are constructed through social processes and interaction (Young and Collin, 2004). This methodology seems particularly appropriate because it captures respondents' career trajectories over a certain period, as the underlying values and beliefs that shape their work expectations and aspirations are often formed long before an individual enters work life or a specific work environment (Rodrigues, Guest and Budjanovcanin, 2013; Kish-Gephart and Campbell, 2015). Braun and Clarke (2006) lay out six steps to conducting thematic analysis. These are familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, naming and defining themes, and producing the report. These are discussed in much greater detail in the ensuing



sections. To allow these themes and relationships to surface, the data will be approached with a constant comparative approach by iterating across the data, prior research, and emergent theoretical ideas (Locke, 2002; Miles and Huberman, 1994; Strauss and Corbin, 1990).

### *Stages of analysis*

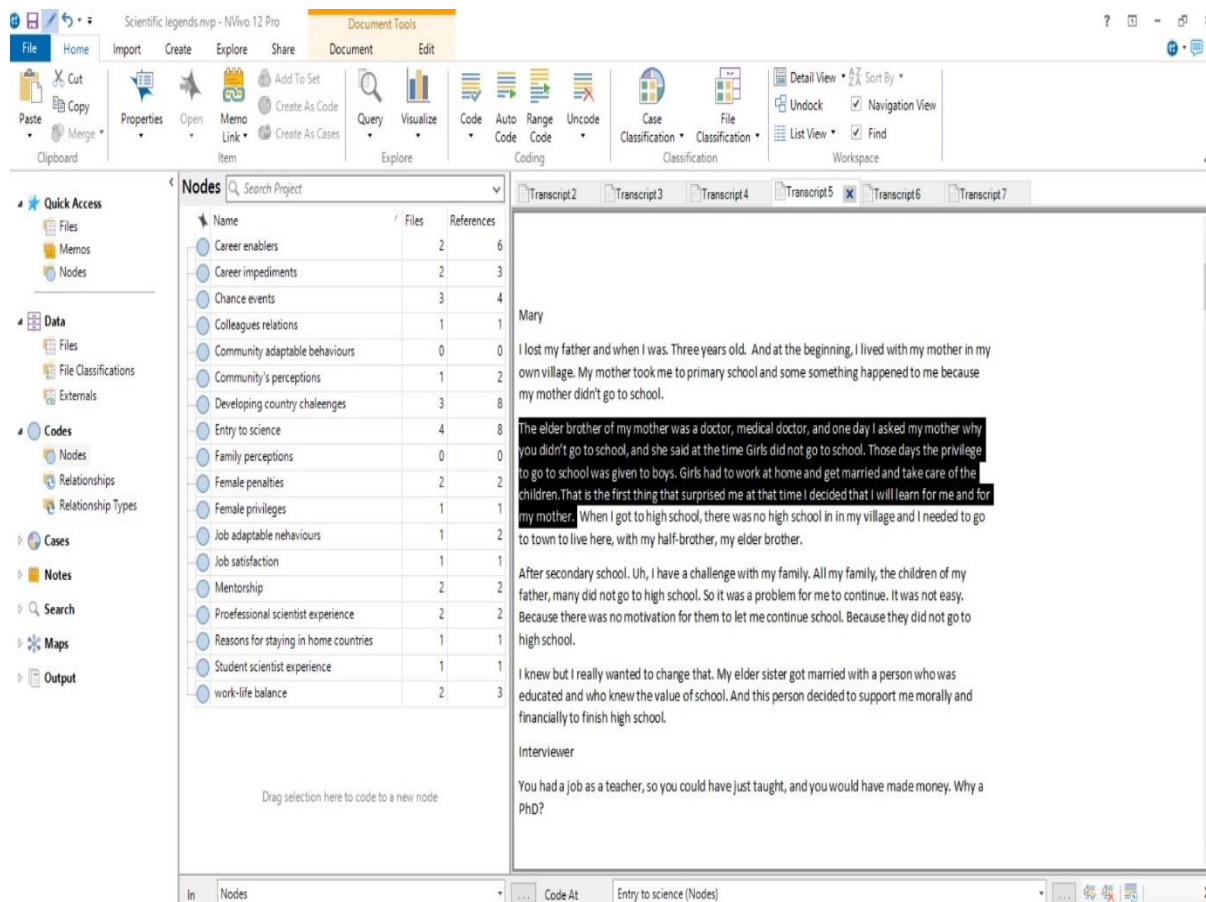
#### **Stage one:** Familiarisation with the data

A process of familiarization is a crucial first step in thematic analysis (Bryman, 2016). As highlighted by Braun and Clarke (2006), it is vital that the researcher immerse themselves in the data to the extent of becoming familiar with the depth and breadth of the content. This immersion often comprises repeated reading of the data, and reading the data in an active way: that is, searching for meanings, patterns and so on (Braun and Clarke, 2006). The first step in this familiarisation process involves the transcription of verbal data into textual form. All transcription was done verbatim, providing a thorough transcription of what was said and how. This procedure allowed for the preservation of the different elements of the interviews other than the verbal content, such as non-verbal language, contextual aspects, and the interaction between interviewer and interviewee (Azevedo et al., 2017).

Accordingly, after all interviews had been transcribed, these transcripts were read at least twice, first after the initial transcription was completed, and then again when the research reached its main analysis stage. This process of familiarisation is essential, as it allows for the researcher to become well acquainted with the body of the material. Admittedly, this procedure of reading and re-reading is cumbersome and time-consuming, to say the least. Notwithstanding, it is crucial, as it sets the tone for the rest of the analysis. Thus, by actively engaging with the data, an intimate familiarity with the words and narratives of the participants was already built up in my mind prior to the main interpretation of the narratives.

***Stage two: Generation of initial codes***

The next stage after the process of familiarisation involved coding of all interview transcripts. A code refers to “the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon” (Boyatzis, 1998, p. 63). Accordingly, the process of coding requires organising data into meaningful groups (Tuckett, 2005). Thus, features of the transcribed text data were identified in relation to the research questions and were assigned codes to denote the meaning conveyed through the coded excerpts. The coding at this stage involved open coding to allow for a proliferation of codes, and subsequently involved assigning names to small portions of text. In order to do so, the data was analysed in great depth, and although the coding was data-driven, I remained open to various theoretical paths (Creswell and Poth, 2016). Each transcript was analysed individually with the aid of qualitative analysis software, namely NVivo 12. As noted by Bryman (2016), the innovation of NVivo not only diminishes the complexities associated with qualitative data analysis, but also saves time when compared to the traditional method of utilizing coloured pens to sort, cut and categorize data. Zamawe (2015) further highlights how, just like the manual analysis, NVivo 12 has little to no influence on most research designs and is actually compatible with approaches such as thematic analysis. Thus, each transcript was loaded onto the software and coded accordingly. At this stage, the main concern of the study was to identify words, phrases, statements, and sentences that resonated with the research questions and objectives. This resulted in the identification of a proliferation of first-order codes. Figure 3.8, below, shows the process of coding using NVivo 12.

**Figure 3.8 Coding using NVivo*****Stage three: Searching for themes***

Following the coding of the raw data into first-order concepts, the second phase of the data analysis moved to a more conceptual level that involved the generation of second-order theoretical themes (Corbin and Strauss 2008). Here, the number of codes was reduced and the search for common elements began so that they could be raised to the level of higher-order codes or themes. A theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set (Braun and Clarke, 2006). An important question asked at this stage is “what counts as a theme?” As Braun and Clarke (2006) elucidate, although ideally there would be a number of instances where a particular theme resonates across the dataset, that does not necessarily make

it crucial for the research. Particularly, though there must be evidence from the dataset to back a theme, it is not a matter of fact that it must be present many times (say, 50% of the data set) before it qualifies to be a theme. Thus, to capture a theme, researcher judgment is crucial. In the words of Braun and Clarke (2006, p. 82), the “keyness” of a theme is not necessarily dependent on quantifiable measures, but rather on whether it captures something important in relation to the overall research question. Thus, the initial first order-codes were grouped based on code similarity to construct second-order themes.

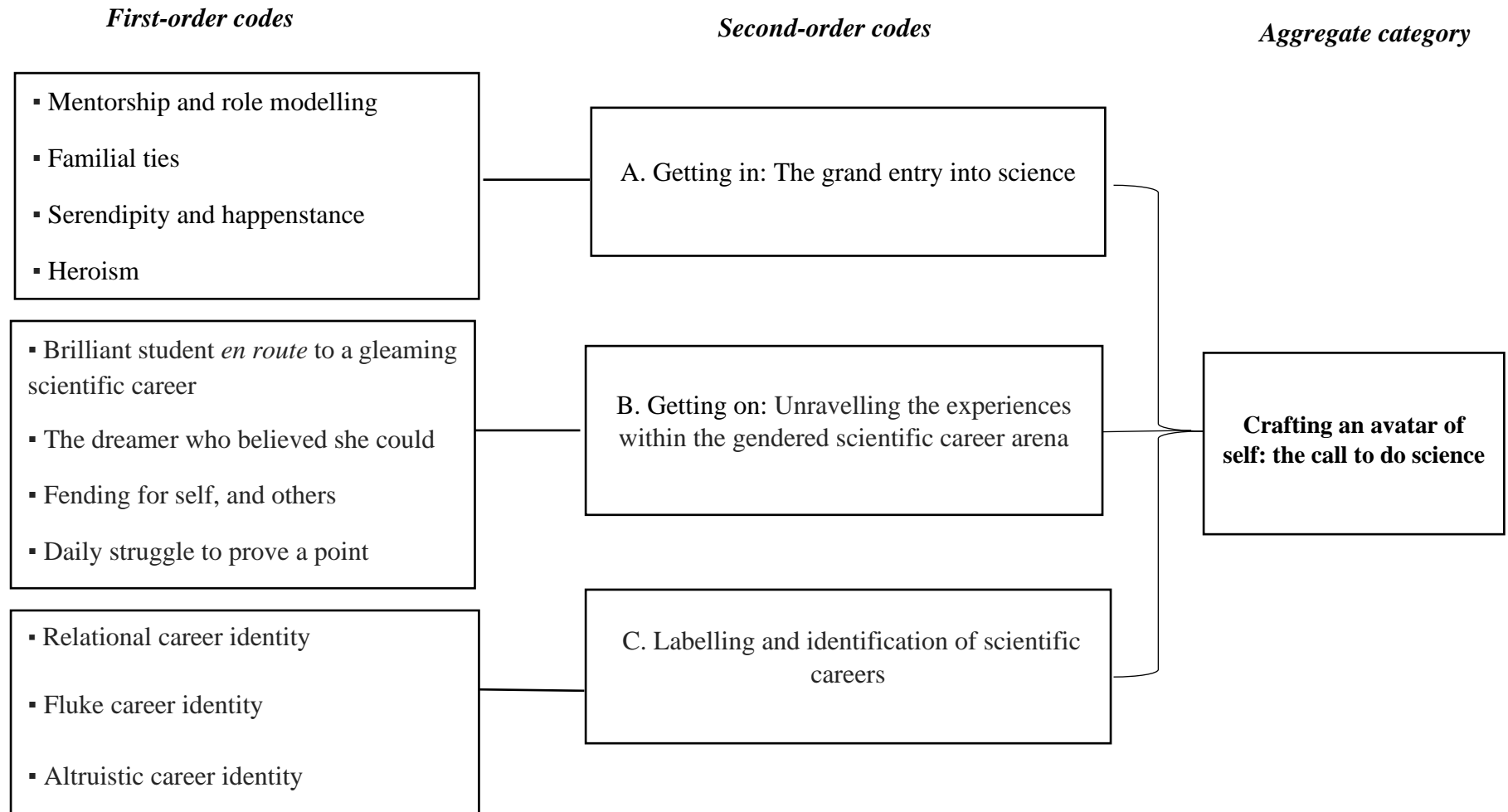
### ***Reviewing, naming, and defining themes***

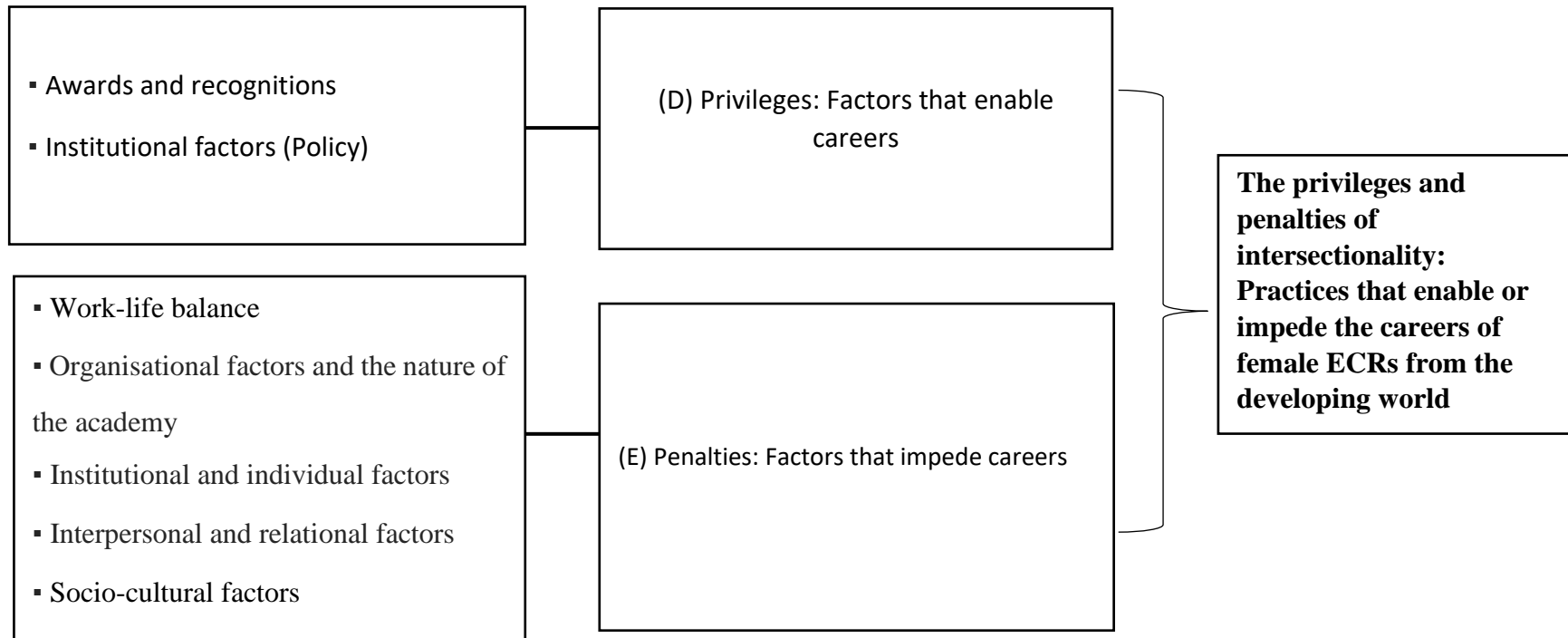
After obtaining themes, the next step involved a review of these themes. During this process, it became evident that some themes could not really be classified as themes, as there was not enough evidence to support them. These were discarded. Other themes also echoed similar sentiments, leading to the mergers of such themes. Yet again, other themes were further broken down into separate themes for idiosyncratic evaluation (for instance, an initial theme labelled as ‘impeding factors’ was further broken down into socio-cultural factors, organisational factors, and institutional factors to allow for a more nuanced assessment of the problem). Again, at this stage, all collated extracts were read once again to ensure that they formed a coherent pattern with both the first- and second-order themes.

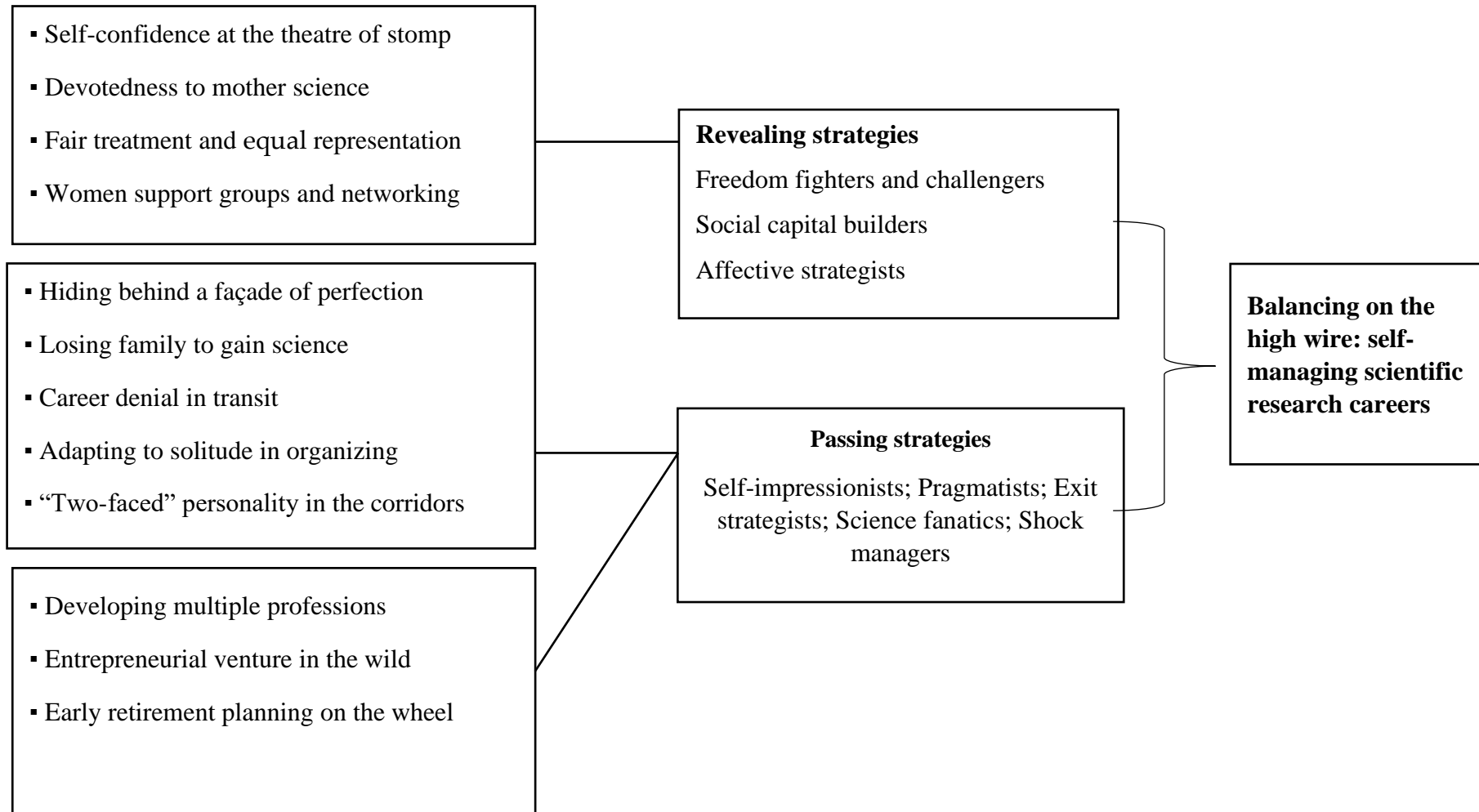
The next stage after reviewing and organising the second-order themes involved the creation of a set of aggregate theoretical categories which consisted of consolidation of second-order categories and their sub-order themes into a refined overarching theme that encapsulated the research aims and objectives. This is the point where the themes are ‘defined and refined’ to identify the essence of what each theme is about (Braun and Clarke, 2006). Again, this was achieved by going back to collated data extracts for each theme and organizing them into a coherent and internally consistent account, with accompanying narrative. Thus, for each

individual theme, a detailed analysis was conducted to identify the ‘story’ being told by each theme, and how this story overall fitted into the broader story that the research hoped to tell about the data, in relation to the research question or questions, to ensure that there was not too much overlap between themes. Figure 3.9, below, illustrates the final thematic map showing the development of codes to final themes, while Tables 3.4 and 3.5 provide an overview of how the various data sets were used in the analysis process.

**Figure 3.9** Thematic map showing the generation of codes.









**Table 3.4. Summary of data sources and how they were used in study**

Data sources	How data and information were used in the study
<p><i>Semi-structured interviews with female ECRs</i> 35 interviews, approx. 280 pages</p>	<ul style="list-style-type: none"> <li>- Development of the historical account of participants' career choices and career decisions</li> <li>- Analysis of the rhetorical devices the female ECRs employed in narrating their own life histories and career trajectories.</li> <li>- Analysis of the female ECRs' perceptions of the enablers and inhibitors of their career development</li> <li>- Developing insight into the coping mechanisms and strategies in self-managing their career as female ECRs from developing countries</li> <li>- Analysis of the intersectional power dynamics that shape the career of female ECRs from developing countries</li> </ul>
<p><i>Archival Data and digital footprints</i> Female ECRs' publicly available profiles from OWSD, and other data available on online profiles, such as blogs, Facebook, YouTube, LinkedIn, company websites, ResearchGate, Instagram. 50 printed documents, approx. 50 pages</p>	<ul style="list-style-type: none"> <li>- Examining participants' digital footprints</li> <li>- Cross-checking socio-demographic and biographical sketches of entrepreneurs.</li> <li>- Examining participants' views and opinions as expressed through their online presence</li> <li>- Examining media reportage on participants</li> <li>- Analysing other publicly granted interviews to OWSD and Elsevier and other media outlets</li> </ul>

Aggregate dimension	Representative data
1 Crafting an avatar of self: the call to do science	<ul style="list-style-type: none"> <li>▪ “When it was time to leave high school, one of my teachers encouraged me to pursue science. My parents also felt the same, although I wanted to be in the Arts. They said I was too smart for Arts and that smart people do science, so I went with it.”</li> <li>▪ “My mother has a brother. He is a medical doctor. But my own mother never went to school because priority was given to her brother. I felt that was wrong even as a child. So, I wanted to do this to send a message to my community that women are equally capable.”</li> </ul>
2 Exploring the privileges and penalties of intersectionality to identify the practices that enable/impede careers of female ECRS from the developing world	<ul style="list-style-type: none"> <li>▪ “Winning the Elsevier award increased my visibility at work. My colleagues got to know more about my work and my research contribution. It also gave a positive impact on securing research grant from IAEA. It demanded more responsibility, output from me and increased expectations of my seniors.”</li> <li>▪ “Due to the lack of co-ordination and resources and research culture, I cannot progress as much I want, and my scientific pace becomes slower. So, in short, I feel like it’s really difficult to keep the pace and excel in research from a developing country.”</li> <li>▪ “The challenges for women are more than men because, for example, if the work requires mobility, for women it hampers work-life balance. We need to plan in a way that will have less effect on our kids and family members.”</li> </ul>
3 Organising stories of strategies to self-manage scientific research career	<ul style="list-style-type: none"> <li>▪ “I am a medical doctor. If this research job becomes uninteresting, I can always go back to my house and put up a signage that says, ‘doctor available in this house’.”</li> <li>▪ “The women in my research centre, we’ve formed a group. We meet once a month, you know, to have fun, go swimming or do something fun. Just to release stress. The men go drinking on Fridays and go golfing or watch football, so why can’t we do same? It’s beneficial to our mental health.”</li> <li>▪ “When I go into the community, I always have to be conscious and not behave too polished, else they would say I’m proud, and this can discourage them from supporting their girls into higher education and STEM.”</li> </ul>

### **3.7 Challenges encountered in collecting data**

Although the research, and in particular the data collection process, advanced quite smoothly, some challenges were encountered along the way which, although they posed no threat to the analysed data, still merit honourable mentions. For starters, the main challenge during the data collection period had to do with the disinterest from ‘old’ participants: that is, those who had won the OWSD-Elsevier award five years and more ago, thus falling between 2013 and 2016. When the first emails were sent out to invite participants to take part in the research, those individuals who responded were those who had won the award from 2017 onwards. It took many more emails, phone calls, and in some instances some participants volunteering to ‘put in a word’ on my behalf before some agreed to take part in the study. Overall, those who were new to the award showed greater enthusiasm and readiness to assist in the success of the study than those who had won the award a long time ago. One participant mentioned that as she had gone on to become a senior academic and no longer identified as an ECR, she did not see the need to partake in the study, but upon further reading of the aims of the study, she had a change of mind. It is in my opinion that this might also have been the case for the many others who showed disinterest in the study.

Another problem encountered was the issue of time difference. As I was based in London and the participants elsewhere (13 different countries), time difference played a huge role when it came to setting up interviews. There were some instances where the time given by a respondent was not favourable due to this time difference, and vice versa. This proved to be difficult in many cases, as some respondents had very busy schedules and could only make time at that very moment. Nonetheless, this was mitigated in the long run through re-scheduling, although it lengthened the time of the overall data collection period. There was also the issue of language barriers. Some respondents spoke very little English, making the interviewing process quite difficult for both the respondent and me. In some instances, the interview questions had to be

translated and sent to the respondent after the initial interview had been conducted, for answers to be typed and sent back to me. These answers were then matched with the transcribed interview text to make up for any mishaps.

The last concern had to do with the issue of cost. Some expenses were incurred in the process of collecting data that were not foreseen. For instance, telephone calls had to be made outside of the UK to talk to respondents who wished to be contacted via that medium. Three interviews were conducted over the telephone, with each call lasting between 30 and 45 minutes. This proved to be quite costly, as international phone calls can be expensive. Overall, however, the data collection was very manageable, and the above concerns were mitigated for in time.

### **3.8 Criteria for evaluating research**

#### ***Reliability and Trustworthiness***

Although assessing the quality of research is mostly linked to quantitative studies, there is a discourse among qualitative researchers concerning the relevance of these criteria for qualitative studies (Bryman, 2016). Reliability, which is primarily the extent to which research can be replicated, is an extremely difficult criterion to meet in qualitative research studies (Bryman, 2016), since it is impossible to freeze a social setting and the circumstances of an initial study to make it replicable in the sense in which the term is usually employed (Bryman, 2016). Yet, many strategies have been introduced over time in pursuance of an approach that meets the requirements of reliability (e.g., Guba and Lincoln, 1994). For this study, the internal reliability construct was employed as a measure to evaluate the reliability of the findings presented. Although the study was conducted by me, my research team, which consists of two supervisors and a research development advisor were actively engaged in every step. Thus, we were able to hold several discussions as a team to agree on the eventual findings that have been

presented. This inter-rater consistency makes the study reliable. Another measure of evaluating the study is an assessment of trustworthiness. Trustworthiness encompasses four main criteria: credibility, transferability, dependability, and confirmability. By triangulating data sources between interviews, archival documents and digital footprints of participants, the study was able to ensure that a substantive amount of credibility was achieved. Again, in line with Geertz's (1973) argument for thick description of events in qualitative studies, the study produces rich accounts of the details of the participants.

According to Guba and Lincoln (1994), such a thick description of events provides others with a database for making judgements about possible transferability of findings to other milieux. Guba and Lincoln (1994) further suggest the idea of dependability and argue that researchers should adopt an auditing approach to their research. This study made sure to keep an audit trail, which entails the keeping of all records at every stage of the research process. Interview transcripts, archival documents, and notes on data analysis decisions were all kept securely in an accessible manner for a possible audit of the study. Finally, the study meets the benchmark of confirmability by acknowledging that while complete objectivity is impossible, the study has been presented in good faith. As part of the limitations of the methodology, I have explicitly stated that although I identify as a woman from a developing country, and as such there is a possibility of bias, I have in no way overtly allowed personal values or theoretical inclinations to cloud the conduct of the research and the findings emerging from it.

### **3.9 Methodological limitations**

Reflecting on struggles is not just instructive for developing methodology; it is also part of the story itself (Sheftel and Zembrzycki, 2019). It is therefore imperative to reflect now on some methodological limitations of the study. On account of the qualitative nature of the study, the main source of primary data came from semi-structured interviews. Although Henry Greenspan

(2019) vividly describes a good interview as a process in which two people work hard to understand the views and experiences of one person: the interviewer, the interviewer often starts off by knowing very little or nothing about the lives, perspectives, politics, and values (Greenspan, 2019) of the interviewee. Hence, not knowing these other sides of participants does a disservice in partaking in this shared authority of which Greenspan speaks. Data provided by participants can therefore not be analysed without contextualising these other factors as politics, values, and perspectives.

There is also the risk of cognitive biases, often associated with retrospective accounts (Galletta, 2013). Such biases arise owing to the inability of a participant to give an accurate account of events due to memory loss or recall bias, or as in the case of egocentric bias, as a result of relying too heavily on one's own perspective rather than what actually occurred in reality (Kishore Sreenivas and Rao, 2019). With the type of research being undertaken, which examined the career trajectories of women scientists, there was a possibility that participants might present themselves advantageously to emphasise an exceptional career or exaggeratedly to make their narratives more pronounced. Nonetheless, it is often argued that this limitation is not a new phenomenon in works that require some elements of retrospection (Wu, Hunter, and Sublett, 2021). Again, all interviews and analyses were conducted by me –a woman originally from a developing country in Sub-Saharan Africa. This was potentially beneficial in terms of engaging participants and promoting openness because they felt comfortable discussing their experiences with someone to whom they could relate.

To avoid relying on presumptions of common understandings that could be deceptive, this also imposed additional responsibilities on ensuring sufficient probing and research of the issue. This also required me to reflect and acknowledge how my identity might have an impact on how the interviews were conducted and interpreted (Kamenou, 2007). Nonetheless, it is my utmost belief that the benefits of the interviewer (me) identifying with most of the participants

outweighed any potential disadvantages. As Creswell and Poth (2016) succinctly put it, no research is entirely objective and faultless. Yet, the issue of subjectivity was curtailed through the rigour employed in the analysis. The final limitation revolves around the area of generalisability. As with most qualitative studies, the aim of this research was not to provide a generalisable discourse on the careers of female scientists, but to provide a nuanced understanding within the context of ECRs from the developing world. Despite the diversity in the sample, the methodological approach may not offer much ground for generalisation.

### **3.10 Ethics approval process**

The study was conducted in line with the Brunel Research Ethics guidelines (See **Appendix A** for ethics approval letter) which suggest that the following should be considered before and during research: informed consent, confidentiality, harm to participants, the right to withdraw, deception, and debrief. In compliance with these standards, a copy of the participant information sheet was sent to respondents during the initial stages of communication. The participant information sheet (See **Appendix B**) contains all the information that would be needed by a respondent to make an informed decision as to whether or not they wish to participate in the research. It touches on a myriad of subjects, from the aims of the research to issues on confidentiality, data management, and the rights of the respondent during the data collection process. Where respondents were content and willing to participate in the study, they were sent a consent form (See **Appendix C**), which required them to append their signatures to formally give their express consent to partake in the research.

Confidentiality is key to protect the anonymity and dignity of our respondents. As such, they were informed, both verbally and in writing, that their anonymity would be protected by transcribing the recorded interviews within 48 hours of and storing them on a secure Brunel server to which only the researcher had access. Respondents were also made aware of the fact

that direct quotations from them would be used in the final write-up of this thesis, and that pseudonyms would be assigned once transcription was completed to prevent possible tracing of obtained data to specific individuals. Again, respondents were duly informed of their right to withdraw their participation at any stage of the data collection process but could no longer do so once the interviews had been concluded and data transcribed. At the end of every interview, each participant was sent a debrief form (**Appendix D**) which contained further details and contacts of the research team as well as a restatement of the study aims and objectives.

### **3.11 Chapter summary**

The chapter has sought to shed more light on the methods utilised in the collection and analysis of data to bring forth findings that have the potential to deepen our understanding of how careers are enacted by ECRs from the developing world. Specifically, the study deviates from the grand narratives ubiquitous in literature, and rather pays significant attention to the ‘micro stories’ of a relatively unknown group of women such as these trailblazing female scientists from the developing world. In this chapter, I have provided sound justifications behind the sampling choices made and demonstrated that the qualitative exploratory research approach, grounded in a social constructionist perspective, is the most appropriate for this study, given its potentiality to make meaning and interpret the world through social processes and interaction. In my case, it has been able to capture the career trajectories of these women – or rather, a period of their lives – thus shaping their perspectives based on their values and beliefs. Again, by using an inductive thematic approach, a sound and rigorous analysis was conducted without trying to fit the data into a pre-existing coding frame (Braun and Clarke, 2006). In the next chapter, I will begin to present my findings by way of telling the compelling stories of these women as they enact their careers while also answering the research questions that guide this study.



## CHAPTER 4

### **Crafting an Avatar of the Self: The Call to do Science**

This chapter contributes to our understanding of how female early career research scientists (ECRs) typically begin their careers in science. The chapter demonstrates how intersectionality plays out in the labelling and identification of careers as enacted by ECRs in developing country contexts, using intersectionality as a theoretical lens. By so doing, the self as author and agent of one's own story is given precedence over the acts that lead to admittance into science and a career in scientific research. The chapter thus focuses on the self-crafting of a career in the call to do science, as presented through three key themes: (1) Getting in (subthemes: Introjecting guides and incorporating models; Science by chance; Science for affirmative action: show of grit and grace under pressure), (2) Getting on (subthemes: Brilliant student *en route* to a gleaming scientific career; Laissez-faire careerists: The dreamers and (un)likely pioneers; The charismatic, uncompromising fighters), and (3) Labelling and identification of scientific careers (subthemes: Relational career identity; Fluke career identity; Altruistic career identity). The chapter ends with a summary and a model of how female ECRs label and identify their careers under contexts of underdevelopment.

#### **4.1 Getting in – the ‘grand’ entry into scientific research careers**

The first theme takes a retrospective look at the genesis of making choices and decisions pertaining to the entry into science. This section provides an overview of the driving forces that spurred the careers of participating ECRs. It will focus on the career decision-making process of female ECRs and identify how their decisions to pursue a career in scientific research were birthed.

#### ***4.1.1 Groomed for Science: The role of introjecting guides and their incorporating models***

Career decisions are fundamental to an individual's socio-economic and emotional well-being (Hartung, 2011). Yet, they remain amongst the most crucial decisions with which individuals have to contend throughout their lives (Lent and Brown, 2020). Not everyone can make decisions concerning their careers, especially children and adolescents, who may lack the capacity or straightforward judgement to make such key life decisions. As a result, career guidance and perhaps some influencing factors are vital in helping young people to make sound and meaningful career decisions (Gati and Kulcsár, 2021). In Savickas' (2013) own arguments, individuals construct the 'self' and build their careers through interpretive and interpersonal processes. In particular, a sense of self is co-constructed by the individual through social processes and interpersonal relationships. As respondents talked about their scientific career lives, they shared stories conveying their early beginnings and ultimate mobility into scientific research careers, which often began with the single decision to pursue a science programme at college or university:

My parents always motivated this curiosity and interest in learning from nature. I didn't have it in mind that this career was the career for me. But I was brought up with the claim that I could be whatever I wanted to be, and when I chose Biology and Botany, I always had that support from my parents. (Maud, Synthetic and nano-chemistry)

When it was time to leave high school, one of my teachers encouraged me to pursue a science-related programme at university. My parents shared similar sentiments with him [teacher], although I wanted to be in the Arts. They said I was too smart for Arts and that smart people do science, so I went with along with them. (Dory, Bioengineering and Micro-biology)

While many participants did not believe that they were forced to pursue science by familial influence, their narratives revealed that their general entry into scientific research careers, starting from their early formative years in school and the eventual transition into science, were as a result of certain influencing factors. These factors differed from each other and fell under

four temporal themes: G1 – emboldening; G2 – *faits accompli*; G3 – collateral damage; G4 – idolization.

For members of G1, whose dominant narratives were classified under the emboldening category, entry into science and eventually into scientific research careers came as a result of the encouragement and motivation of parents, guardians, and mentors. Their talents, gifts, and genius were discovered very early in their childhoods by their ‘guides’ and they were subsequently supported with the tools and necessary guidance into making career decisions and choices that made maximum use of their potential. While details of participants’ stories differed one from another, the stories told unanimously suggest receiving utmost backing from parents and teachers in their formative years:

My parents always motivated this curiosity and interest in learning from nature. (Maud, Synthetic and Nanotechnology)

My teachers and parents were extremely supportive of me and encouraged me to pursue my interests. Although my father never went to school, he saw through my curiosity and was determined to see me pursue those interests. (Emelda, Applied physics and Nanotechnology)

Members of G2 epitomised the ‘*faits accompli*’ – that is, those who got into science even though they did not initially want to be scientists. These are individuals who had their ‘careers’ decided for them, mostly by parents, and were ‘told’ quite simply to do their parents’ bidding. These individuals had massive interests in a host of different things, with science not being one of them. Yet they were somehow cajoled or literally forced into unearthing their scientific selves because their parents or mentors believed this to be the best option for them. The dominant narrative here is that “science is for smart people” or “all smart people do science” as recounted by Suzzy and other participants, who, although they desired in their juvenescence to, for instance, be creatives, had no choice at the time than to go along with their parents’ wishes:

As far as I can recall, I have always been a good student. I was good in all the subjects at school. But I loved to sew. I still sew for myself to this day. Nobody taught me. It came to me naturally. At a point I knew I was born to do this. But because I was good in all the subjects, my parents told me I must do science and become a medical doctor ... they gave me this whole lecture on job security and all that. I didn't agree with them, but I couldn't say otherwise. I took their advice anyway and ... here I am. (Suzzy, Environmental Chemistry)

Those who were fortunate enough to not have science shoved down their throats like Suzzy were nonetheless coaxed into believing that they were too “smart” for anything but science – a strategy which seemed to have worked in the cases below:

The funny thing is, when I was a teenager, I wanted to become an actress. I would act in all the school dramas and was even president of the drama club. I loved theatre and performing. My parents were not so pleased with my choices. My mother constantly told me to focus on my books and that I was too smart to be an entertainer, as she chose to call it. I gave in at a point. I don't know if those words she used to say had any impact on that decision, but I guess it did. (Zana, Financial Mathematics, and Mathematical Modelling)

The next group, G3, entered into science because science was inherent in their family ‘bloodline’. These group of people from ‘scientific homes’ suffered collateral damage by virtue of their family, ancestry, or associations. They came from backgrounds where parents and/or older siblings, uncles, aunts, and cousins were already well-established scientists (researchers, engineers, medical doctors, senior academics, etc). Pursuing science to the point of making a career out of it was all they knew, although nobody in the family had explicitly ‘forced’ them to do so. These individuals simply did not wish to become the ‘black sheep’ of the family by looking the other way. To this group, the entry into science was all about safeguarding family legacy and ‘honour.’

My grandfather was a professor who later became a well-known politician in this country. Both of my parents were also professors at the university. I grew up in a science environment. I wanted to become a professor – no, I HAD to become a professor

[chuckles]... just like my parents. I am an only child and I sort of felt obliged to do this. To honour them, keep their legacy alive. (Sophia, Particle Physics)

My father was an engineer while my mum taught chemistry. My older brother had two masters' degrees before getting his PhD. For me, getting into a scientific career was bound to happen, although my parents constantly told me I could be anything I wanted. There was just this thing ... like you don't want to be the odd one out. (Herty, Physics)

For members of G4, their entry into science was influenced by people other than their parents, whose lives and activities inspired their decisions in some way to do science. As Savickas explains, the development of an agentic self, and consequently career adaptability, starts during the early formative years of childhood. During this stage, children select role models, and through identification and imitation, incorporate the role model's identity as part of their own self-identity (Savickas, 2013). Individuals thus tend to choose role models who are similar to them in some easily identifiable way, such as gender or race (Quimby and Desantis, 2006). Participants in G4 developed a budding interest in science and scientific careers through idolization. These individuals looked up to people, predominantly other women, who at the time were distinctively part of the small group of women 'lucky enough' to pride themselves with a scientific career. The participants in this group recognised that these role models created lasting impressions on them, which would serve as a constant reminder towards achieving the impossible.

There was this time in high school when I was selected to represent my school in a programme within our district. One of the speakers – the only female speaker – was a physicist. I didn't know there were women physicists at the time. She really struck me. I remember leaving that day and telling myself I wanted to be just like her. (Yola, Theoretical and Computational Chemistry)

Participants also believed that having role models was crucial in building up the fortitude to enter into a career visibly dominated by males, further emphasising the need to be role models themselves if more girls are to be motivated into STEM careers.

Having someone who looked like me in that position gave me this strength, this mental fortitude that, you know, if she could do it, then I could do the same thing too. This is why having a role model is important to me, and that is why I strive to also be one in my daily life. I don't know who might be inspired by what I do. (Mary, Biochemistry and Food Science)

The above narratives highlighted the fact that although entry into science was a result of guidance and familial influence, there was not one universal blueprint to which participants could subscribe. Guidance and influence, although present, were manifested through positive, negative or a combination of both approaches. Nonetheless, participants who were 'forced' to do science by their parents acknowledged that judging by their current successes, it was perhaps the right thing to do.

#### ***4.1.2 Science by chance: Randomness and luck at work***

These participants found it very difficult to describe how they had actually decided to do science. Although some were of the opinion that they could not recollect when they had made that decision to focus on science at school, they remembered vividly how, after getting into science programmes, their actual transition into scientific research careers had taken an extemporaneous turn. Participants, through their self-narratives, revealed that although their entry into scientific research careers had been partially influenced by parents, mentors, role models, or by their own personal judgement, the actual journey into becoming a research scientist often took an unplanned route. A strong theme was accidental and opportunistic career entry, with participants often describing their careers as unforeseen:

When I finished my master's, I got a job as a graduate assistant in my department. One day, my HOD called me into his office and told me of a PhD scholarship that he wanted me to apply for. I honestly did not want to apply because I read through and did not believe I would be selected. I actually don't remember putting any effort into the application. I just wanted to do it because my supervisor had personally asked me to, and I did not want to disrespect him. Long story short, I got the scholarship and here I

am today. When I think about it, I still can't fathom how everything happened. (Kai, Science and Technology)

Luck is an important factor in life, and serendipity plays a crucial role in the way life unfolds, including working life (Grimland, Vigoda-Gadot, and Baruch, 2011). Often occurring at the individual, socio-cultural and institutional levels, these findings reflect the role of randomness, luck, and chance as key elements in charting the course of a successful career in scientific research. Indeed, most participants expressed their career trajectory as an unstructured sequence of events that did not always result from careful planning and action (Bornat, Henry, and Raghuram, 2011). At the individual level, familial status appeared to have played a crucial role in participants' ability to afford an education up to the level that they desired, as one's family status can usually create more or less favourable conditions for one's career success (Hotchkiss and Borow, 1996). The prevailing logic here is that children from middle-class and upper-middle-class families potentially have access to better resources, more stable financial support, and better living conditions and educational environments, which facilitate more positive opportunities for their psychological and physiological wellbeing (Borow, 1996). By this obvious chance element, it is not surprising that children from affluent family backgrounds eventually achieve a higher occupational level that is compatible with their families' higher socio-economic status (Borow, 1996). Thus, it became evident throughout the interview and analysis stages that for many participants, their families' social status was the golden ticket into the magnificent world of scientific research, as illustrated below:

My father is a former speaker of parliament in this country and so I would say I have been privileged to have attended some of the best schools, both in this country and abroad. I consider myself very lucky and I don't take that for granted. (Kai, Science and Technology)

Thus, Kai concedes that having been born into one of the poorest countries in the world did not prevent her in any way from attending some of the best schools around the globe, and ultimately

achieving her dreams. She admits that she has “great respect for other women who went through so many hardships to achieve their dreams, but in all honesty, [she] cannot relate to their stories as [she] had a different life.”

Some participants, however, did not believe that their social class was relevant in their career choice. Although a few of the participants were from middle-class backgrounds, the majority were from working-class heritage. Despite the role played by family status and background, another chance factor emerged in the form of “standing out” and building “unusual” or “extraordinary” acquaintances. These narratives centred around finding supervisors, mentors, or meeting random people who would later play an instrumental role in their career trajectory.

I believe wherever I go, I carry this presence. I stand out. I don't know what that is, but it always connects me to the right people, sometimes unusual people, sometimes extraordinary. (Julie, Applied mathematics)

My supervisor was God-sent. He is still a mentor to me up to this day. He was first my supervisor for my master's degree. Then I had no plan to continue with a PhD, but he told me he saw something in me and encouraged me to apply for a PhD. Even when I got pregnant with my daughter during my PhD days, he was ever so supportive and would sometimes act as my assistant in the lab. I would not be where I am today without him. (Yola, Theoretical and Computational Chemistry)

Participants also recognized at the individual level that “lost opportunities” had been their blessings in disguise. Mira, who described her career journey as “long and trying,” was devastated when a rejection to study medicine altered the course of her life. She says, “who knows what would have happened if I had made it into medical school, but life happens, and when it does give you lemons, you make lemonade.” She commented:

Where I come from, if you're bright and you read science at secondary school, the next thing is to go to medical school. That's the ultimate dream of every science student in secondary school. I desperately wanted to go to medical school. But fortunately, or should I say unfortunately, I did not meet the cut. I was devastated, of course. I was offered my second choice, which is biological sciences. I had the option of staying at home and reapplying to medical school the following year, but I just didn't want to stay at home, so I went with the second choice. Would I have achieved the same feat if I went to medical school? I don't know. In the end it all played out well. (Mira, Computer Science and Engineering)



Thus, whilst the individual level offered elements of chance events in the form of familial status, standing out, meeting random people, and blessings in disguise, at the socio-cultural level, religiosity and faith were most pronounced. Prayer and spirituality were central to this group. Most participants acknowledged how their distinctive religious beliefs and faiths contributed to their career successes. In this space, some found the words spoken over their lives by “priests” to be the catalyst to cementing their names in this male-dominated career, while others’ unwavering faith in “God” meant that they took whatever came their way with aplomb. The following extracts mirror their sentiments:

My parents always reminded me that when I was born, a priest at the temple took me into his arms and said I was a lucky child, and I would grow up to do many great things. I believe those words. (Kai, Science and Technology)

I am Christian, and my faith tells me that God has good plans for me. I believe my career is one of those plans. I pray every morning and I believe God certainly has a hand in my career because when I look at where I am coming from and where I have gotten to in life, it could only be God. (Mercy, Minerals Engineering)

The implication here is that most participants appeared rather inclined to lean on hope and trust in something when the going got tough. In those moments of futile desperation, they turned to their convictions in the divine, with the confidence that some light was bound to shine at the end of the tunnel.

I couldn’t afford to pay my tuition fees when I was at the university. I prayed and prayed. I didn’t know where the help was going to come from. But the help did come out of the blue. Suddenly, my sister’s husband took an interest in my education and paid my fees. (Zana, Financial Mathematics and Mathematical Modelling)

Chance events at the institutional level were fixated on push and pull factors and gender effects. Push and pull factors are those dynamics that either encourage people to leave their points of origin and settle elsewhere or attract migrants to new areas. For most of this study’s participants, the emerging patterns revealed that the lack of resources and high unemployment

rates in their home countries propelled their desire into their career destinations, as these careers came with job security and other incentives that were not readily available with other career paths.

If you are employed by the university, you are respected, you have a good salary, you get a bungalow for yourself. Your children have a healthy environment to grow. (Suzzy, Environmental Chemistry)

High unemployment rates in this country does not really allow you to pick and choose as you want. Even with career, you have to be strategic, because you don't want to finish university and become a liability to your parents. (Mercy, Minerals Engineering)

In addition to these push and pull factors, participants also revealed that the 'gender effect' played a significant contributing role in their mobility into their present careers. Most participants, who found themselves within the Gen X and millennial age brackets, were 'fortunate' to have already been in science programmes at a time when their countries were going through reformations on girls' education in general and especially for more female representation in STEM. These institutional realignments were timely, as they provided many opportunities in the form of PhD funding, research grants and allowances for these women.

The time I was doing my master's degree was the same time my country was very keen on educating the masses on the importance of girl-child education. It was very timely because I got a scholarship to pursue my PhD because the government was very committed to supporting the few women in science. (Mercy, Minerals Engineering)

When I applied to the university for my undergraduate degree, the cut-off point was made lower for females. I was very fortunate because then the government was trying to encourage parents to send their female children to school. Lowering the cut-off point helped me to get in. (Tina, Pharmacology)

Thus, participants' storied narratives reveal that although they were already into science, their mobility into their present careers had a stroke of randomness, luck and chance elements attached. It was found that chance phenomena can be easily identified not only at the individual level, but also in the broad social and cultural structure, as well as at the institutional level.

Nonetheless, irrespective of these accounts, it became apparent that participants capitalized on these otherwise unplanned events that emerged in their lives and utilized these chances with a positive attitude and a set of creative skills: what Krumboltz (1979) calls ‘planned happenstance’. The key tenet of this concept is that individuals have to capitalize on the unplanned events that occur in their lives. Planned happenstance is thus the human intentional action to use these life events in an optimal manner (Krumboltz, 1979), as exemplified below:

Getting my undergraduate and master’s degrees were the most difficult moments of my life. I worked two jobs. Even with that, I could not manage to pay all my fees. Several times I believed I was going to drop out. But I worked extra hard and studied hard. When I finished my master’s degree, I got a fully funded scholarship to do my PhD. (Herty, Physics)

#### ***4.1.3 Science for affirmative action: show of grit and grace under pressure***

The final identified trend connected to participants’ entry into science was marked by a display of grit. Grit, often defined as perseverance and passion for long-term goals (Duckworth et al., 2007), is a non-cognitive trait that has been acknowledged as a key predictor of positive career outcomes (Duckworth et al., 2007; Ion et al., 2017). Grit is often associated with courage, resilience, perseverance and facing circumstances with aplomb. Through the narratives of my respondents, it became apparent that their ability to ‘bounce back’ and retain a stable equilibrium to pursue science after experiencing innumerable detours within their cultural setting was the distinguishing factor, the character arc, in their career trajectory (Savickas, 2013). They showed ‘grace under pressure’ (Sarpong and Maclean, 2015; Warral, 2015) and pursued their scientific ambitions in the midst of such rhetoric as ‘the place of the woman is in the kitchen’ and ‘a woman’s duty is to get married and have children.’

When I finished secondary school, all the girls my age in my family were all settling down and already having babies. I was the only one that wanted to continue into the university. I’m glad my parents were there to support me, but it wasn’t easy with my other family members. Even within the community, people started tagging me as a

barren woman because I wasn't married and having children at that age. (Mercy, Minerals Engineering)

For women like Mercy, their entry into science and eventually into scientific research careers was, in the eyes of extended family and members of their communities, a particularly ignominious way to kickstart their lives. They were females who had been privileged to receive an education to the secondary school level. The next discernible exploit would be to get married, have children, and earn the respect of the community folk as dutiful, well-mannered women. Following the decision to continue their education and even to dare to pursue scientific careers, something reserved for men, portrayed them as rebels, and bad examples for other young women in the community:

I remember when I started my PhD, there were gossips going round my community that at my age, I was still going to school and not thinking of getting married and starting a family. People even told their daughters not to befriend me because I would influence them to remain unmarried. I didn't let any of that get to me. I knew what I was about, and nothing was going to deter me (Mercy, Minerals Engineering)

With this in mind, they set out on a mission to prove a point and establish legitimacy for women in science. Their identity took a heroic configuration, deciding against all odds to make a mark, change the status quo, and set the pace for other young girls who found themselves in similar positions to have faith and confidence to go all out and pursue their dreams. After all, if they could do it, then so could other girls.

Nonetheless, not everyone was fortunate to have the full backing and unending support of their parents while their immediate community regarded them with scorn. Anna recalls how her own parents, albeit supporting her decision to go into science, did not fully approve of her choice of career. For people like Anna, their determination and strong-willed attitude, going against the wishes of their parents, and in some instances teachers and mentors, ensured that their dreams of becoming scientists transitioned into reality. For these individuals, science was more

of a calling than a career. They fell in love with science from the minute they became conscious of their selves, deciding early on that they would dedicate their lives to it, much to the disapproval of their parents, who thought they would be better off as teachers or nurses: professions deemed more noble and appropriate for women. But in the end, the parents had to concede, as the participants did well for themselves. Their careers as scientists have marked them as trailblazers, earning them many accolades and global recognition:

My parents supported me when I said I wanted to study science. My mother asked me to consider nursing or teaching at the local high school, which according to her was more suited for women. I stood my ground. They were not very okay in the beginning but today they are very proud of me, with all my achievements. (Anna, Chemical Engineering)

In making my university applications, one of my teachers, who was supposed to be a guide, actually discouraged me from my choices. He said I was not going to make the cut for the programme I was selecting. I was disappointed but I still went ahead, and I got in. (Tyra, Atomic Energy)

Yet for other participants, the notion of having grit was not simply limited to pursuing their dreams, but also to ‘prove a point’ to their detractors. They set out on a mission to change the narrative in their communities by proving that whatever men can do, women can do as well, or perhaps even better. Men, in these communities, were viewed automatically as more intelligent, as born leaders and better investments than women. Most parents had yet to see the benefit of putting their girls through school, as they would simply end up as wives and mothers. These participants, who found themselves under such contexts of patriarchy, had no female role models in science to look up to, so they decided to become role models for themselves and for other young girls in their communities. They wanted, through their accomplishments, to influence other parents in their communities to see the relevance of giving their children equal access to education.

My mother has a brother. He went to school, became a doctor. But my own mother never went to school because priority was given to her brother. Even as a little girl I

knew that this was wrong. I made a promise to my mother that I would go to school, that I would become a scientist. I felt I needed to send a message to my community that women are equally capable of achieving great things. (Alexa, Bioenvironmental sciences)

Here, the unfettered desire of parents to sponsor a male child's education over that of a female, which appeared profusely shocking, albeit widespread at the time, became the source of inspiration to get into an otherwise 'male' career. According to such accounts, socio-cultural challenges can be rescinded into opportunities depending on how they are acknowledged. While being the 'good girl' and following the stereotypical norms and practices in a society which stifles growth and development may be the safe passage into socio-cultural acceptance, as argued by Flora, it does no good in the end, as it "maintains and progresses the cycle rather than breaking [it]." While this act of bravery to defy the norm often attracted scorn, and in some cases mockery, the launching and subsequent successes of these female scientists' careers has rewritten their names' long affiliation with something negative into something synonymous with splendour.

It took a lot of nerve to say I wanted to go to school, and an even greater level of boldness to venture into science. It was a lot of hard work and lonely days, but it all paid off, and today I am seen as some sort of hero whenever I visit my village. People tell me they see me on TV, and some want to take pictures with me. I mentor so many young girls. I have heard parents come to me, asking me to advise their girls to go to school and become like me. Its humbling but I think I achieved my goal in the end. (Flora, Pharmacognosy)

In a related extract, Mary recounted how she believes her actions have established some sort of legitimacy for women in science:

Because people like me, who grew up seeing nobody like us doing what we're doing now ... because we're here and we're succeeding, now everyone knows that yes, we can. If we had not dared to change the narrative, the narrative would still be that we are not capable. (Mary, Biochemistry and Food Science)

Indeed, the participants in this category used their strength of character to break the cycle of stereotypical bias against science and scientific careers that existed within their small spaces. In the first instance, participants were resilient and displayed courage to enter into science. They set out on a mission to prove a point and establish legitimacy for women in science. Their desire to pursue a scientific career took on a heroic approach, deciding against the odds to make a mark, change the status quo, and pave the way for other young girls who find themselves in similar positions to have the faith and confidence to go all out and pursue their dreams.

#### **4.2 Getting on: Unravelling student scientists' and ECRs' experiences within the gendered scientific arena**

The career journeys of participants culminated with the receipt of the OWSD-Elsevier award for ECR scientists from the developing world. Prior to this feat, most participants were already well established in their fields within their respective countries and sub-regions. However, their distinctive journeys had started many years prior to becoming the scientists that we know of today. Embedded within this theme are the distinct narratives of participants following entry into science and scientific research careers. Details of experiences that were pivotal in shaping their careers within the gendered scientific career field are brought to light. As the narratives on participants' entry into science have established, to enter into science, they not only had support but also had to endure hardships, re-strategize, and face innumerable challenges. These narratives thus contained evaluative elements, which send a subtle signal pertaining to what ought or ought not to be done if one wishes to succeed in the scientific career arena. While details of these career experiences differ, participants relied on the idiosyncratic factors that propelled them into science to establish a position for themselves in their narratives.

#### ***4.2.1 Brilliant student en route to a gleaming scientific career***

##### **Mentoring**

For members whose primary entry into science was based on the guidance of family and mentors, or through the incorporation of role models, their transition into becoming research scientists took a very steady course. With the support of family and mentors, they were ably guided into their present flourishing careers. This group strongly emphasised mentorship as a key ingredient to sailing a smooth tide in their experience both as students and as ECRs. They revealed that advice and continuous feedback from mentors was particularly helpful in their journey. Some comments include the following:

The support I received from my supervisor during my PhD was extremely crucial in my journey to becoming who I am today. I still have a very good relationship with my supervisor. He has become a mentor for life. (Nadia, Community and Public Health)

My supervisor supported me from my master's through to my PhD. She was very lovely, and she would tell you things as it is. I would say I improved a great deal thanks to her feedback. (Dory, Molecular Biology/Parasitology)

The portrayal of mentorship as a crucial element in the career development of individuals is well established in the literature (Jyoti and Sharma, 2015; Chen, Wen, and Hu, 2017; Ogbuanya and Chukwuedo, 2017). Nonetheless, the provision of mentorship, as observed through participants' narratives, was not always structured or formalised. Formal mentoring helps protégés to understand their strengths and weaknesses and improve upon them through open communication with a mentor (Joo, Yu, and Atwater, 2018). Most participants simply referred to their supervisors as mentors, because these supervisors provided some guidance or support in their journey as students scientists. In their early careers as research scientists, this lack of mentorship posed complex challenges, especially as they were women trying to navigate a career largely dominated by men:



As a student scientist, it was pretty smooth for me. My supervisors were always on hand to assist. But when I moved into the real world of work, it was like I was on my own. I was the first female physics lecturer in my department ... at that time, it was very difficult to blend in with the men, you know, get someone to mentor you or coach you. I had to work twice as hard, even coming in on weekends because I wanted them to take me seriously. (Freda, Nuclear Medicine)

The above extract illustrates that although the provision of mentorship is one of the essential keys to career development, choice-making, transition and success (Byrne, Dik and Chiaburu, 2008), the absence or inadequacy of formal mentoring can negatively affect personal learning and hinder job satisfaction in the long run (Joo, Yu, and Atwater, 2018).

### **Collegial support, orientation, and practice environment**

Some participants recalled having experienced ethical dilemmas at some point in their lives as student scientists and early career scientists. The long hours spent in the lab posed significant challenges, not only to them, but also to their families. Some participants recalled the uneasiness and discomfort they experienced regarding having to work long hours in labs where they were the only women present. Another participant bemoaned how her chosen career conflicted with the religious beliefs of her family, which often tended to shield and over-protect females.

As a woman, one of the challenges was that my family did not feel comfortable with the study and work obligation in the night shifts. They were and are always worried if I am in a “safe place”. (Nadia, Community and Public Health)

In spite of these dilemmas, participants nonetheless revealed benefiting from a collegial support system that eased their transition from student scientists to professional scientists. Although it was unclear what exactly this type of support entailed, participants acknowledged that the support they received made their work much easier, and at times validated their efforts as new

entrants into the profession. Likewise, participants also identified teamwork – that is, being able to mutually give and receive assistance – as invaluable. One participant remarkably mentioned how vital it was to her that senior colleagues, who were predominantly men, valued her input and contributions. To her, this empowered her to keep doing whatever she was doing and removed any feeling of self-doubt. The following extracts mirror these sentiments:

Everyone here is lovely. When I first came in, they were always on hand to help. They encouraged and supported me and made me feel like part of the team. (Mary, Biochemistry and Food Science).

When you work with people who appreciate the work and effort you put in, it sort of validates everything you're already doing and gives you this new confidence to carry on. (Regina, Epidemiology).

Beyond this support system, references were made to collaboration as a key ingredient in respondents' career development and success. As collaborators are usually associated with positive outcomes, regardless of whether for fun or a more serious activity (Wyllie et al., 2020), the experiences of these ECRs expedited their social cohesion into the circles of their institutions.

### **International Exposure**

The privilege to travel abroad for further studies triggered critical reflections amongst members of this group. It became apparent that their career directions took a different turn as those experiences shaped their perspectives and facilitated the acquisition of soft skills that propelled them to thrive and flourish in their careers. For these individuals, their exposure to foreign education, meeting different people from different countries and cultures, gave them a cutting-edge advantage over their colleagues who had never had that experience:

I spent about four to five years in Australia for my PhD. Prior to that I spoke no English at all. But I had to learn English because I was there. And that has helped me so much

in my career...It also exposed me to different cultures and many other perspectives on my work. I came back home a much better person and I believe this played an active role in my career progression...promotions and all, because I came with new ideas, new perspectives. (Alexa, Bioenvironmental Sciences)

With increasingly intense competition for grants, funding, and collaboration, these ECRs recognised the importance of ‘being exposed to the rest of the world,’ as it builds up credibility in their careers. There was consensus among participants that having a PhD from a ‘developed country,’ as persons from third-world countries, was something that they would encourage other up-and-coming scientists to consider, as it not only facilitated their own career progression, but also ultimately aids national development. One participant had this to say:

When you travel and live in a developed country for some time, you come back home with all these marvellous ideas that you probably never would have had if you remained here. The difference is that those developed countries have done many things that we are yet to do. So, when you go there, you learn from them. Then you come back home and use that new knowledge and experience to help your country. (Suzzy, Environmental Chemistry)

Participants nonetheless had different views on how this international exposure had impacted their lives and careers in general. While the general agreement was that it had influenced their careers in a positive way, the disparity lay in the ways in which this impact was represented. For Suzzy, for example, her battle with loneliness and struggle to ‘fit in’ in another country had forced her to switch from her initial plan of working abroad to return home, an unlikely place where she would later find her success and achieve her career breakthrough. In contrast, for Trudy, travelling abroad for her PhD had broadened her network base and given her life-long opportunities, such as being able to establish a partnership between her current research institute and her *alma mater*.

These storied retrospective narratives invoke the proverbial African spirit of ‘it takes a village to raise a child’ by placing the need for familial, social, and institutional support as a driving

force in facilitating career development and progression for females. Thus, for this group of participants, their will and desire for a scientific research career, coupled with external support and ample exposure, allowed for a quick ascent.

#### ***4.2.2 Laissez-faire careerists: The dreamers and (un)likely pioneers***

For participants in this category, going into a scientific research career was a ‘second-best’ option, as words like ‘chance,’ ‘fate,’ and ‘unexpected’ were used to describe how they had become research scientists. Building therefore on the commonality of chance events as a precursor to making career decisions, these ECRs shared various experiences in their career trajectory that resonated with the belief that every person has experienced some form of chance event that has influenced their career (Krumboltz, 1996). Chance, as Louis Pasteur noted, “favours the prepared mind” (as cited in Bandura, 1982, p. 750). Thus, these participants remained open to unexpected opportunities as student scientists and continue to remain open to taking advantage of chance events even now as professionals.

Career decisions do not come with some sort of map. Yes, by all means you must have a plan, but we live in an unpredictable world and no plan is a master plan. You can only hope that you’re on to something worthwhile. (Kai, Science and Technology)

Consequently, participants acknowledged the lack of a clearly defined career plan, even now that they have entered into their careers as working scientists. To highlight this, in her years as a PhD student, Titi was still unsure whether she wanted to pursue scientific research as a full-time job. She describes how she “was never fully sure if academia and research was for me” but she “went with it anyway.” Likewise, Anita mentioned how she did not really bother about promotions or recognition in her career. She summarised her career philosophy by arguing that she tries “to not attempt so much to change the way that something is developing or happening.” An ardent believer of the ‘que sera sera’ mantra, Anita believes that whatever will

be will be, and approaches her career with a laissez-faire posture, leaving things to take their own course. Mira, also sharing similar sentiments, summarised her career experiences as “indifferent” and “open to anything”:

I have had a very indifferent attitude ever since I was a student. I don't know. Maybe it's because we are women doing this [science research] so you have to develop thick skin. I really don't care at all whether I receive mentorship or not, whether I receive support, promotions or not. They are all good, but if you make up your mind that your successes are dependent on these things, what happens then if you don't get it? I have always been focused on just doing my best and leaving the rest. In this kind of job, you have to be open to everything and anything as a woman. (Mira, Computer Science and Engineering)

Participants here recognised a sense of flexibility and adaptability in their career trajectory, specifically in their transition from students to professionals. For these individuals, getting into scientific research careers ‘by chance’ meant that they quickly had to adjust and adapt to circumstances as they arose. This mind shift would be their guide throughout their years as students and as early career researchers. A common narrative here pertained to how they had been able to utilise their disappointments and often workplace injustices to build a more meaningful career. Victoria recounts not being taken seriously by some of her male colleagues at the onset of her career:

We were just two ladies in my department when I started. Some of the guys there, they didn't take us seriously. It's like they were always on the lookout to see if we will make a mistake. (Victoria, Physics/Meteorology)

Instead of being downcast, Victoria and her colleague appeared unconcerned and continued to work hard and do what they did best. Ultimately, their work produced positive career outcomes. Victoria humorously remarked: “When our work began to speak for itself, now they take us seriously and treat us better”. Yet, for others, an unexpected opportunity, chance conversation or vacancy was generally the genesis of their career progression. For example, Flora's

flexibility was put to the test when an unplanned departure from a senior member of staff at another institution propelled her into a position that she did not see coming:

About two years into my job at [x university], I got a call from a friend telling me a senior member of their staff had left and his position was vacant so I should apply. I was not very sure about this job because, you know, as women, sometimes we want to be one hundred percent sure we can get on with a role. It was something I wanted, and I always wanted to work for this research institute, so I applied, and I got the job. I think I got very lucky [laughs]. (Flora, Pharmacognosy)

Here, being ‘lucky’ is used to rationalise and explain career move decisions in the absence of a clearly defined pathway. In this regard, the *habitus* of ECRs is characterised by serendipitous entry and unplanned career progression (Hu et al., 2015). These chance events allowed participants to make sense of their experiences as successful female ECRs within a highly competitive sector dominated by men. Luck, serendipity, randomness, or chance therefore enabled ECRs to overcome issues of class, race, or gender that would otherwise have been stumbling blocks in the attainment of their career goals.

It’s been a long journey. To be here today, with all my achievements and accomplishments, I count myself as very lucky. Coming from where I come from, I know not many have been this privileged to achieve these kinds of things. (Flora, Pharmacognosy)

In spite of this, there were others who, although they echoed sentiments of luck, did not entirely embrace the concept in its entirety.

I know I’ve been lucky, but I don’t want to attribute everything to luck. I am also a hard worker. I worked really hard to get here. I have made a lot of sacrifices for the sake of my career. Some people will say “this woman is one lucky one”, but I beg to differ. Luck only comes to the prepared mind. (Suzzy, Environmental Chemistry).

Admittedly, participants in this study never explicitly referred to these opportunities and ‘chance’ as sheer luck, possibly because as scientists, they are used to depicting and

representing facts in their decision-making. Nonetheless, their narratives resonate with the planned happenstance theory of Mitchell, Levin, and Krumboltz (1999), where participants are able to transform unplanned events into opportunities and take voluntary measures to address the unplanned circumstances that comes with those events. Moreover, it appears, through the narratives of this category of participants, that they recognized in them a sense of privilege, being successful in a career with low female representation at the global level. Therefore, the general chorus expressed here was that their achievements and successes as female ECRs from developing countries where resources are scarce, and opportunities are almost non-existent, could not have been possible without some element of ‘luck.’

#### ***4.2.3 The charismatic, uncompromising fighters***

If it's all about your own development, or progress, then you will get discouraged and throw in the towel at the least provocation. But if you believe in something bigger than yourself, if there is a greater cause, then you will press on until whatever you began is accomplished. (Maud, Applied physicist)

With “perseverance and passion for long-term goals” (Duckworth et al., 2007, p.1087), the above extract mirrors the emotions and perspectives of this faction of participants, whose storied experiences depicted their internal wiring for grit, courage, and resilience. Their narratives showed individuals whose careers commenced from a basis of conscientiousness and an altruistic tendency to use their innate potentialities for the greater good. They made decisions about their own careers and set out to pursue them, regardless of the barriers that stood in their way. Doing scientific research was their calling, and they were aware that their ‘little’ communities, countries, and even the world relied on their research. Respondents in this category shared stories from their student days and early careers, recounting the obstacles and challenges they encountered and are still confronting within their career space.

## **Exploitation**

Many of the stories shared sentiments of exploitation at certain times in participants' career journey. Barbara was excited when she got her first job in a research institute. She wanted to prove to her employers and senior colleagues that they had hired the right person, and so she would stay in the lab for longer hours and sometimes go in during weekends. She offered assistance to her other colleagues whenever they needed help with minor tasks. Her hard work and attention to detail earned her the nickname 'mother of the lab' – something to which she initially paid no attention. However, she recalled some senior male colleagues taking undue advantage of her by literally asking her to do their jobs for them "simply because I am a woman, and they know I can't say no when they ask". According to Barbara:

I just wanted to show that I was equally capable just like my male colleagues....But in the end I experienced a lot of stress and burnout. I fell sick and had to stay away for a couple of months. When I got back, I decided to focus on me and my research, and my responsibilities. Then I became the 'bad guy.' My colleagues said I had grown wings, but who cares, my health is more important than their opinion [laughs]. (Barbara, Electrical engineering)

Barbara's story reflects societal stereotypes of women as 'mothers', 'helpers,' and 'nice people.' It is noteworthy, however, that like Barbara, participants who shared similar stories all concluded that they would not be where they are today without these experiences.

I believe all these things were meant to happen. It's all part of the learning process. (Rose, Pharmacy)

It's actually good you experience these things early on. It strengthens you and builds your resilience as you climb up, because trust me, it doesn't get any better up there. (Mary, Biochemistry and Food Science)

Interestingly, while some participants believed that this 'exploitation' provided life lessons they needed in their career journey, others willingly subjected themselves to such exploitation,



as they saw it as an opportunity to better their careers. They were the humble sheep, and often played dumb, because they saw it as an opportunity.

I got the opportunity to work with one professor. I did most, if not all, of his work for him at the time. He was using me, and I knew it. I knew it was unfair, but I kept quiet because this was Professor [X] we are talking about. It was an honour to be working alongside him. There was so much I needed to learn from him. And he has been very instrumental in my career to this day. He has been a great mentor and he has introduced me to many great scientists. (Regina, Epidemiology)

Regina's story ultimately depicts the image of a young woman trying to break into a career dominated by men and having to 'tolerate' all the excesses and unethical practices in order to succeed.

### **Embracing episodes of rejection**

Participants related to the concept of embracing rejection as part of their career trajectory. Georgina, for instance, recounted her determination and persistence to get a PhD despite numerous rejections for a scholarship. Even at present, she is still committed to her job as a researcher despite the numerous grant rejections that she has conceded.

Because we don't have many resources and support from here, we have to compete with our counterparts from the developed world for the same grants. That's not easy because obviously we lack so many things here. (Georgina, Nutritional sciences)

According to Georgina, the intense competition for grants, coupled with the tenured track of the profession, means that one has to accept rejection as part of the job. The existence of this predicament has left some participants anxious and worried about the next prospect.

I worked in Italy for two years, then my tenure ended. Then I got a job here and moved. It's also for two years and I'm one year through. I worry sometimes where I'll be going next. It's like always on the move, you don't know whether you're staying or going. (Mary, Biochemistry and Food Science)

For people like Mary, there is pressure not only from competition for grants and receiving tenure, but also the influence to publish.

The mantra is “publish or perish”. There is so much pressure to publish because, well, if you don’t, then you won’t receive tenure or get promoted or actually accelerate in your career. And the number of rejections we face sometimes is disheartening because you are not publishing enough. Meanwhile the resources for research are not forthcoming. How can we publish when we cannot even do research like we ought to? (Georgina, Nutritional Sciences)

Yet, despite these setbacks, participants continued to display the courage to get on with their jobs.

I still do my best to work with what I have. The journey to this place has not been easy and I know challenges will always persist, but I do my best (Mary, Nutritional Sciences)

From the narratives, what appears momentous with regard to embracing rejection is the extent to which scientific research as a society appears to be a breeding ground for such experiences to thrive. Whether through lack of resources, intense competition for grants, or pressure to publish under unfavourable conditions, participants recounted the pressures within the scientific research community, often leading to stress, burnout, and anxiety. As Dory, a bioengineering researcher, put it bluntly:

What the world sees is the perfect picture, the results and recognition that has come with my career. What the world rarely gets a glimpse of are the sleepless nights, relentless efforts, and the many sacrifices that have gone into making this career (Dory, Bioengineering)

### **Career identity paralysis and imposter syndrome**

Embracing a new identity as a research scientist often came with conflicting identities. While trudging forward toward the verge of perfection, participants reported feeling ‘stuck’ at some

points, especially when they felt pressured to conform. Their sense of self failed to keep up with their new role as professional scientists.

When I was a student, I had a lot of time to go to the lab and carry on with my work. Now I have so many responsibilities. I teach, attend regular meetings, represent my department at the senior level – it's a lot of work. I had to hire a personal assistant. Now I don't really spend that much time at the lab, and I wish it wasn't so. But this is the reality. (Zana, Financial Mathematics and Mathematical Modelling)

This change has not only proved to be problematic for those transitioning from students to professionals, but also for those moving from industry to research.

Although I am still a medical doctor, I spend a greater amount of my time at the teaching hospital. Sometimes I feel my identity as a medical doctor is challenged because in this profession, it's like being at the clinical side is seen as...is much more preferred. I love the academic side of it, and I enjoy my work very much, but I just feel that I may eventually go back to the clinicals (Emelda, Applied Physics and Nanotechnology).

While Emelda was still a medical doctor, her identity as lecturer and researcher remained contentious. She had not fully embraced her new identity as a researcher, as she felt that society, and indeed the medical practice community, held clinical doctors in higher esteem than those who chose the 'academic' side of the profession.

Again, the pervasiveness of imposter syndrome was pronounced in the narratives. Participants recounted moments in their student and professional lives where they had felt self-doubt and questioned whether they were the right people for the job, as described below:

Every time someone came here to look for Dr. [X], expecting to meet a man, I questioned myself if I was fit to do this. (Tyra, Atomic Energy)

One time I went on an outreach programme with my assistant, who by the way is a man. The people, including the women, thought I was the assistant, and he was the doctor coming to see them. The horror on their faces when I was called in as the doctor. It was as if I had committed an abomination. That stayed with me for years and at a point [I thought] maybe I wasn't good enough for this. (Anna, Chemical Engineering)

From the above excerpts, the participants' self-doubts became emotionally unsettling (Hutchins, 2015), which would result in sleep deprivation and anxiety for some. Although imposter syndrome is often downplayed and presented as something 'we all have' at some point in time (Anderson, 2016), participants argued that this was a serious problem which needed much attention, especially for women in non-traditional female careers coming from less advantaged backgrounds.

### **4.3 Labelling and identification of scientific careers**

Just as individuals have to learn how to deal with forming their own identity, they must also learn to consciously define that part of the world of work that fits in with this identity (Meijers, 1998). In this section, the salience of identity is explored in relation to how participants perceived their identity positions from their experiences as ECRs from developing countries. Findings from this section suggest that the intersectionality of gender, positionalities as ECRs and situatedness inform the identities that female ECRs from developing countries ascribe to their careers. For ECRs, whose identities are arguably in flux, projecting their identities through their drive to enter science is a vital resource for conceptualising their potential future selves. In the present study, ECRs focused on three types of identity:

**A.** Relational career identity (construction of the ECR identity based on the concept of familial/relational influence).

**B.** Altruistic career identity (construction of the ECR identity based on the concept of "calling").

**C.** Fluke career identity (construction of the ECR identity based on the concept of "luck" and "chance").

Trajectory A participants entered into scientific research careers through the “guidance” of family, friends, mentors, and role models. Through, for instance, the advice of a mentor or the desire and will to follow a certain family tradition, these participants have found themselves in a career that has come to represent who they are. Moving up, their experiences as student scientists and later as professional research scientists continued to evolve around this family and collegial support. They were ardent believers in the power of networking and its related benefits. As Blustein (2011) and Richardson (2012) firmly echo, career development is understood as occurring within a network of relationships, with the emergence of vocational interests, choices, decisions, and opportunities to access and advance in the workplace deeply entrenched in culture and relationships. Statements like ‘I’m a family person’, ‘I did this to make my family proud’, and ‘I hope my teachers are all proud of me’ underline the importance that these participants attached to their circle of influence. Thus, for these participants, the construction of their career identities was rooted in their relations to others in their environment and society. The following extracts support this assertion.

There would be no career without my family support. My parents have been instrumental in whatever I have achieved so far. My parents identified my interests at a very young age and guided me into this. (Nadia, Community and Public Health)

Whatever I am today, I owe it to my family and the great mentors who devoted their time and effort into my personal development. (Tyra, Atomic Energy)

For the participants whose narratives fell under trajectory B – altruistic career identity – their entry into scientific research as a career was self-motivated. Altruism is defined as prosocial behaviours or attitudes of an individual that are beneficial to others but not necessarily beneficial to the individual (Zaff, Malanchuk, and Eccles, 2008), which can manifest as behaviour, motivation, a set of moral values, or as a more fundamental psychosocial construct (Wegemer and Eccles, 2019). This group of participants thus narrated how they loved science, how science was a calling, and most importantly how they hoped to use science for the greater

good. These individuals also wanted to prove a point by changing the dominant community narrative that science was for boys. They took control of their careers, often in the midst of very daunting challenges, defying all odds in an unwelcoming environment, remaining committed to their pursuit of a career in scientific research. Their narrative experiences as students and professionals centred on the injustices, challenges, and bias they faced, and continue to experience, in their careers. Despite their struggle and hectic journey into their present careers, these individuals are now hailed as icons, role models, heroines and pacesetters. Their selflessness, courage and perseverance have earned them the approval of both critics and admirers. The following quotes mirror the sentiments of this group of participants.

When I set out on this journey, it was to prove a point. Now I believe that point is well established [smiles broadly]. I often laugh when I say this, but science is my own social responsibility, it is my way of giving back to society and I'm happy my work is making a real-life impact. (Anna, Chemical Engineering)

When I finished secondary school, I wanted to go to university. All the young women my age in my community were getting married and having children. But I wanted to go to school, so I persuaded my parents to allow me. People called me names, unprintable names. My company was shunned. But I stuck to my guts. It was a very lonely road, but today my name is mentioned in that same community to motivate young girls to get into science. (Mary, Biochemistry and Food Science)

For trajectory C – fluke career identity – narratives revealed that although entry into science was primarily influenced by parents and mentors, the actual journey into becoming a research scientist took an unplanned or extemporaneous route. Participants from this group described their entry into their scientific research careers by revealing that although they were already into science, their passage into their present careers had several elements of randomness, luck, and chance along the way. A common narrative here was that they had met a ‘Godsend’ – an individual whose presence brought many career-changing opportunities – very early on in their lives as students, or that an unforeseen occurrence had propelled them to jump ship from a

different career goal to pursue a scientific career. Their experience as students and professional scientists was more relaxed and laid back. They were indifferent to the challenges and biases that exist within their career setting. These participants rather believed that every career has some chance events that influence its outcome. As such, they had resolved not to control everything that happened in their lives, including their careers. All they could do was keep on putting in their best effort, leaving the rest to chance, as recounted in the following:

Career decisions do not come with some sort of map. Yes, by all means you must have a plan, but we live in an unpredictable world and no plan is a master plan. You can only hope that you're on to something worthwhile. (Kai, Science and Technology)

As illustrated by the above quote, participants' estimation of making meaning out of their career was neither impervious nor crystal clear. They had no rules or 'master plan,' as Kai put it, and were seemingly unperturbed that their outlook on the meaning of their careers may not necessarily be the dominant narrative or the standard expected of scientists.

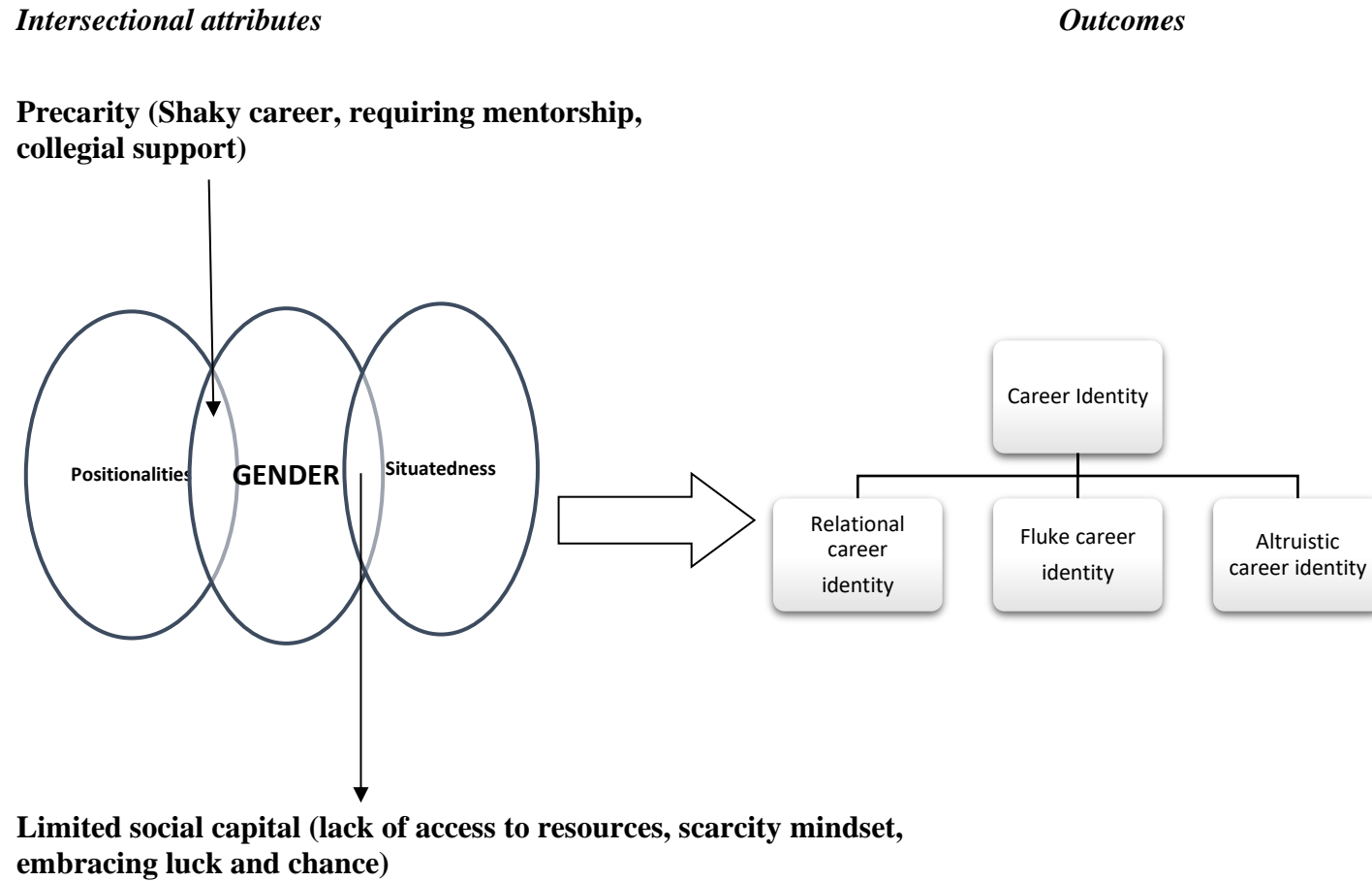
#### **4.4 Chapter summary**

Findings relating to the careers of female ECRs from the developing world focused on the motivation behind such career decisions, experiences within the gendered scientific career society, and the meaning that these ECRs make of their career trajectory. Overall, narratives integrated stories of strength, evolution, transformation, faith, optimism, and tenacity in distinct contexts, manifested in three ways: getting in, getting on, and ascribing meaning to their identity as ECRs. By focussing on intersectionality as the overarching lens of the study, it was observed throughout the narratives that the ECRs' unique positionalities as early career research scientists and their situatedness as developing country citizens intersect with their gender as females to influence the way and manner in which they make sense of their careers. A significant finding of the analysis was that, despite the fact that participants primarily created

narratives about their motivations for choosing a career in science as being altruistic, many of them rejected the idea that their identities were only created within the limited 'science as a calling' narrative, which confined them to a single narrative focused on a single aspect of their identity. Their identity as ECRs was thus constructed based on the interacting influence of the self and societal agents, as shown in Figure 4.1, below.



Figure 4.1. An intersectional model reinventing the career identities of female ECRs from developing countries



In addition, findings relate the career trajectory of female ECRs from underdeveloped nations to the crafting of an avatar. Each participant, who identifies with one of the identity trajectories, chooses a character, shapes and builds her life around it, and brings that character to life. For the relational family identifiers, that character was a family to impress. The altruistic identifiers desired to be the 'sheroes' of their era, while the fluke identifiers crafted a nameless superhero, who would sail them where the wind blows. The next chapter will look deeply into the factors that both facilitate and hinder the careers of these early-career female scientists from developing nations, while the chapter that follows will delve more deeply into the factors that both enable and impede their careers.

## CHAPTER 5

### **The privileges and penalties of intersectionality: Practices that enable or impede the careers of female ECRs from the developing world**

While the previous chapter examined the factors that influenced the career entry decisions and choices of female ECRs, this chapter seeks to identify the advantages and disadvantages of their intersecting identities, which ultimately facilitate or hinder their careers. Before discussing the obstacles that impede the careers of these female ECRs, the chapter will begin with a discussion of the career enablers. In addition, an intersectional lens will be used to illustrate how a conventional career path in scientific research has influenced the lives of these women, thereby establishing a system of privilege for some and disadvantage for others. The focus here will be on the individual components, before moving on to the institutional and national levels. This section will provide an overview of how the various levels intersect to confer privileges and/or penalties on these early-career female scientists. The chapter will culminate with a model that illustrates how the overlapping identities of female ECRs from poor nations are both advantageous and detrimental to their careers.

#### **5.1 Career Enablers**

##### *Familial support*

The significance of family support in reaching career goals and aspirations was strongly underscored by the participants. Some individuals described how their extended families helped them to realize their dreams. They praised their families for moulding their perspectives and encouraging them to pursue higher education and leadership roles:

My older brother paid my school fees throughout university. I lived with him and his family until I got a job and could afford an apartment. There would be no career today without him. (Herty, Physics)

Others benefited from additional family help from parents and siblings, particularly with domestic tasks and childcare:

My mum has been so helpful. She always looks after the kids so that I can focus on my projects and other things. (Kai, Science and Technology)

I can always drop my children at my sister's house if I need to go somewhere or have to stay longer at work. I know they are in safe hands with her, and I get the peace to focus on my work knowing there is always someone around to help. (Tyra, Atomic Energy)

Support from a spouse was commonly cited as a career enabler. The capacity of spouses to assume additional responsibilities that are often allotted to women was highlighted as a crucial element contributing to a less stressful lifestyle, which impacted their careers. Some participants were able to guide their careers in the proper direction with the help of their spouses' encouragement and sacrifices, such as relocating to a different place.

My partner understands my job demands and is always there to help. (Dory, Microbiology)

My husband chose to relocate here with me when I had this offer. He knew this was an opportunity I always wanted, and he didn't want to stand in the way of my career development. (Anna, Chemical Engineering)

In order to pursue a career in scientific research, one must commit to long hours and perhaps unexpected schedules. Due to the strong family support that they received, participants were able to invest time early in their careers in acquiring the varied array of skills necessary for success.

### ***Mentorship and Networks***

Narratives aimed to raise awareness of the enablers of female scientific careers, with the goal of making the invisible success factors of female scientific careers visible. 'Mentorship' and 'networking' were common themes among more than half of the participants. One of the

primary accelerators of their career progress, according to participants, was having a mentor in the academy. One participant, for example, noted how her mentor was essential in her transition from student to professional:

My supervisor gave me my big break, literally. When I was nearing the completion of my PhD, he came in one day and said “Apply for this job”. I did, and that was where my career began as a professional. He is also a big name in the field, so having some publications with him also aided in me getting my first job. We still do collaborate on some projects from time to time and he’s always there to give me good advice. He has and will continue to be an integral part of my career, and my life in general. (Sophia, Physicist)

When asked if the gender of a mentor played a role in facilitating their careers, the majority of participants believed that while having a mentor of a different gender may not have a unique impact on the type of mentorship provided, women who had female mentors or supervisors felt more comfortable and established better mentor-mentee relationships. This is what one participant had to say:

I don't think having a male or female mentor is the issue, but rather the type of relationship you can develop with each other. Nonetheless, I believe that women who have female supervisors will feel more at ease and have a much better relationship. I also believe that because we are women, we understand each other better and can better assist each other. (Zana, Mathematician)

Indeed, career success has been strongly linked to the acquisition of social and human capital (Tharenou, 2005). Human capital commonly relates to education and developed skills and is therefore advantageous for obtaining senior positions in the workplace, whereas social capital often refers to a person's relationships and circle of influence (Córdova et al., 2019). Historically, men have had an easier time acquiring social capital through networking than their female counterparts (Gamba and Kleiner, 2001). The concept of networks or networking was thus prevalent in the participants’ narratives. Some participants mentioned that in order to advance in their respective fields, they had to establish the appropriate networks along the way:

For me, I believe networking is a very important aspect of career development. You go to these conferences, and you meet like-minded people. Some of the best opportunities I've had in my career came from people I met and established a professional relationship with. (Emelda, Physicist)

The Elsevier award introduced us to a lot of key players in our field. I got the opportunity to meet so many other women from different countries who were keen to collaborate with me. When my country got into war and the university where I worked was bombed, I was left without a job. It was one professor from Germany whom I had met earlier, he was the one who recommended me, and I got a job and moved over. (Dory, Microbiologist)

One participant further stressed how networking had been instrumental in securing her current job. She threw more light on how joining a female group had relaxed her nerves, especially as an ECR, and paved the way for better opportunities:

During my post-doc days, there was this group for the women in the department, so I joined. We would occasionally meet for tea and those things. Quite informal, but it was good for me, because I'm quite introverted and I felt more comfortable with these women, most of whom were more experienced and would offer free advice. It was in one of such meetings where one lady told me about this job opportunity, and I applied, and I got in. (Portia, Biological Sciences)

The above extract highlights the fact that networking in itself may be contingent on group participation or otherwise and has historically been dominated by men to the extent that women have been excluded or deemed undesirable. This may still be the case in STEM disciplines, where access to all key informal networks is particularly challenging for women (Sagebiel, 2018). The increasing participation of women in networks that give useful contacts is therefore one of the factors contributing to their success. Even if more women are joining mixed networks, they may also find support and social capital through networks built or established expressly for women, which can be a helpful supplement to mixed networks (Coleman, 2010). In addition to providing valuable contacts, such women's networks provided both emotional and professional support to participants, potentially having a positive effect on their professional development.

These accounts emphasised the significance of forming relationships with knowledgeable and established senior colleagues in the scientific research community. According to the stories presented, this is crucial, since it raises the protégé's profile and opens doors to promotion and collaboration (Murphy, Gibson, and Kram, 2017). It also makes apparent the fact that although networking in itself is a useful tool that facilitates the careers of ECRs, the much greater challenge lies in not just networking, but making effective usage of such networking opportunities to actually facilitate the career development process.

### ***Awards and Recognition***

Awards are extrinsic gifts that become societal symbols of acknowledgement (Frey and Neckermann, 2013). They provide recognition and publicity, aid in recruiting funding, encourage career advancement, and reinforce career accomplishments (Morgan and Wood, 2017). Awards and recognition from colleagues, organisations, and other external actors were crucial for the professional development of participants. The majority of interviewees reported how recognition by their colleagues or institutions confirmed and solidified their positions as scientific researchers.

Whether we like it or not, there are those people that will always not take you seriously because you're a woman. Yes, you're a scientist but you're also a woman. So, when your research starts being recognised by others, especially those outside the periphery of your own institution, it sort of legitimises your position as a researcher. (Trudy, Chemical Engineering).

Individuals, particularly male colleagues, took Trudy seriously as a researcher when she was acknowledged for her contribution to research. Additional individuals shared her sentiments:

I was the first female physicist in my department. It was hard to make my point when I first started. My professors who taught me were now my colleagues, so in their eyes I was still a student [laughs]. Winning an award like the Elsevier award gave me this confidence I never knew existed. My colleagues also started seeing me as a big deal

from that moment. They even started to treat me differently. (Mercy, Mineral Engineering)

They [male colleagues] saw me more as an assistant than as a colleague. They never said so, but it was obvious. They wanted me to do their work for them and run errands and stuff like that. Being recognised on a huge platform, an international platform, certainly made it sink in that I am a colleague after all. Now we're doing some amazing stuff together and the respect for me has soared. (Sarah, Environmental Engineering)

Most respondents' careers were enhanced by winning prizes such as the Elsevier award, which gave them worldwide recognition and expanded their networks.

The award gave me this visibility that I never had before. We were in newspapers, we were on TV, people wanted to interview us. Even now, here you are writing your thesis about us [laughs]. It was surreal. Now everywhere you go, people take you seriously because they know you know your stuff. (Suzzy, Chemistry).

Others found that it gave them an advantage over their colleagues in terms of promotion and obtaining external funding.

Winning an international award certainly comes with some advantages. Applying for grants, you know – funding, for instance, can get very competitive. But when they look at you and they see that “Oh, this person has even won such and such award”, I believe it gives some advantage over another colleague who has no awards under their belt. It validates your credentials as a researcher. (Yola, Chemistry)

### ***Individual agency and adaptability***

Personal attributes such as consciousness, tenacity, hard work, and resilience were viewed as enablers of career advancement by the majority of participants:

As my career progresses, I've realised that it all comes down to commitment and dedication. I am a self-motivated, goal-oriented individual. Where I go is unaffected by other people's perceptions of me. I enjoy what I do and strive to improve myself every day. (Mira, Computer Science Engineering)



I knew this journey would be challenging from the start. I prepared myself for whatever experience lay ahead of me. If you want to advance in this field, you must be extremely resilient. (Suzzy, Environmental Chemistry).

Participants' individual agency was demonstrated by breaking gender norms and stereotypes associated with women in their respective cultural backgrounds. Mercy, for example, described how she overcame the urge to marry after high school in order to pursue her aspirations.

All of my female cousins were getting married and having babies after secondary school, but I opted to continue my studies. People started calling me names. Some people thought I was barren. I never let anything bother me. I had to be brave. (Mercy, Engineering)

Such display of resilience and tenacity was what enabled people like Mercy to advance in their careers. Even as an ECR, Mercy said, "one must constantly be confident and not afraid to show the world what you can do." Such bravado was displayed by other participants throughout the interview process. One participant, for instance, recalled a moment in her early career when she had to stand up for herself, and for other females:

I was the department's first female physics lecturer. My entire team was made up of men who taught and trained me. As a result, they never considered me a colleague. I was still a student in their eyes. Whatever I said was never taken seriously by them. I was not even invited for meetings. I attended a meeting I hadn't been invited to one day. I took a seat. I made my case and spent a long time debating with them about why my suggestion ought to be considered. I never cared if someone called me rude behind my back. I stood firm and ensured that numerous adjustments were implemented around here. The things I fought for are now benefiting the female lecturers that joined us later on. (Titi, Physics)

According to these compelling accounts, individual agency has been a crucial force in the career advancement of female ECRs by influencing certain organisational reforms that would have otherwise hampered their careers.

### *Career support and ancillary services*

Career growth was reported to be facilitated by institutional career support services. Some participants mentioned that their organizations provided them with support services that helped them to advance in their careers. These services have played a vital role in the advancement of participants' careers, ranging from career development workshops to opportunities to learn new skills.

After my PhD, I got the opportunity to work for [X] university in a post-doc role. I was encouraged to take some courses in English language because my English wasn't very good at the time. I took those courses, and it has really helped me in my career. I have had many opportunities because I am bilingual. (Esther, Biochemistry)

My institute have quarterly training on various things for us. I believe it is useful because we are scientist alright, but we are leaders as well and there are many things we need to know as well. Like conflict resolution, work-life balance, those things. Those workshops are very necessary, and I am happy we have such a thing in place here. (Victoria, Physics)

More than a quarter of respondents indicated that the development and availability of supplementary services like wellness departments helped to create a healthy work environment. Although this had nothing to do with professional advancement or growth, they stated that being part of a culture that prioritised employee wellness provided them with some sense of security, which influenced their attitudes towards their work. Mary had the following to say:

When you are in an environment where you know you are supported, you work hard. And by working hard, your work begins to get recognition. It is very important, and organisations have to realise the importance of these wellbeing and support departments. (Mary, Biochemistry)

However, for some individuals, this type of assistance went beyond what wellness departments could provide. These participants stated that providing support for females with childcare obligations, which was previously unavailable to them, could help them to improve in their careers. Through their narratives, these participants indicated that institutions could better assist

them by developing support services that suited their genuine demands. Mercy, for example, claimed that females in her organisation appeared to be underperforming relative to their male counterparts in terms of research output merely because they had caring responsibilities.

If there is a project or conference and they [female researchers] have to travel out of town, they have to go through so much to get a family to look after their children or spend a lot of money on nannies. We have to start thinking about what women really need in terms of workplace support. If they could access some small funds to assist with such issues, such as paying for a nanny, or if they can at least have research assistants to support during such stages in their lives, I believe a lot of our girls will be more than happy to go the extra mile. (Mercy, Minerals Engineering)

People like Mercy believed that it is past time organizations reconsidered what their female employees truly deserve. The argument is that by addressing these needs, female employees will be more motivated to engage in their work, especially in areas dominated by men, such as in scientific research.

### ***Tenure-track positions and career stability***

Promotion and tenure discourses are often impassioned, occasionally contentious, and nearly always fascinating. These discussions extend from long-standing concerns to more recent disagreements regarding the changing structure and obligations of university faculty employment (Kanter, 2011). As a result, when this (in)famous topic came up, the participants' opinions were split. While some disagreed, others thought the tenure track career approach was beneficial, since it provided a clear image of what was expected of them if they were to climb up the professional ladder. One participant explained it in this way:

I believe everyone who wants to get into an academic career aspires for a tenure-track position after their PhD. I stand to be corrected though, but it gives you a clear picture of what is ahead, and you know exactly what you need to do to get promoted. It is not always easy to get. I have colleagues that went into non-tenured posts before they got into tenure-track posts. So contrary to popular belief, it is not always straightforward, like after PhD then straight into tenure-track positions. (Esther, Biotechnology)

Esther's views indicate how female ECRs aim to achieve tenure-track positions early in their careers, as they offer a steady path in the direction of their careers. Her remarks also show that this type of work is critical to academic success because it provides a solid future and further prospects for progression. The knowledge that they would have a certain degree of job stability provided an indirect type of incentive for this set of interviewees:

You know, in our part of the world, job stability is everything. One of the reasons every parent wants their child to do science is purely because they know they are more likely to have a stable job. For me, knowing how the university system works already puts my mind at ease because I know when I am due for promotion, and I know what I have to present to get that promotion. (Herty, Physics)

I have friends in certain jobs where they have worked like five years, and no promotion, nothing. It's like you can be promoted today or the next two or five years. You don't really know. There's no clear path and that can be frustrating. Fortunately, for this type of work, teaching and doing research at the university, it is not like that. There may be some biases against women here and there, but if you work hard enough and do your part, nobody can really cheat you out of what you deserve. (Dory, Molecular Biology)

These remarks demonstrate the importance women place on job stability and how having a steady career or profession informs their employment choices (Brown-Wilson and Parry, 2013). For these participants, who come from developing country contexts where unemployment is common, the desire for job stability and having found a job that provides this stability acted as an enabler of their careers by way of motivation, as they were compelled to put in the extra effort needed to sustain and enjoy the security that comes with this career.

## **5.2 Barriers**

Although considerable effort has been made, women in science still face impediments. There is no certainty that women and men will have equal opportunities to develop in their careers, even if they are represented equally early on in their careers. In many contexts, women have a

lower rate of progression and a higher percentage of attrition from employment in science research as compared to men. By addressing these issues, participants highlighted a variety of obstacles, some institutional and others attitudinal, that frequently hindered their careers as women scientists from underdeveloped countries. Significant roadblocks identified by the majority of women included typical gender-based stereotypes such as juggling work and family life, a hostile work culture, a lack of funding and resources, and the teaching and research dilemma. A vast majority (27) of respondents cited overt discrimination and gender bias as the main challenges to their careers, with some attributing limited career opportunities as a result of these factors.

### ***The work–life (im)balance conundrum***

Despite the near-cliché status of the work–life balance mantra, it remains one of the most fundamental issues women face in the workplace today. There seems to exist an unspoken expectation that women should be responsible for the upkeep of the home and the children. Research has found that women, particularly those living in traditional communities, are expected to take on a greater share of the tasks associated with family life than are males. These responsibilities can include providing sole care for their children, husbands, and extended families. They are also expected to perform additional chores around the house. It has been discovered that the fulfilment of such role expectations is a significant barrier to the advancement of women’s academic careers (Nguyen, 2013).

The difficulties of reconciling work and family obligations emerged as a dominant theme among participants. Most of the participants (both married and single) acknowledged that, although living in the twenty-first century, women are still expected to manage household responsibilities for their families. They expressed regret for these difficulties, noting that they were due to the ethos of their academies, which required mainly research as the way to advance.

Aside from their family responsibilities, the participants felt overworked in a variety of areas, including teaching, research, supervision, leadership, and administration, all of which hampered their research productivity and career opportunities. The following extracts mirror these sentiments:

I don't think we as women in this type of work can achieve the perfect work–life balance. One will always have priority over the other. For me, my work takes the majority of my time. I wish I could spend more time with my family, but the job demands are so tedious that even when I get home, I want to go straight to bed. The research, the teaching, the supervising, all the other roles are equally demanding but if you don't excel in all, especially in research, your career stagnates. (Anita, Engineering)

My daughter's father and I got divorced because I was never around. I was working on this UN-sponsored project. It was a big deal for me. I was always travelling, never around. It was too much for both of us, so we had to separate. That's the nature of the job and you need an understanding partner, or you'll always have problems. (Alexa, Bioenvironmental Sciences)

Most participants considered that 'work–life balance' was just a fantasy concept that did not exist in their reality. To them, it has always been and continues to be a decision to pick and choose between family and career. Barbara made the decision to pursue a career:

I was doing so well, and I didn't want anything to distract me from my dreams. In the end I chose not to get married. I don't have any kids for now, but I may consider having one in the future – who knows? I'm just focused on my career because I've concluded you really can't have both. (Barbara, Electrical Engineering)

She was perplexed by society's high expectations of women's ability to excel in both work and family life:

Today's women work full-time, just like men, yet are expected to perform brilliantly at home, just as our moms and grandparents did when they didn't have day jobs. It's an unfair expectation, and no woman should feel guilty for prioritising her desires and goals over societal expectations. (Barbara, Electrical Engineering)

Others, like Herty, considered cultural and societal standards as difficult to change. Herty believed that women are unique beings with the ability to multitask and excel at various tasks at the same time. Although society's expectations of women are not always fair, she believed that by compromising and making sacrifices, such as putting career on standby at certain times to pursue other equally important things, like starting a family and raising children, is one of the few ways women can achieve 'work-life balance.'

I had to put my career on hold for a while because I wanted to have children and raise them to a certain age. Now that they are both nearly teenagers, I have returned and am now working on advancing my career. I could have achieved so much career-wise in all those years, but I haven't lost anything really because I am back, and I am already doing well. I am proud of my decision. At the end of the day, it's family first. (Herty, Physics)

Striking a balance between personal and professional commitments has been an important feature of participants' lives, and if they were unable to satisfy their domestic obligations, as many participants in this study acknowledged, feelings of guilt took over. Work and family duties have been a significant impediment to these participants' career advancement, as seen by some persons having to put their careers on hiatus to meet parenting responsibilities or turning down certain offers to accommodate their families' demands.

### ***Lack of funding and resources***

Securing and maintaining funding is fundamental for a successful scientific research career (Cardel, Dean, and Montoya-Williams, 2020). Yet, inadequate funding and resources were highlighted by all but one of the participants as a barrier to their career advancement. The only participant who stated that funding would not be a problem worked at a British research centre where she was fully equipped with a modern laboratory and had access to many resources that housed research activities. The majority, however, purported to be at the base of the funding or grant application pyramid. To begin with, as early-career scientists, they were at a

disadvantage when competing for resources with more seasoned scientists. Second, if they had to compete globally with their colleagues from wealthy nations, who are typically more resourceful and have better connections, then the context of their work in poor countries placed them at a disadvantage. Third, as women, they were perpetually at a disadvantage due to the tendency of some funding agencies to prioritise the individual (gender) over the science (Witteman et al., 2019):

Funding is a major issue. There aren't enough funding bodies or institutes in this country. As a result, we must always rely on those that are available abroad. And it's challenging because you're competing with everyone on a worldwide basis, and you're already at a disadvantage because you're from here. (Dory, Microbiology)

I really feel that if you are like me and want to be successful in these areas [funding], you must always be in the shadows of a senior colleague, mainly male senior colleagues because women are few in this sector. (Tyra, Atomic Energy)

Participants further highlighted how this lack of funding was affecting their career advancement:

It's not as if our counterparts in the west are smarter or more capable than we are. We have many outstanding and excellent ideas. It's only the resources are just not available. (Suzzy, Environmental Chemistry)

For some scientists, the existence of this problem has major repercussions because it limits their ability to network and participate in collaborative research, as described more below:

Before remote working and Zoom conferences became a thing, most of us could not afford to even attend conferences outside this country, because we had to foot those bills from our own pockets. This limited our ability to network and collaborate with other scientists from other countries. (Anna, Chemical Engineering)

Even with the advent of virtual reality, participants still faced significant barriers:

Having good internet connection is sometimes a problem. Just imagine how tedious and frustrating that can be in this time and age where information is everywhere but for



some of these reasons, its accessibility becomes difficult. (Anna, Chemical Engineering)

This country, they [the government] still don't really understand the importance of research, or perhaps they do but they just don't prioritise it. Researchers are always crying to the government to release our research allowance, which we are entitled to, but it never comes. (Mercy, Minerals Engineering)

The arguments addressed here suggest that the problem of insufficient funding is more than just an institutional issue: it is also a national issue. Participants felt that their talents and skills were not being fully utilised, and that they were being shut out of producing cutting-edge research simply because institutional and national policies did not prioritise research, resulting in a lack of local funding for research and a near-exclusive reliance on foreign grants.

### *Gender based stereotypes*

At the organisational level, men are more likely to be promoted and qualified for leadership roles in STEM departments because stereotypically masculine characteristics such as autonomy and competition are valued more than stereotypically feminine characteristics such as community nurturing and empathy (Lester, 2008). As a result of these misconceptions, women seeking scientific employment in STEM usually face hiring prejudice and limited career opportunities, making it challenging for them to advance (Casad et al., 2020). Some participants shared stories to reflect on some of the prejudices they had faced in their life as ECRs:

I know I speak for a lot of women when I say this because when we meet, we talk about these things. One of our greatest fears as early career researchers is having children or starting a family. I know many colleagues that desired to have children because they thought they were at that age, but you always have to stop and think about your career. Will I lose my job, will I be paid if I get pregnant, will I even be hired? And so, for places like here where jobs are difficult to come by, you always have to hold, not because that's what you want, but you have to be strategic and make sure your career has a firm footing before you make such a move. (Maud, Nanotechnology)

It is apparent from Maud's excerpt that some of these women endure unconscious prejudices that cause them to sacrifice other equally vital things in order to obtain or maintain employment. Zana recalled being asked during a job interview whether she planned to have children soon. When she inquired as to why she was asked this question, the interviewer explained that they lacked the means to hire someone who would immediately take maternity leave. Despite the fact that she had no plans to start a family at the time, she was highly offended by this question. She explained further:

Will they ask a male candidate whether he intends to have kids soon? In as much as it may appear to be a harmless question, I believe it was uncalled for, and clearly showed how biased some institutions are against women in their hiring. (Zana, Mathematics)

Herty, for instance, agreed with Zana's comments and found it difficult to understand why such biases persist. She shared her personal story of attempting to compete for a position within her organization.

We have a society, all the science departments here. I went to vie for the presidency position, and I had one colleague [male] come up to me to say I'm good but I should go for a more feminine post like the vice president or general secretary because the society is not ready for a female president, and that they need someone who is 'hard' to push their agenda. I was stunned to be hearing such words from the lips of a scientist, an educated and well decorated one for that matter. (Herty, Physics)

Such narratives demonstrate how deeply ingrained negative conventional ideas reinforce the belief that women are inferior to men in particular communities. As outlined below, hegemonic masculinity, which is influenced by socio-cultural norms and beliefs as well as organisational perspectives on gender disparity, has an effect on women's capacity to develop in their scientific careers:

As the first female in this department, I faced many obstacles. The men, most of whom had taught me at some point, never saw me as a colleague. I was not invited to meetings

because, well, maybe they thought I had nothing to offer. How was I supposed to grow and thrive in such an environment? When I stood up for myself, I was called rude, ‘a hard woman’ [in local dialect, meaning a masculine woman]. (Mercy, Minerals Engineering)

When I won the Elsevier award, I had a male colleague come up to me and instead of congratulating me, he said I won the award because I am a woman, and that if the award was not limited to women only, there’s no way I would have won. So I should stop making a big deal out of it. For some time, I was hurt, and asked myself if all this [career] was even worth it. (Herty, Physics)

Narratives like this lend credence to the notion that the vast majority of women working in STEM disciplines are compelled to repeatedly prove their level of competency (Seron et al., 2018). They need to go above and beyond in order to destroy existing gender stereotypes.

I am happy with my accomplishments so far, but I still hope I can win another award, one that is not just limited to women, so that I can prove to them that I am capable. (Herty, Physics)

However, establishing themselves is important for these women, not only to win acceptance from male colleagues, but also to provide hope and reassurance to the many young girls who look up to them. “Failure is not an option if you come from a location where all eyes are on you to achieve,” says Flora, a pharmacognosist. As a result, the pressure is not only to disprove the sceptics, but also to serve as a role model for young females despite the numerous obstacles.

### ***The teaching and research dilemma***

All but two of the participants had academic positions in institutes of higher education. These participants lamented the fact that promotion and reputation in the academy depended on research, yet they were burdened with teaching responsibilities as ECRs, making it difficult to focus solely on research. As ECRs, their primary objective is to establish themselves as world-

class researchers. On the other side, if they were to focus solely on their research, they would devote less time to other areas of their engagement, such as teaching and mentoring resulting in less time for research. Participants suggested a “less teaching, more research” strategy (Orlando and Gard, 2014) as a means of assisting them in advancing their careers as astute scientists:

Don't get me wrong. I love my students. But what good does it do to my career when I spend more time teaching than doing research? I had more time for research when I was a PhD student than now. Now I spend less and less time in the lab because the workload is too much. (Yola, Theoretical Chemistry)

According to remarks like these, it became apparent that while it does get better as one ascends the professional ladder, the immediate dilemma was how to climb that ladder when there is not enough time to conduct the research that will ultimately lead to promotion. This issue was a recurring theme in all of the participants' accounts. One participant who had recently transitioned from academia to industry recalled feeling overwhelmed, worried, and close to a mental breakdown at one point – an event that encouraged her to reconsider her career course.

She remarked:

As women, we tend to think that the 'academia' pathway is better suited for us because we believe it will give us greater autonomy over our life. Personally, I was disappointed. It's a different ballgame altogether and I couldn't cope with the pressure. Now I work for [company X], I am still doing my [scientific] research and I have better work-life balance as compared to when I was at [X university]. (Mary, Biochemistry).

As with Mary, most participants also made references to stress, anxiety, and pressure. Regina mentioned how she developed depression as a result of work-related stress at the onset of her 'glamorous' career.

People thought I had such a beautiful career. But I was very depressed. And I couldn't say it to anybody because I am a scientist, and I am not supposed to be very emotional. The stress was too much, and I felt I wasn't succeeding, looking at the rate I was going.

But I got help. Now I am okay because I have put certain mechanisms in place to help with my stress and anxiety. (Regina, Pharmacy)

On the topic of stress and anxiety, a lot of participants noted that these issues arose mostly from insufficient transitional support for ECRs from student to professional status. According to these participants, institutions must appropriately orient staff and give ongoing support, especially for new employees, in order to better prepare them physically and intellectually for their roles.

### *Attitudinal characteristics*

Individual characteristics, such as self-doubt and an excessive dependence on societal norms, were viewed as impediments to scientific career advancement. In spite of the fact that none of the participants personally identified with these characteristics, it was clear from their narratives that they viewed these unfavourable attitudes as a barrier to career advancement.

It is not enough to finish a PhD and come and teach. Women must aspire to higher heights. Sometimes we don't even try. We just get comfortable where we are because we have sort of accepted the fact that we can't reach certain heights. (Georgina, Nutritional Sciences)

Some participants highlighted how religious beliefs and societal perspectives promote male supremacy, enabling women to become accustomed to taking the back seat:

It is engraved in religion, in our culture, that the man is the head, women must submit, all that stuff. And so even if you are being harassed, or discriminated against, some women just choose to keep quiet. Standing up for yourself has been classified as a sin. (Alexa, Bioenvironmental Sciences)

The majority of respondents stated that this attitude problem among certain women impedes the career advancement of others. This is due to the fact that if one woman chooses to accept prejudices while another chooses to resist them, then the latter becomes the 'difficult' or

‘disrespectful’ woman who is a ‘disgrace to womanhood’. In general, participants were less concerned about the name-calling and prejudices they faced. As one participant (Georgina) put it, “these biases are pervasive in our society and may never be eliminated.” The participants were particularly interested in the notion of women getting together to encourage one another and prepare the way for the next generation of women.

### **5.3 Intersectionality as played out in practice**

The term ‘privilege’ is often viewed as a contentious application of intersectionality (Lutz et al., 2011). This is due to the fact that intersectionality as a construct has its roots firmly embedded in fighting for the oppressed or marginalised groups in society (Mooney, 2016). Nonetheless, the numerous institutions that frame everyone’s lives impose varying degrees of consequence and advantage on each individual (Collins, 1998). In this sense, each person is subject to a range of phenomena that enable their success or failure in their setting. Findings, as discussed in the preceding sections, suggest that the multiple identities of female ECRs from developing countries, while disadvantaging them in many scenarios, can also serve as enablers to their career development. These advantages and disadvantages can play out at the individual, organisational and national levels, as explained in much detail below.

#### ***Individual level***

The narratives of respondents revealed that, at the beginning of their careers, their intersecting identities as women, ECRs, and nationals of developing countries were, in various ways, both a privilege and a disadvantage. First, within the home and personal context, intersections between gender norms and social power dynamics of gender provided advantages in the form of familial support for their dreams and aspirations, especially for those who were encouraged to pursue science by parents and other familial guides. However, the same power relations

within the aforementioned categories created new impediments, such as a dearth of networking opportunities, an absence of mentors, and the inability to balance work and family responsibilities.

Family life changes you, really, no matter what you know. It's not everybody that's fortunate to have a supporting spouse who encourages them. If you do, that is an exception, but if not, so you struggle and have to make sacrifices for your family for your marriage and you usually end up putting yourself and your dreams behind. (Leila, Microbiology and Environmental Sciences)

According to the majority of these women, even though they receive some assistance from family, it is insufficient, and they are more likely to reach their breaking point because they are constantly limited by conflicts between the socially constructed demands of family and their career as scientific researchers, which requires long hours of work and a commitment to fulfilling the call to do science. Another concern was mentoring. Although participants acknowledged getting mentorship, it was informal and unstructured, and was primarily limited to their PhD advisors.

Apart from my PhD advisor with whom I learned to be a scientist while we were working together during my PhD, I do not think I have received any other mentorship. (Anna, Chemical Engineering)

However, individuals underlined the positive experiences and benefits they had gained from their current roles. The capacity to perform something they loved, were skilled at, and made a living from was a significant factor in their perception of privilege. The majority of women in this study used terms like "fortunate" and "satisfied" to describe how they felt about their career trajectory.

Despite the challenges, I feel extremely lucky to be here today. It is not every girl who, coming from where I'm from, was able to make something meaningful out of their lives. To be here today, in this career, winning this award, I count myself lucky. (Emelda, Physics)

These experiences reverberated particularly loudly among participants, who frequently drew parallels between themselves and other girls they had grown up with who were unable to realise their ambitions. The advantage here was having a family who supported their aspirations, having a chance to receive a scholarship or obtain finance for their education, having the perseverance to triumph despite numerous setbacks, and even having the possibility to find good work after graduation.

### *Institutional level*

At the institutional level, female ECRs described their lives as interwoven with several interconnected sources of privilege and penalty. Participants saw themselves as fortunate to be among the few women making progress in their fields. However, many felt as though they were being punished for having this privilege due to the numerous obstacles they confronted daily within their organisations. Mercy, for example, described the unfavourable working atmosphere she had experienced as follows:

When I first started working here, they did not have a female staff washroom. I was the first female lecturer in this department. I had to use the students' bathroom. I reported it several times, but nothing was done about it. It took a whole year after coming here before a female staff washroom was made available. (Mercy, Minerals Engineering)

The lack of female representation in a department like Mercy's meant that she had to fight many needless battles to enjoy the basic necessities accorded to someone in her position, despite receiving accolades from family, friends, and the community for her accomplishment as the department's first female faculty member. She said: "I believe I am right to say I made history. But that history also came with a price". In fact, nearly all respondents indicated that they tended to suffer in silence as a result of the numerous obstacles to their career development at the organisational level, such as a lack of funding opportunities, an unfavourable work



environment for women, and the difficulty of obtaining tenure-track positions. Some participants were of the opinion that these challenges contributed to the underrepresentation of women in these careers, as the prevalence of such conditions pushed people away, resulting in high attrition among women in these fields. For example, Mary elaborated on why she left her university teaching position:

I could not cope with the workload. It was getting too much, and I was spending less and less time at the lab and with my family. I was always stressed and started getting anxiety. I was no longer satisfied with my job, so I had to make a change (Mary, Biochemistry)

Another respondent told of her plans for the future:

I have plans of going back to clinical medicine. I have plans of setting up my own clinic and practising. I don't see myself doing this until I retire. (Freda, Nuclear Medicine)

Regardless of the difficulties, the sense of self and social fulfilment that came with them was very appealing.

In spite of all these challenges, this career path makes me happy and fulfilled. People respect me in the community. They see me as a role model. Even at the workplace, my superiors are always ready to show me off at the slightest opportunity, especially after winning this award. It's a nice feeling. (Freda, Nuclear Medicine)

Their female gender was a source of agency for ECRs during the course of their careers. They used language such as "role model," "first woman or one of the few women," "tough," and "endless efforts" to describe their positions in their respective organisations. Although this gender construct provided a generic source of agency for the participants, it intersected with their positionality as ECRs to shape their professional experiences. The challenging nature of the academy was more pronounced in their cases, as informed by the way they were viewed

within their organisations. This intersection began with who was most likely to advance in their career. One participant described the situation as follows:

Employers like to present a perfect picture to the outside world that they are diverse, they value inclusion, and so on. And so, they take in one or two women to look good. But internally, they are far from putting structures in place that can facilitate our growth and development. (Suzzy, Environmental Sciences)

Therefore, gender and positionality are not mutually exclusive for these female ECRs from underdeveloped nations. Rather, they combine to influence their career opportunities and outcomes.

### *National level*

At the national level, participants recognized the effort that many developing countries are putting in place to support the 'Women in STEM' agenda. Some participants had benefited immensely from these policies, especially when they were students.

I was fortunate to already be at the university, pursuing my first degree in engineering, when the then government started this campaign to promote girl-child education. In their effort to encourage young girls into science, scholarships were distributed to girls who sought to further their studies after the BSc program. So I benefited from this scheme. I had a full government scholarship to pursue both my master's degree and my PhD. (Mercy, Minerals Engineering)

Participants acknowledged such policies as privileges for females, as they would not have been eligible for such benefits had it not been for their gender.

The government recently announced a plan to lower the cut-off point for girls interested in pursuing STEM degrees at university. It elicited mixed reactions. Some people believe that both genders should be admitted using the same criteria, but I disagree. The government is attempting to make STEM more accessible to females, not to degrade or make them appear less intelligent than their male counterparts, as some people are attempting to portray through misinformation. (Suzzy, Environmental Sciences)

The establishment of award programmes targeted at celebrating their work and performance, such as the OWSD-Elsevier award for female ECRs from developing countries, was another benefit they reaped as a result of their status. Participants spoke about the positive impact such programmes have had on their careers, as well as the necessity for similar initiatives to support women in STEM from disadvantaged communities or countries.

The award allowed me to make visible what women from my country can do in terms of science. It allowed me to make known my specialty, which is ethnobotany, and put it at the same level of importance as biotechnology – an appreciation that did not exist. (Portia, Ethnobotany)

I got much more visibility in my country, and in the region. I have been involved in many outreach activities because people want to know more about my work. I think I have been able to share my research with many non-expert people. Considering that my work is theoretical particle physics, and that in Guatemala there is a lot of contempt for science, I felt it was a great opportunity to put my grain of sand to help people to understand the importance of science. On a more professional level I have received few invitations to share my work in the Region. (Sophia, Particle Physics)

Despite the advantages that institutional and national policies have created to make STEM more accessible and appealing to women, participants said there were many additional challenges that disadvantaged them. They explained that policies were mostly focused on how to recruit girls into science, with little attention paid to how to nurture and develop their capacities once they were in science. One participant shared her personal story about being underpaid for doing the same job as a male colleague in the past.

When I found out I was being underpaid, I complained. A male colleague asked why I am complaining. According to this person, I didn't need the money because I'm just a woman with no responsibilities. But men have responsibilities because they are the major breadwinners in their families. He later said it was a joke, but even if it was, such jokes shouldn't be made in the first place. (Barbara, Electrical Engineering)

According to such narratives, governments, for example, must ensure that the gender pay gap is closed by enacting legislation to support such activities. As Barbara said, "Governments

must be intentional in their commitment to assisting women at work, particularly women who find themselves in industries dominated by men.” Participants concluded from these stories that simply getting girls interested in science is not enough if they are not given the support they need to succeed. They discussed a need for allocating research budgets and putting in place systems to make funding more accessible. They also stressed the importance of reorganising, implementing, and promoting family-friendly policies, such as maternity leave programmes.

I lived and studied in the United Kingdom. And I'm aware that women get nearly a year of maternity leave to bond with their newborns and mentally prepare themselves before returning to work. Maternity leave is only three months in this country. So, if you begin your maternity leave in the ninth month of your pregnancy, you only have two months to return to work. Even if you request an unpaid leave extension, there is a good chance it will be denied. Consider having to leave your three-month-old to go to work for several hours. This is a significant problem that the government must address. (Mercy, Minerals Engineering)

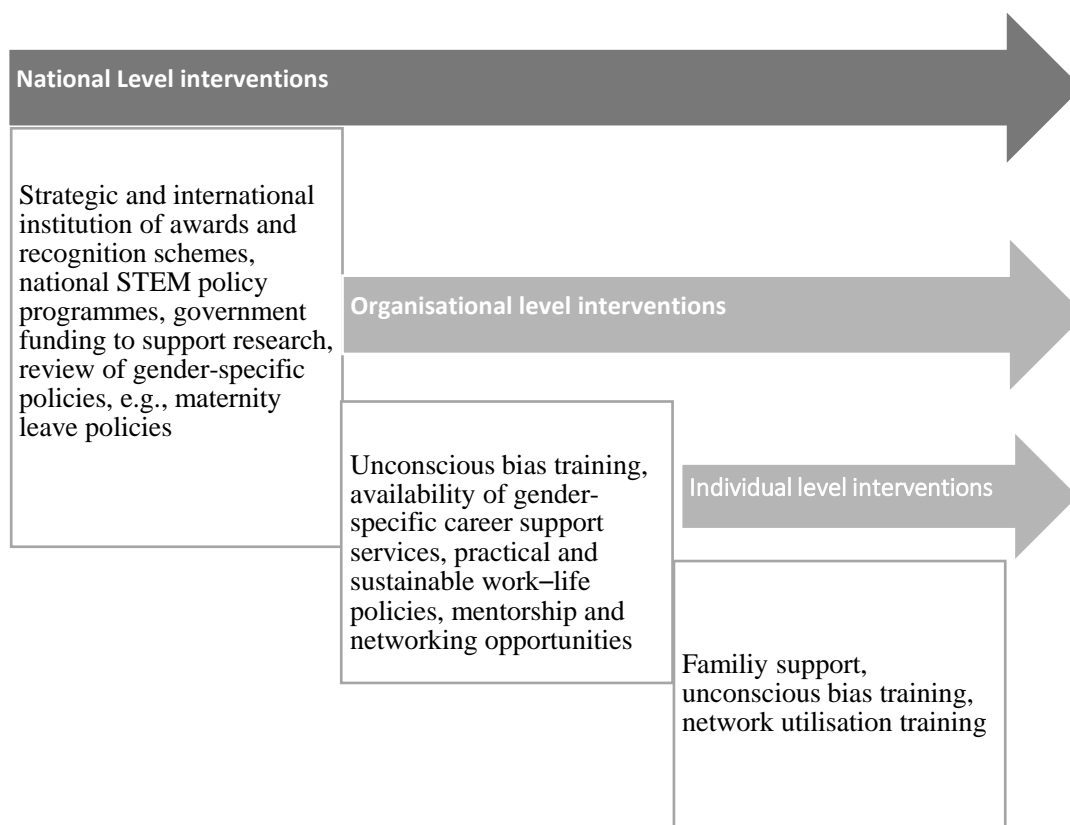
The absence of female representation in the upper echelons of government and institutions, according to participants, is to blame for these practices. They added that because the people in charge of these reforms are mainly men, they may not have a good understanding of what women need to survive and achieve in their careers. Although major efforts have been made to attract female talent to STEM professions, it was necessary to create policies that favoured these women's career advancement. Such narratives demonstrate that institutional-level structural power dynamics intersect with overt and covert organisational rules to produce differential outcomes across multiple intersecting lines, resulting in a lack of career advancement opportunities and uncertainty regarding research funding among early-career women scientists from developing countries. A lack of local funding opportunities, for instance, forces these scientists to compete for funds on an international level, where racial and other forms of discrimination may occur, such as funding bodies assuming that western

researchers are superior to non-western researchers. In many instances, participants argued that they had little choice but to accept short-term contracts with western academics who employed them to do local research.

### ***5.3.1 Mitigating barriers to enhancing the careers of ECRs***

The findings presented above call for much intervention to promote the careers of female ECRs from developing countries, as their seeming disadvantages resulting from their multiple identities far outweighed their advantages or privileges. In light of this, participants were asked to suggest solutions they would like to see implemented to help mitigate some of the challenges that they have had to confront and continued to experience as ECRs. A number of these solutions were unravelled and categorised under individual-level interventions, institutional-level interventions and national-level interventions, as shown in Figure 5.1, below.

At the individual and institutional levels, participants suggested that to mitigate the problems of work–life imbalance, unconscious discrimination, lack of funding, unfavourable work environment, and tenure problems, there was a need for such interventions as unconscious bias training for all individuals as well as the help of family, particularly partners and spouses, in supporting their careers. Again, they tasked institutions to address such issues pertaining to their career development, including favourable work–life balance services, making available career development resources and services, mentorship, tackling issues of equitable compensation, and ensuring fair promotions in the workplace.

**Figure 5.1. Career development interventions for female early career research scientists**

Participants believed that although their national governments were doing remarkably well to tackle the issue of getting more females into STEM, there was still room for improvement. Some highlighted the need for local recognition of their contributions to science rather than having to wait for international bodies to recognise their contributions. They believed that the strategic and intentional institution of awards and recognition schemes, national STEM policy programmes, government funding and grants to support research, and reviews of gender-specific policies such as maternity leave policies, were among the ways in which national governments could intervene to enhance their career development.

## 5.4 Chapter Summary

This chapter has examined the career enablers and barriers encountered by early-career female researchers from developing nations. The chapter also examined how intersectionality, as a contextual concept, might manifest as both a benefit and a disadvantage in particular settings. Individually, our participants were privileged, since they were among the few women to thrive in this male-dominated scientific career path. However, they were unable to balance the demands of work and family life and lacked mentors, particularly female mentors, who might provide them with guidance. On an organizational level, participants were privileged because they were among the first women to work for their respective organisations. However, this came at a cost, including difficulty adjusting to a male setting, a lack of career support services, and a promotion structure that ignored their needs as women. At the institutional level, participants alluded to being privileged by benefiting from government programmes and other initiatives targeted at empowering women, while also paying the penalty of unfavourable maternity leave policies and a lack of local research funding, which hindered their careers.

The chapter has given insight on how institutional power dynamics interact with social structures and individual agency to confer distinct privileges and penalties on individuals. Intersections of gender, positionality and situatedness and the differential privileges and disadvantages attendant to female ECRs do not work in isolation. Instead, these ascribed social identities are interconnected and yield multiplicative effects on the career development of female ECRs. In the same vein, interventions must also not target just one aspect of the whole: for instance, focusing on only individual-level interventions. On the contrary, interventions should embrace all three facets, namely the individual, institutional and national levels, to effectively enhance and promote the careers of female ECRs from developing countries. Having identified these career facilitators and barriers, the next chapter will focus on the coping

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mechanisms and methods that these early-career female scientists utilized to self-manage their careers in their unique contexts.



## CHAPTER 6

### **Balancing on the high wire: self-managing scientific research careers**

This chapter examines in depth the strategies and coping mechanisms utilised by the participants for self-managing their scientific careers as female early career research scientists (ECRs) from developing nations. Career self-management (CSM) theory tells us that CSM loosely encompasses a variety of attitudes and preferences that help people to become more self-directed and flexible in managing their careers in today's dynamic world of work (Wiernik and Kostal, 2019) by allowing them to develop, implement, and monitor career goals and strategies (Greenhaus, Callanan, and Godshalk, 2010). Through the identification of a wide range of career self-management behaviours, categorised under the headings of revealing and passing strategies, the chapter begins with a thorough examination of the passing adaptive behaviours in which participants engage to help manage or cope with their careers. The part that follows will further examine the revealing behaviours that participants have employed to manage their careers. A process model showing the various phases through which female ECRs go in the self-management of their careers provides a visual representation of the CSM strategies that female ECRs from developing countries adopt in order to self-manage their careers. A summary will then conclude the chapter.

#### **6.1 Passing Strategists**

Women must put forth a lot of effort to manage both their gender and their identity, according to Lewis and Simpson (2010) in their study on the (in)visibility of gender in organisations. This is because organisational contexts have the potential to make gender more visible while also making people's career identities invisible (Simpson and Lewis, 2005). At the initial stages of their career, ECRs gravitated towards utilised passing strategies, tactics Leary (1999, p.85) likens to a "cultural performance where one member of a social group masquerades as another

in order to enjoy the privileges afforded to the dominant group”. Such performances can be intentional or unintentional (Bennet et al., 2019) but aims to present an alternative, more acceptable self. From participants’ narratives, it could be deduced that they had engaged in many forms of such strategies at the onset of their careers. In this study, findings suggest that the use of such passing strategies to manage career identity happens not only within the organisation, but also of outside the organisation. While narrating their career experiences, participants alluded to engaging in some form of subtle “identity shifting” as a form of career coping mechanism. Participants engaged in various forms of identity shifting, from engaging in self-impression management to career distancing. These are further elaborated below.

### ***6.1.1 The self-impressionists***

This specific set of participants attempts to devise a strategy based on “impression management” – a phrase coined by Goffman (1959) to describe what performers do when seeking to impress their audience. Goffman compared society with a context in which we perform a role in connection to an audience, which is where impression management performances occur. In this context, the performer is susceptible to judgments and may feel accepted or rejected based on his or her adherence to generally accepted social norms. Therefore, it is essential to employ impression management strategies strategically (Goffman, 1959). Most participants indulged in some form of impression management strategy as they sought to find practical approaches and solutions to dealing with the problems that came about as a result of their career choices. They sought to manage their careers by adopting strategies that work, without the involvement of those creating the problems. Unlike the revealing career strategies, which sought to engage people, institutions, and the wider society, this group took matters into their own hands by dealing with situations themselves.

The story of Herty, a physicist from Sub-Saharan Africa, illustrates perfectly the self-impression management at work in the lives of female ECRs from the developing world. Herty's story began when some family and friends started questioning her choice of career when she decided to pursue a PhD.

Strangely, I have regularly encountered criticism on the career path I have chosen from people in places other than the workplace. Family, friends. "What in God's name are you doing there?" is something I probably heard countless times when I first started my PhD. (Herty, Physics)

Thus, for Herty, it became evident very early on that her immediate environment was not going to be very welcoming and supportive of her career choice. She therefore came up with some remarkable and genius strategies that had been helping her to cope with her career. Her first strategy was used to deal with people who already know her identity as a female researcher while her second strategy involved dealing with those who have no idea who she is. These strategies are further elaborated in the following extracts:

I am very careful how I deal with people. For those who know me, like family, friends, people from my village, I make sure when I am around them, I don't bring my "educated" things around. If it involves acting uncouth, I have to swallow my pride and do that, because if I behave too polished around them, they will say "Oh, I went to school and became a snob". This will not encourage them to support other young girls. But if I behave like them, they will say "She went to school but she's still like one of us". (Herty, Physics)

Another strategy is that I take very good care of my mother. I have renovated her house for her. I buy her things every month. In my village they don't see girls do these things for their family. When they see these things, it will motivate them to invest in the education of their girls because they know in their old age, they will be well taken care of. (Herty, Physics)

Regarding her second strategy, Herty had this to say:

When people don't know who I am, I prefer to hide my identity. For instance, we just moved to a new neighbourhood, and I've made some wonderful friends, but I told them

I'm a teacher. They think I probably teach in a secondary school, and I am okay with that. Because the moment they find out you're a researcher, you work for the university, suddenly their attitude starts to change. They feel too small, in a way, to associate with you. They start to look down on themselves. I'd rather they don't know who I am (Herty, Physics)

Camouflaging their identity as scientists and researchers seemed to be a perfect strategy for most of the participants, as they found this to be a very easy way to deal with people.

At first, people will come to the office and for some reason they'll walk straight to me and ask to see my boss, Dr. X [*surname of participant*], because their assumption is that I am the secretary and Dr. X must surely be a man. It used to upset me at the beginning, and I would often vent my anger on these people. Now I don't do that anymore. If they come and they ask for Dr. X, I take their letters and tell them I'll make sure he gets it. I don't have time to explain myself anymore. (Georgina, Nutritional Sciences)

Another participant described her impression management style for coping with her career, likening her strategy to a popular Hollywood film.

You know that movie, "Act like a lady, think like a man" – it's rather the opposite in this career. You have to act like a man and think like a lady. Because we ladies, we are perfectionists. We pay attention to detail, etc. etc. But you also have to be assertive, more confident, take criticisms well without crying. You can cry when you go home, but not in front of them. (Emelda, Applied Physics and Nanotechnology)

The hypervisibility of women (Dickens, Womack, and Dimes, 2019) in male-dominated careers was yet another reason why some participants adopted an impression management strategy.

As one of the few women in this department, I know I am highly visible. I have been told by several colleagues that I look too good to be a scientist, that I should have been a model. I am very aware I am being watched. I am very careful how I express myself. I have learned to speak more decisively and argue my case with precision and concision. (Sophia, Particle Physics)

Findings show that participants often adopted a two-faced personality approach, showing a more masculine proposition when the cameras are on, and switching to their authentic selves when the curtains are drawn. They often, to a large extent, hid behind a façade of perfection to portray a faultless image of a serious and competent scientist rather than allowing themselves to be human. The extract below mirrors this scenario.

When you start this career, you have to understand that you need to prove yourself more if you want to gain respect as much as a man. You have to be extremely good at what you do. It's almost as if there's no room for error. You have to be perfect, or so I thought when I started. Now with my experience and many successes, I'm letting myself go a bit. I am human, after all. I can't be perfect. But that was hard to do in the beginning because of so much expectation. (Mercy, Minerals, Engineering)

### ***6.1.2 The pragmatists***

Some participants (five ECRs), reported to being “realists” and dissociating themselves from the purported “victimhood” narrative with which being a woman scientist is often associated.

I simply don't subscribe to that school of thought that being a female scientist is some sort of special case that needs all this noise. And this is me being real. People make it look like we're some damsels in distress needing rescuing. (Anna, Chemical Engineering)

This group in particular often shied away from the topic of gender and its possible effects on career outcomes. Although aware of the gender disparities existing in their fields, they chose to refrain from making comments that connoted the possible advantages or disadvantages resulting from differences in gender. Thus, they sought to generalise their responses as much as possible without any inferences to gender specific norms. One common approach was a mass appeal to the ‘hard worker’ rhetoric, focusing on the single construct of ‘hard work’ as a precursor to succeeding in a scientific research career without considering any other factors. Their narratives emphasised the fact that there are no peculiar strategies in managing careers except to work hard, as mentioned in the quotations below:

Hard work pays, and it does not matter your gender. I focus on my work, and I work hard. And I am happy with where I am. (Dory, Nuclear Medicine)

I haven't got any strategy to deal with my work except to work harder. (Zana, Financial Mathematics and Mathematical Modelling)

Thus, the argument here is that the harder one works, the more likely one is to succeed in one's field. When these participants were further asked if they did not consider hard work as a strategy, they all made reference to the fact that everyone who works hard is rewarded and that this is more of an ingrained value rather than a strategy.

Hard work is a value that one must inculcate. It is not a strategy because you can plan to work hard, but if you're lazy and you don't imbibe the ethics of it, you will not be able to pull through. I tell my girls to work hard, and they won't be complaining about not being treated fairly. (Dory, Nuclear Medicine)

With such statements as the above, participants in this group tended to ignore the problem of any biases that might be present due to other others, rather bringing in the solution of working hard instead of complaining. One participant recounted an incident where a male colleague had once made a remark about how "she walks like a model". Although people around her felt that this was uncalled for, she herself was not offended, as this was not the first time that she had received compliments on her walk. Such "small talk", as she put it, did not bother her. However, what annoyed her most was when she was referred to as a "woman scientist". She stressed the fact that men are simply called scientists and women should also be scientists and not women or female scientists. Regardless, she argued, this had no connotations for her possible success or failure as a scientist.

When people say you're a woman or female scientist. That annoys me. I am a scientist. What is a female scientist? Do you call men "male scientists"? But then again, these things are trivial. I don't think I would fail as a scientist simply because someone chose to address me as a female scientist. (Mira, Computer Science and Engineering)

This group of participants, throughout their interviews, appeared to stick to a well-rehearsed, often-told narrative about themselves. They were more interested in talking about their career trajectories in terms of positions they had held, the research they had done and were currently doing, the awards they had received, and so on, rather than sharing their everyday experiences as women ECRs from developing countries. They presented themselves as the ‘typical’ scientist – serious, rational, overconfident, non-superstitious beings, who talk facts rather than make assumptions – hence their lack of interest in talking about anything outside of the science domain. Thus, to these scientists, their hard work as ECRs had paid off, as shown by their many achievements. Hence, their experiences have been nothing short of amazing, requiring no specific adjustments or coping mechanisms.

### ***6.1.3 The exit strategists***

In the fields of business and organisation studies, exit strategies are typically associated with entrepreneurs who meticulously lay out methods to reduce the risk of losing their existing business, prepare themselves for the post-exit phase, and increase the likelihood of re-entering business after exiting the industry (Rahyuda et al., 2017). Some of the participants used the phrase “Plan B” to refer to an alternative line of work that they could pursue in the event that they grew dissatisfied with their existing jobs, or if their jobs became unsustainable. This “Plan B” was a well-thought-out strategy that they had developed in advance. These techniques centred on, for instance, giving up entirely on a career in scientific research and switching to a field that has nothing to do with the field of science at all. This sentiment was notably prevalent among careerists whose dominant narrative centred on their accidental entry into science, as well as those who believed that science was not their first career choice but had been forced upon them by family or mentors.

Maybe one day when I get bored, I'll go back to designing clothes. Never say never.  
(Suzzy, Environmental Chemistry)

The narratives of these participants reveal that not only did some intend and have the potential to leave the scientific community totally, but others also planned a hypothetical migration from academia to industry. At the time of the interviews, three individuals had successfully departed from academia for non-academic positions. Regina, who had just started her new employment at the time of her interview, responded as follows when asked what prompted her move:

When I started [at old job] and saw the pressure and lack of funding and everything, I made up my mind to leave for industry. It's the same research I do here, but there's no pressure on me to go and seek funding. Everything is funded here. The labs are well stocked. (Regina, Epidemiology)

For individuals like Regina, issues such as a lack of project funding and unequipped laboratories were a major factor in their decision to move to an environment where these factors were never an issue. Money, in the form of salary and compensation, was another reason why some participants engaged in the development of an exit strategy. According to some of the narratives, although money was not the primary motivator for pursuing a career in scientific research, we live in a world where money plays a significant role, and thus issues such as fair wages and compensation cannot be ignored. This is especially true when taking into account the fact that some of these women also served as the breadwinners for their families. One participant noted that scientists are almost always expected to work for free and that any discussion of compensation is viewed as unprofessional and exploitative. In light of the fact that many scientists are leaving their jobs to pursue more lucrative possibilities elsewhere, she believed that this attitude toward them must reform.

People are leaving to industry because the pay is not good here. They pay better there. Sometimes they have to understand that we want to do ground-breaking research and make the world a better place, but we're also mothers, we're daughters. We have



responsibilities. Bills, rent, car. The money in academia is really bad here and great researchers are still poor, living in small houses, driving small old cars. The young generation do not want to end up like that. So, they leave when they get the chance. (Maud, Synthetic and Nano-chemistry)

In a similar vein, some of the participants discussed their ambitions to leave the academic sphere and go into other settings, so long as they were able to continue their research.

The idea of moving into industry is not something that I've entirely ruled out. As long as it's research I'll be doing, it doesn't really matter whether I'm inside or outside of academia, although I would prefer to stay here. (Anita, Environmental Engineering)

In yet another case, a number of people, in particular those working in the field of medical research, also mentioned the possibility of going back to clinical practice for a number of different motives. Some people felt that the consistent disrespect they received from their colleagues in clinical practice was sufficient motivation to really consider making this adjustment.

There's this thing where it's like if you're not practising, as a clinical practitioner, and you're doing research, it's like they look down on you in a way. They sometimes treat you like a second-class doctor. (Nadia, Community and Public Health)

Others believed that since they already possessed the required training and credentials, working in the medical field was a more secure alternative that they could always fall back on in the event that things did not go according to plan.

I am first of all a medical doctor. In the worst-case scenario, I can go home and put up a signage at my door that "doctor here" and I will get patients come in with their problems. Eventually, I hope to open up my own clinic someday. I may not quit research entirely, but who knows? (Portia, Biological Sciences)

Some participants also alluded to the possibility of pursuing various entrepreneurial ventures. These participants had no intention of giving up their jobs as scientific researchers entirely;

however, they did intend to launch their own businesses in order to supplement the income they received from their primary source, as the money they earned was insufficient to meet their demands. While some individuals had already established a “side business”, others harboured the ambition to do so in the not-too-distant future. The following statements serve to clarify this scenario.

I have a little pharmacy that I run on the side. I have dreams of growing it into a big brand. When that time comes, I may not be able to do both. If I can manage both, that would be perfect, but if I have to choose one, it would definitely be my business. (Flora, Pharmacognosy)

I have plans of starting a small-scale business soon. I have the idea, and everything is laid out. I’m just waiting for one or two things before it fully begins. (Mercy, Minerals Engineering)

The findings of the study show that this specific group of female ECRs did not wish to leave their positions conducting scientific research at the beginning of their careers. However, once they were aware of the situation’s gravity, they immediately began formulating their escape plans.

When I young and I thought about this [career], I thought it was going to be just me and my equations – that I would dedicate all my life to it. But it’s not like that. I don’t only do research. I teach. I mentor. I do administrative tasks. I’m not even doing as much research as I would have liked. (Zana, Financial Mathematics and Mathematical Modelling)

In the instance of Zana, the fact that she was devoting fewer and fewer hours to research during the early phases of her career was having a negative impact on her mental health. She claimed that “this is not what [she] signed up for” when she accepted the position. Despite the fact that she was adamant that this was not how she felt anymore because she had grown to appreciate what her position entailed, she did not believe that she would remain in the academic field until she was ready to retire.

#### ***6.1.4 The scientific fanatics***

Similar to the “hard worker rhetoric” participants, this group also reported not utilising any specific or peculiar strategy to manage or cope with their careers. These early career researchers were mostly apathetic towards their career outcomes and simply engaged in what was identified as managing their conformity within the scientific career space. The reason behind this indifference is further elaborated in the excerpts below. These participants entered into scientific research for the love of science and could not see themselves doing anything besides what they did presently. Their love and admiration for science superseded any challenges or pressures that came with their work, as expressed below.

I just enjoy it. I don't think there is any pressure. (Hannah, Ethnobotanist)

Comments such as that of Hannah above mirror the sentiments of those careerists who got into scientific research careers for the love of it. Hannah recounted how, as a young girl growing up in her village, she had been fascinated by the traditional plants and herbs used by her grandmother for medicinal purposes. This curiosity on her part had birthed an early desire for the study of plants. With the support of her parents and grandmother, she had gone on to do what she had always wanted to do: ethnobotany. To her, this was her calling, and waking up every day to do what she does was enough motivation to keep her going.

I really do not have any challenges and peculiar strategies for doing what I do. As far as I remember, this is what I was born to do. My husband is also into botany, and I think that has also helped me a great deal because we do the same things, so we understand each other in terms of our jobs. (Hannah, Ethnobotany)

Pursuing the same career as her partner became highly visible in Hannah's narratives, having talked about “helping each other out”, “collaborating”, and “understanding each other's jobs”.

Additionally, she mentioned that her partner's social networks had also become hers and that she had benefited in some ways because he was already in a much more senior position prior to their marriage, thus highlighting the positive aspects that her union had had on her career as an early career scientist.

In the same vein, other participants reflected on their desire to pursue science, their expectations when they set out to pursue this career, and how these expectations had been met. One participant recounted how she had received massive support from people, especially her PhD supervisor, who had continued to support her in diverse ways to develop her career. For this reason and others, doing anything beside their career as scientists was not an option for participants in this group.

When I decided this was the career for me, I was not expecting to have things easy. As a female in this country, I thought it would be a very big challenge to make it, but I pursued this career anyway because it is this or nothing for me. I guess my expectations were just my fears and worries because I have had amazing support from people, especially my PhD supervisor, who is the first person I still call when I need any form of support. We have collaborated on several projects, and he has been very instrumental in my career development. Science is for me, and I am for science. (Emelda, Applied Physics and Nanotechnology)

In similar fashion, another participant stated emphatically that she was married to her job as a research scientist and as such would do anything, including making huge sacrifices, to continue her career as a scientist. She mentioned how, as a child, she had envisioned getting married, having children, and starting her own family one day. However, her job demands, coupled with her current desire to climb the occupational ladder and get to the top of her career, had taken precedence, requiring her to make some significant adjustments in her life. She insisted that she had made this decision as a matter of choice and further argued that it was high time that women were not subjected to any pressures or judged on such things as getting married or

having children, as these things were subjective decisions that should be left to the discretion of the individual.

I am married to my job, literally. I chose not to marry or have children because I want to focus on my career. I have big dreams to get to the top of my career and I understand that for every choice you make in this life, there is always an opportunity cost, isn't it? ... I feel like it's so old fashioned to put pressure on a woman to get married or have children – it's high time we moved on from this kind of talk. If a woman wants to marry and have children, good. If not, also good. (Portia, Biological Sciences)

The idea of being married to one's job or career reveals the extent to which these participants had clung on to their jobs for dear life for fear of 'career death.' They were ready to play the game, unwilling to challenge any biases that might 'cancel' their careers or jeopardize their career development prospects. As such, they had made a pact with themselves to ignore any visible or invisible problems they might encounter and rather focus on doing what they did best. These participants had not laid out strategies to use as a guide to manage or cope with their careers as female ECRs. On the contrary, their love and devotion for the careers that they had come to embrace was the motivating factor that kept them going. They articulated their narratives with pride and joy, and each presented the persona of a decisive, career-driven and ambitious individual who knew exactly what she wanted and never failed in achieving what she set her sights on.

### ***6.1.5 The shock managers***

A major theme constructed from the data is managing outcomes arising from career shocks, which are vital to understanding an individual's career, given that they are frequently turning points or catalysts for transition (Akkermans, Seibert, and Mol, 2018). Five participants discussed the need to develop the spirit of figuring it out in order to thrive and succeed in the

professional environment. For example, Sophia discussed how she was still trying to figure things out post-COVID-19.

I am still trying to figure it out. In the middle of the Pandemic, being a researcher and having a daughter, I am just trying to make things done. (Sophia, Particle Physics)

As argued by Akkermans, Richardson, and Kraimer (2020), career shocks, whether positive or negative, have serious implications that reflect the dynamic interplay between individual and contextual factors, which ultimately serve as antecedents in career decisions. Thus, participants echoed the need for constant adaptability in order to deal with any career shocks. In a similar manner to Sophia, Tyra described how not only the pandemic, but also her taking on additional responsibilities as the main carer for her ailing mother-in law, had affected her life.

No one expected coronavirus, but it came. Now my mother-in-law is very sick, and I have to take care of her. It's a very hard time. The lockdowns, the restrictions, going to and from hospitals. I'm just thinking maybe I need a break from all this [career] for some time to put my thoughts together. (Tyra, Atomic Energy)

As negative career shocks can trigger unhelpful, negative emotions such as anxiety, self-doubt, and frustration (Seibert, Kraimer, and Heslin, 2016), in order to deal with the tension and worry, participants like Tyra engaged in reflective activities and expressed their emotions, which also served as a means of identifying potential solutions to their current problem. Another participant, who had undergone a career shock due to political unrest, described how she had handled this pivotal moment in her life:

My university was bombed. I was in the lab with my students when this happened. One day I was doing excellent research and moving on with my career. Suddenly, I was jobless. Luckily, I got another job in Italy. I stayed for two years. After my contract, I got my current job and moved here as well. This is also a two-year contract and I have already done one year, so I'm thinking "What next?" again for me. (Georgina, Nutritional Sciences)

When Georgina was asked how she coped with this situation, she had the following to say:

For me, I am grateful to be alive and I am grateful to have a job that brings in money. It's difficult moving from one place to another, but I always stay positive.

In order to deal with the unpleasantness of their situation, some of these participants who had had unfavourable career shocks adopted gratitude as another coping mechanism. As emphasised in the following remark, a strategy for handling such circumstances was found to include not only gratitude but also the determination to keep improving oneself despite these setbacks:

During the lockdown, because I spent all the time at home, I learned many new skills. I enrolled in online classes and took many short courses that I know will be beneficial to me and my line of work. (Flora, Pharmacognosy)

People like Flora, despite suffering a career shock, made the most of the situation by honing their career competencies to be current, marketable, and relevant. Similar to Flora making hay while the sun shone, not all career shocks were negative. Participants narrated having experienced positive career shocks, such as being recognised and receiving awards on an international platform. Mary, a biochemist narrated how her winning the OWSD-Elsevier Award for Female Early Career Researchers from Developing Countries transformed her status from an obscure researcher to a world-renowned scientist. Similarly, Tina said:

The OWSD award was a very wonderful moment, but it also came with a lot of surprises. The interviews, the media attention and everything. I remember I was interviewed on national television and the next day my email was overflowing. Young people asking me to mentor them. People asking me to come and speak at their events. It was a shock. (Tina, Pharmacology)

Tina emphasised once more that positive career shocks might “get in your head” if they are not properly managed. Another participant, Kai, echoed this sentiment, stating that instead of

embracing the sudden rise to fame and attention that comes with receiving a prestigious award as motivation to continue working hard, it may make one “feel comfortable” and “give a false sense of having arrived”:

I never thought for once that because I have won this wonderful award so it means that I should relax. If anything, it was rather a wake-up call that the world is watching me, and I should even do better than I am doing now. (Kai, Science and Technology)

The majority of participants in this category believed that learning how to deal with successes is an essential skill for career management. In spite of the fact that humans frequently acquire coping skills in response to adversity, they argued that positive occurrences could have negative consequences if not handled properly.

Many a time we focus so much on how to manage our challenges. We forget that we have to learn to manage our successes too. I have seen successful people who couldn't manage themselves well and in the end that success led to their demise. (Kai, Science and Technology)

We are taught to overcome problems, find solutions. We are not taught to manage successes, and I think this is a conversation that we need to start talking about. (Flora, Pharmacognosy)

Participants in this group presented themselves as “people” with feelings, anxieties, hopes, and dreams. They appeared to have no concern as to whether or not their narratives conformed to preconceived notions of what a scientist should and should not do. They were self-assured, but they also displayed their fragility as people who occasionally encounter both negative and positive things which have a substantial negative impact on their professions. Their experiences also highlight the need to understand how career shocks, even positive ones, can have detrimental effects if people are ill-equipped to handle them on their own.



## **6. 2 Revealing Strategists**

Analysis of the data showed that when participants were more settled into their work environments, they took on more revealing strategies in managing their careers. Participants demonstrated management behaviours or coping mechanisms that were visible, undisguised, and obvious to anybody who looked closely enough. Participants at this stage of their early career research life began to be more vocal in “fighting” for their career development and better work conditions. Overall, participants narrated events that showed their dominant narratives after they had settled a few years into their jobs were to align with this strategy. Consequently, the revealing strategies displayed were distinguished by their tendency to question the political establishment in the scientific professional field, taking on added roles as advocates and pioneers of programmes aimed at modifying the working conditions of women in science, building human and social capital, developing grit, and finding effective ways to manage scarce resources within their unique settings.

### ***6.2.1 The freedom fighters and challengers***

Specifically, these careerists took charge of their own careers by searching for ways to enhance and possibly expand women’s opportunities in the science sector. They regarded this as doing what they had to do to bring about the desired change in their respective professional fields. These participants, for instance, fought for equal treatment and working conditions for female employees, themselves included, thereby disrupting the status quo within their organisations. They were firm believers that their careers would become better solidified and on track if conditions such as gendered inequalities that persist not only at the organisational, but also at the societal level, were to take a new turn.

Advocacy is somewhat part of my job now. I believe it is my duty to ensure that not only I, but all women receive fair and equal treatment here. It is not just about me or

my colleagues here, but those that will sit here tomorrow when I am no longer here. (Herty, Physics)

If we remain silent to what we deserve, then we will continue to complain without any improvements in our jobs. Like I mentioned earlier, I had to fight for basic things that everyone, whether man or woman, needs to get their job done. We're not there yet, but at least we're far from where we were yesterday, so that's something. (Rose, Pharmacy)

According to some participants, fighting for basic necessities was not only frustrating but also career-threatening. However, in order to have a space that was suitable to work and function effectively and productively, they had to travel this arduous path.

Because I was the first female lecturer in this department, there were no female washrooms for staff when I started. I had to either use the students' women's bathroom or walk all the way to another department. I brought this up many times and I was called names. Some said I was incorrigible, incredible, to demand for a women's washroom when it's just me. My answer was, "If you won't use the student's bathroom, why should I?" It was tough but I put up a fight, and now we have one here. (Herty, Physics)

Others were of the opinion that active participation in the ongoing effort to advocate for fair and equal treatment in the workplace, particularly for women in science careers, was only appropriate because many before them had begun the fight: therefore, it was their responsibility to continue the tradition. In addition, they argued that such practices would help to shape the mentality of not only the "illiterate" members of society, but also the highly literate members, such as male co-workers who refuse to let go of certain old customs, traditions, and biases that alienate female professional development in the workplace.

There are those [colleagues] who unfortunately still perceive us as lesser beings or subordinates, although we have the same qualifications. We have to help such people shift their mindsets. By speaking up and clearly articulating what ought to be done right, we are able to create that professional persona and people begin to take us seriously. (Georgina, Nutritional Sciences)

Advocacy for the equitable distribution of career development opportunities, they argued, will further enable the validity of their identity as professionals (Sturges, 2008). For instance, when Georgina from the extract above talked about some male colleagues taking her seriously, she emphasised how female ECRs often feel judged or (de)valued based on their gender rather than their professional abilities. Consequently, some participants said that the underlying motivation for their desire to be supporters and defenders of women in scientific research professions was to regain their legitimacy as professional scientists.

When I told them [some male colleagues] to stop calling me ‘mummy’ they said I am being snobbish and that they are just being courteous. But that made me uncomfortable. I am not your mummy. We are colleagues. This is a professional setting. I’d like to be addressed with my name and title just like everybody else. (Mercy, Minerals Engineering)

Such stories point to a poor organisational culture that has enabled sexist comments or even jokes to become commonplace and seemingly innocuous, despite the fact that they made participants feel extremely uncomfortable and anxious in some cases. In light of this, the most likely career management strategy under these conditions is to abandon silence and speak up.

I had to learn very early on in my career to learn how to talk a lot. I am naturally an introvert. I don’t like complaining. But because everything was so wrong, and if you don’t talk, it’s almost as if you accept whatever is happening. (Yola, Theoretical and Computational Chemistry)

Additionally, some participants noted that speaking up was not confined to their organisations alone. In an effort to achieve the career advancements they desired, they went a step further and engaged their communities. They had many common experiences, some of which assisted them in adapting their advocacy rhetoric to encompass a larger portion of the community.

In the course of my research, we travel to a lot of remote places. Before we get there, the people there already know we’re coming. They know Doctor So-and-So is coming, and their idea of Doctor So-and-So is certainly not this petite, five-foot two woman. So, when we get there and they realise I’m that doctor, you can literally see their

disappointed faces. But the question is, why should it be so? In this 21<sup>st</sup> century, why should we still have these problems? You see why we can't stop sensitizing people and advocating for more women's representation on STEM. This is one of the only ways we can save women in this profession and keep the doors open for others in these parts of the world. (Anita, Environmental Engineering)

Participants reported being passionate about shifting the mindsets of people within their communities, as they saw this as a way of gaining acceptance to do their jobs. As such, members of this group were keen to organise and/or support programmes aimed at educating their communities about women in STEM careers.

When I was growing up, there were no women from my village in such careers. Now I go back and speak to the parents especially on why they should educate their girls and encourage them into STEM. If we want to gain acceptance from our communities, it must start from the parents, not the girls. (Herty, Physics)

One of my senior colleagues set up this NGO that goes to the villages and remote places in the north especially. They organise outreach programs to sensitize the locals on why they should send their girls to school. I volunteer whenever I can because it's very important. If the community gets it, the institutions won't have much choice but to change as well. (Suzzy, Minerals Engineering)

Thus, these participants made an explicit and intentional effort to manage their careers by defying organisational and social norms through their fight for organisational recognition and their negotiations with the broader society for acceptance.

### ***6.2.2 The social capital builders***

Creating and cultivating social capital was yet another way in which these careerists engaged in revealing strategies to self-manage their careers. Social capital has been recognised as crucial for the career progression of women, often highlighting how networking can be used strategically to break through the glass ceiling (Wellington and Spence, 2001). However, research has also found that in work settings, women are frequently excluded from key social

groups (Cabrera, 2007). These careerists therefore used this as a tool to create social capital in the form of creating informal women's support groups that aimed to empower each other by fostering wellness and collaboration.

You know how men have their "boys' club" and they go out on Friday nights for beer, and they go golfing and all that. At my university, we the ladies have also formed a similar thing where we plan and go out occasionally. We have picnics, we go out swimming and engage in other activities outside of work to improve our wellness and mental health, and also get to know each other and foster that togetherness. (Sophia, Particle Physics).

In order to build social capital, safe areas were established to allow female co-workers to interact, exchange ideas, have fun, and share knowledge. One participant emphasised the importance of such "women's support groups" in giving ECRs stability, a sense of belonging, and security.

Developing a close-knit relationship with the few women in the department offered me a sense of security because I could always approach them for assistance outside of the workplace. They were essential in my settling here, and that provided me with the determination to continue my work. (Zana, Financial Mathematics and Mathematical Modelling)

These groups assisted women like Zana, who found it challenging to socialise in unfamiliar settings, in establishing new contacts, locating mentors, and obtaining the assistance they needed to advance in their careers. Thus, female ECRs using this strategy as a CSM technique utilised this informal networking to learn from other women in senior positions, or to create close ties and even possible working relationships with other female colleagues, all of which benefited their careers. Such benefits included job opportunities and recommendations for future employment.

It was one of such 'informal' meetings that this lady announced they were hiring here but they wanted it to be low-key. I told her I was interested in applying and she coached

me on how to go about the application and even wrote me a wonderful recommendation letter, and here I am. (Anna, Chemical Engineering)

I am a member of the Women in Science association in my country. It was in this group that one of my colleagues told me about the OWSD-Elsevier award for women in science. She herself had been a previous winner, so she encouraged me to apply. I did apply, and lo and behold, I became part of the winners. (Sophia, Particle Physics)

Furthermore, these women's groups provided physical and emotional support, aimed at improving the wellness and wellbeing of their members. Some participants shared experiences of how being members of such informal women's social groups had benefited them in various ways.

We try to encourage members to stay physically fit and healthy. We have occasional yoga or swimming sessions as a group, and I believe this contributes to our general wellbeing. If we are healthy, then we can have the sound mind to focus on our work. (Maud, Synthetic and Nano-Chemistry)

When I got divorced from my husband, it was a very difficult time for me. I got into depression, and it was a very difficult time. My other colleagues were there for me. They took me out and cheered me up. You know ... they are women, so they understand how I felt. I felt the sisterhood at that time (Barbara, Electrical Engineering)

Informal women's support groups and networks therefore play a crucial part in how female ECRs from developing countries self-manage their careers as they seek to create their own social networks through which women can feel safe to network and socialize, especially in conservative societies where women's respectability could be undermined by their relative closeness with members of the opposite sex.

Culturally, women are not expected to get too close with members of the opposite sex. Even if you decide to network with men, there's always that limit as to the extent to which it can go. That's why these groups are vital to both the personal and professional development of women. It gives us that safe space to build that closeness and professional relationship that we otherwise would not have been able to do. (Nadia, Community and Public Health)

In her comments about whether or not women's social networks create a safe space, Suzzy emphasized the frequency with which young women in her country encounter sexual harassment and other obstacles when seeking to negotiate their careers. She claimed to know other female ECRs who had suffered sexual harassment, though she herself had not been a victim. Some of these women, she claimed, were even threatened with the loss of career progression opportunities if they did not comply with their superiors' untoward and unprofessional requests. Suzzy stated that these women's groups were "a must".

Women's support groups and networks are a must. In this country, even if your male superior harasses you and you report, as a young researcher, chances are you don't even know where to go. Or you may even be too scared to go to, say, the police. This is why it is important that women up there provide mentorship and support to those coming up, and the best way to achieve such outcomes is through these informal networking groups where we can be ourselves and share our highs and lows and provide support for one another. (Suzzy, Environmental Chemistry)

Finally, having a clear awareness of the value of social capital development and career outcomes, participants stressed the significance of creating such women's communities where knowledge could be exchanged, collaborations could be formed, and budding careerists could be mentored.

Because you are seeing and interacting with people who can relate to you and your experiences on so many levels, participation in such networks can help you advance in your career as an early-career researcher. (Julie, Applied Mathematics)

### ***6.2.3 The affective strategists***

Modern career perspectives emphasise the necessity of being self-directed, values-driven, and adaptive in order to have a successful career (Hirschi and Koen, 2021). According to the present study's findings, some participants engaged in perfectionism-related behaviours. These individuals lamented the fact that, as a result of the underrepresentation of women in their departments, they were continuously the focus of attention within their organisations and in the

broader society. They recounted that this obvious visibility holds them to a certain standard, from which they cannot deviate. Therefore, their strategy was to adopt a perfectionist approach to their tasks. One participant explained this as follows:

When I started, it was as if all eyes were on me. Make one mistake, and people will think you're not capable. I can't afford to make mistakes around here because I need to prove that I am capable. (Herty, Physics)

Both positive and negative perspectives were used to analyse these pressures. Although this perfectionist mindset was beneficial to the workplace and led to impressive gains, it also required more time spent at the office, which could result in higher levels of burnout.

I have never left [the workplace] exactly on time. I always stay behind and mostly the last to leave the office. I also come around almost every Saturday. It means less time with family and also less time for myself, but I have to do this because I want to excel at my job. (Mercy, Minerals Engineering)

Likewise, another participant who shared similar sentiments had this to say:

For females, we have to work three times harder to match up with the men. People generally don't take you seriously, so you have to put in the work and start getting awards or some form of recognition before they start to take you seriously. We have to put in that extra work. (Mira, Computer Science and Engineering)

It became apparent that some participants were not content with their existing professional triumphs as a result of this adaptive coping mechanism of perfectionism. Some individuals had incredibly high standards for themselves and were unduly self-critical. For instance, Herty still considered that she had not yet accomplished anything, despite receiving the OWSD-Elsevier award for women in science, all because of a male colleague's comment:

After getting the award, a colleague walked up to me and said if I haven't done anything special and that I won because the award is only for women. And I agree with him. I have set a target to win another international award, one that is not just tailored for women, but one that includes all genders. Then I would be satisfied. (Herty, Physics)



It appears, based on the above excerpts, that for some of these individuals, this perfectionist behaviour was not a result of their innate predisposition to be perfectionists, but rather was a coping mechanism to enable them to function as women in the midst of highly masculine careers, as discussed below.

We are just a few women here, and if we don't put in those extra hours, how are we going to match up to change that narrative that we are not capable? We have that burden of proving that we indeed belong here. We have very little choice. (Suzzy, Minerals Engineering)

The deliberate choice to distance oneself from particular connections was another practice that emerged from participants' narratives. Participants who described circumstances in which they were compelled to break off relationships with certain people – most commonly partners and spouses – due to their careers experienced this “wanted loss” phenomenon.

I love family. I always wanted to get married and have children and live happily ever after. My ex-husband felt I was not there enough for him. My work involves a lot of travelling and sometimes we spend weeks, even months. And it was causing problems, he wasn't supportive of my work. Even suggested I end this career. (Alexa, Bioenvironmental Sciences)

Alexa gave many examples of the gendered power dynamics that led her to prioritise her career above her family. She described her circumstance as a very trying time in her life when she was obliged to give up her home in order to get the peace of mind she needed to refocus on her career.

I realised he always got upset whenever I had to go away for a few weeks. It was always arguing, fighting. It was a very frustrating and dark period of my life. I had to sit down and do some deep thinking and reflections and choose which path to go. When I am forced to choose between my career, which I struggled and sacrificed so much to build, and a husband, who wasn't very supportive anyway of me, I think we both know the answer to that. So yes, I got divorced. I wish it didn't have to get there. But it was the right thing to do. I love science. This is my life. (Alexa, Bioenvironmental Sciences)

In addition to these gendered tensions at home, another participant described instances in which she had to sever ties with her husband's relatives in order to save her career.

There was a time when I had to cut ties with my husband's family, because I had just completed my PhD and got a job and my husband at the time was teaching at the secondary school. His family felt because I was now more educated than him, and I was probably earning more than him, then it meant I won't respect him anymore. They threatened that I quit working at the university and find a secondary school to teach, else they would get another wife for my husband. I cut them off and focused on my career. Now my husband also has his PhD, so they are okay with me because we both have PhDs. It's funny but it's real and very common in this country. (Herty, Physics)

Herty makes a strong case for concentrating on transforming societal perceptions of women in historically male-dominated professions. She contends that if this mentality is not altered, women who find themselves in such occupations would still find it difficult to sustain such careers.

I know women who would have been great scientists, but because of some of these problems, they left to take on lower jobs – you know, jobs that will not make you earn more than your husband, so that there will be peace. Some even became housewives. We lost all these great talents because while institutions are focused on educating the girl-child, we forget that we must also educate the larger community to change their mentality. (Herty, Physics)

Another scenario led two individuals to make the philosophical claim that everything in life is a trade-off. They both presented the argument that it is unreasonable to try to strike the ideal balance between all aspects of life. As a result, one should always be prepared to accept the opportunity cost of choosing.

In this life, you win some, you lose some. In this country, if you're a woman and you don't want to be a housewife and have babies, then you have to accept that you will have to make some serious sacrifices for your decisions. (Esther, Biochemistry and Biotechnology).

You can't have a glamorous career and a perfect family. That is what I have come to know and that is being realistic. As an early career researcher, you're new and you want to build that solid foundation. So definitely, some difficult decisions have to be made. (Mira, Computer Science and Engineering)

Additional analysis of participant narratives revealed that some participants utilise adapting to solitude as a career management approach. For these participants, becoming the scientists they are now has been and will continue to be a particularly lonely road. So, becoming accustomed to isolation was a necessary evil in order to take charge of their careers and consequently to excel at what they do.

I know I speak for most people when I say this. The PhD journey itself can be so lonely and you think "Oh, everything will be fine once I complete". Then you finish you realise that "Oh, it was much better when I was doing the PhD". What can you do? You must get used to it if you want to succeed. (Esther, Biochemistry and Biotechnology)

Another participant described the entire experience of being a female early career research scientist as a "lonesome journey":

Being a woman scientist here is a very lonesome journey. You are on your own most of the time and you have to work so hard to get the recognition you deserve. We work very hard. We are married to our work. (Regina, Epidemiology)

When asked what constituted this loneliness, these participants indicated that their failure to develop meaningful friends in their workplaces and their incapacity to additionally find time for social events always placed them in a position of isolation. Participants stated, however, that as time passed, this had become "normal" and no longer a concern, since they were able to accept how things turned out.

It's pretty normal to feel alone most times in this job. At first, it was a problem, but now when I look at my work and I look at my students and my many successes, I feel satisfied. I know I did something right. (Georgina, Nutritional Sciences)

The central idea of coping with loneliness as a career management approach highlights yet another challenge faced by female ECRs as they work to challenge accepted norms. As one participant described it, they have to “close their emotions” and put on a brave front out of fear of being identified as women – an identification that has come to denote weakness or fragility. These participants urged female mentors and support groups within organisations to do more than just focus on professional work and partnerships: they also urged them to take a strong interest in offering some advice in navigating through such emotions by sharing their own experiences. One participant particularly emphasized this, as recounted below:

Even the senior female researchers here, everyone acts so tough. Like that is norm here. If you show a little emotion, they will say you're weak. We have to act tough. If the senior researchers who are mentoring us, if they share their own experiences outside of scholarship with us, we will be in a much better place to deal with some of these problems. (Mercy, Minerals Engineering)

As noted by other participants, it appeared that not all women were eager to pass on their knowledge and experiences to newcomers. It appeared that some enjoyed the attention of being the only woman, and the emergence of another female face was seen as a threat, which further heightened the feeling of solitude at the workplace.

“What makes the early stages hard is that we all know the gender disparities and all and so sometimes you would think that after going through all of this, we would be very kind and helpful to other females that would be coming in later on. Don't get me wrong. Many are very happy to help but I have also observed that some are some who love this whole idea of being the only woman to do this and that. Some also feel they've experienced all of this so other must do same. They are not very friendly and very welcoming when they see other females, much younger and with much prospect. Those ones can actually make life difficult with overly excessive critique of everything people do, you know, just to hold on to their positions (Tutu, Hydrology)”

The above extract hints at the unfortunate tendency of some ECRs to develop the ‘Queen Bee syndrome’ (Cibibin and Leo, 2022) where they may show no interest in helping other women,

especially new ones, in navigating the workplace through support and mentorship. However, Leila, a microbiologist, argues that this is not the case as they themselves are still trying to adapt to the many career shocks and realities of their environment. Hence, it goes beyond a matter of insensitivity or indifference towards helping others, but merely a way of coping with their own matters.

Resilience emerged as one of the participants' most notable career-affirming coping mechanisms during the process of adaptation. Participants were compelled to demonstrate their tenacity and commitment in order to adapt to the organisational culture, which was predominantly masculine. Thus, female ECRs used this tactic, especially when they had just begun in their tenure positions. The following is how one participant described her strategy:

I merely want people to believe that I am absolutely unbreakable despite the fact that this is not the case. Basic sense, first impressions are the ones that count the most. [...] If you come prepared with a certain amount of authority and a great deal of self-confidence, then and only then will that actually function and be completely accepted by everyone. (Victoria, Atmospheric Physics)

Another participant recalled:

Naturally, I make an effort to push myself a little bit against such men so that I may demonstrate that being a woman does not imply that I accept everything passively. (Titi, Atmospheric Physics)

Some female ECRs were perceived by participants as lacking self-assurance and having a predisposition to avoid "chaos". They contended that this resulted from women traditionally being expected to be "silent" and act in a ladylike manner. So, for some female ECRs, certain topics – such as those involving money and promotion – were off-limits. However, these participants saw that their male colleagues frequently spoke up about these issues, which may have contributed to their propensity to remain happier in their positions and therefore advance more quickly. The extracts below mirror these sentiments.

I've noticed that in order for women to be successful in this career, they need to achieve the correct balance between being confident and maintaining their femininity. (Esther, Biochemistry and Biotechnology)

Sometimes they [female ECRs] think that if you talk about money and promotion and those things, that it's unladylike. They don't talk even if they have to. But the guys will talk and that's why they get what they want. This is a skill I have learnt myself and it has helped me tremendously. (Alexa, Bioenvironmental Sciences)

Thus, in order to blend in and enhance their chances of thriving within their organisations, female ECRs participated in behaviours that were typically androgynous and occasionally outside of their comfort zone in order to manage their careers. According to the narratives, it appears that female ECRs are unable to be themselves, and must instead learn to have a different kind of confidence, one that requires them to exhibit traits of “toughness” or “hardness” in order to integrate smoothly into their new careers. Consequently, because they feel pressured to adhere to the “rules of the game” in order to appear competent or qualified, their responses compound the problem of ongoing misalignment with self. According to one participant, it appears that female ECRs must “put up” with a multitude of unwritten rules and must essentially always be on guard to “prove a point” to this superior “someone” who realistically does not even exist.

The model set out in Figure 6.1 below presents the self-management strategies of female ECRs over time. It describes a four-stage process of career self-management strategies with examples of how female ECRs manage their careers throughout their early career lives. The model thus offers contributions for addressing these issues towards building a career-self management approach.



Figure 6.1 Career self-management strategies of female ECRs

		STYLE OF SELF-MANAGEMENT			
		PASSING STRATEGIES		REVEALING STRATEGIES	
		Initial Phases	Dilemma Phases	Adapting Phases	Reconstruction Phases
<b>INTERSECTIONAL MARKERS</b>	<b>Time in Transition</b>	<b>Self-impressionists</b>		<b>Freedom fighters</b>	
		<b>Scientific fanatics</b>			
	<b>Gender (Female)</b>	○ Camouflaging self	○ Identity distancing	○ Scientific advocates	○ Movers and shakers of organisations
		○ “Two-faced” personality	○ “Same-career” relationships		
	<b>Positionality (ECR)</b>	<b>Shock managers</b>		<b>Social Capital Builders</b>	
		○ Show of gratitude and determination	○ Forging a spirit of “figuring out”	○ Building networks	○ Creators of women’s support groups
<b>Situatedness (Developing Country Nationals)</b>	<b>Exit strategists</b>		<b>Affective strategists</b>		
	<b>Pragmatists</b>				
	○ The “realists” and workaholics	○ The job-hoppers	○ Perfectionism	○ The “wanted loss” phenomenon	
		○ Scientific entrepreneurs	○ Adapting to solitude	○ Building grit and resilience	
			○ “Queen Bee” syndrome		



The model presents two critical dimensions: style of management, indicating the strategies upon which these ECRs draw to manage their careers; and markers of intersection, which show how the various identities embedded in the ECRs' identity react to different strategies at different times. The model offers nuanced and comprehensive perspectives on the various transitions that the female ECRs undergo during their early career research lives and the self-management strategies and coping behaviours upon which they tend to draw at each stage of the transition process. At the initial phases, ECRs tended to draw on passing strategies. A possible explanation may be the fact that this was the end of their student lives and the beginning of their working lives as professional research scientists. Here, they aspired to seek challenge and find authenticity (O'Neil and Jepsen, 2019) as research scientists, which could possibly explain their engagement in such strategies as a show of gratitude and determination to succeed, while engaging in impression management strategies to carefully curate an image that represents how they wish to come across. At the dilemma phase, they were open to the realities of what it means to actually be an ECR from a developing country. At this juncture, participants showed strategies relating to identity distancing and desiring partners and spouses within the same career domain who would support them, build their pool of networks, and collaborate with them on projects. At this stage, participants also developed their spirit of 'figuring things out' and some left their positions for other jobs that they believed would better support their vision.

Participants then moved to an adapting phase where they took it upon themselves to speak up and voice their concerns regarding issues surrounding their career development. They also realised at this stage that building networks, albeit significant, is not an end in itself. They became interested in finding sponsors: senior, influential personalities in their industry who would give them the needed exposure to help their careers by way of opportunities (O'Connor and McKinnon, 2021). However, some participants bemoaned how other female colleagues at

this stage developed the ‘Queen Bee’ syndrome – a term coined to describe the general phenomenon where women who have been highly successful in male-dominated environments are likely to oppose the women’s movements, including lending support to other women through mentoring (Cibibin and Leo, 2022). At the reconstruction phases, female ECRs were “well transitioned” into their career fields and had developed a thick skin. They tended to challenge the status quo more often at this stage and engaged in various activities addressing the issues of women in STEM careers.

### **6.3 Chapter Summary**

The purpose of this chapter was to explore the self-management behaviours and gendered practices that early-career female research scientists utilise to control or cope with their careers, considering their intersecting identities and accumulated career trajectories. Although participants faced cultural and institutional impediments in their career advancement, they exerted individual control over their career growth and career transitions, which determined how they responded to both anticipated and unanticipated career events, challenges, and transitions (Wang and Wanberg, 2017). It became apparent that their intersecting identities of gender, positionality, and situatedness enabled unusual methods, such as impression management and career distancing. In addition, it was observed that the pattern of career self-management behaviour in which a participant engaged was in some way related to the level of career satisfaction they were currently experiencing. Thus, this chapter has examined how to manage their careers, participants begin with more covert passing tactics and progress to more revealing ones as they become more rooted in their work environments. The subsequent chapter will focus on a general discussion of the findings of the study's analysis, with an emphasis on the study's theoretical and practical implications, before discussing its limitations and directions for future research.

## CHAPTER 7

### Conclusion

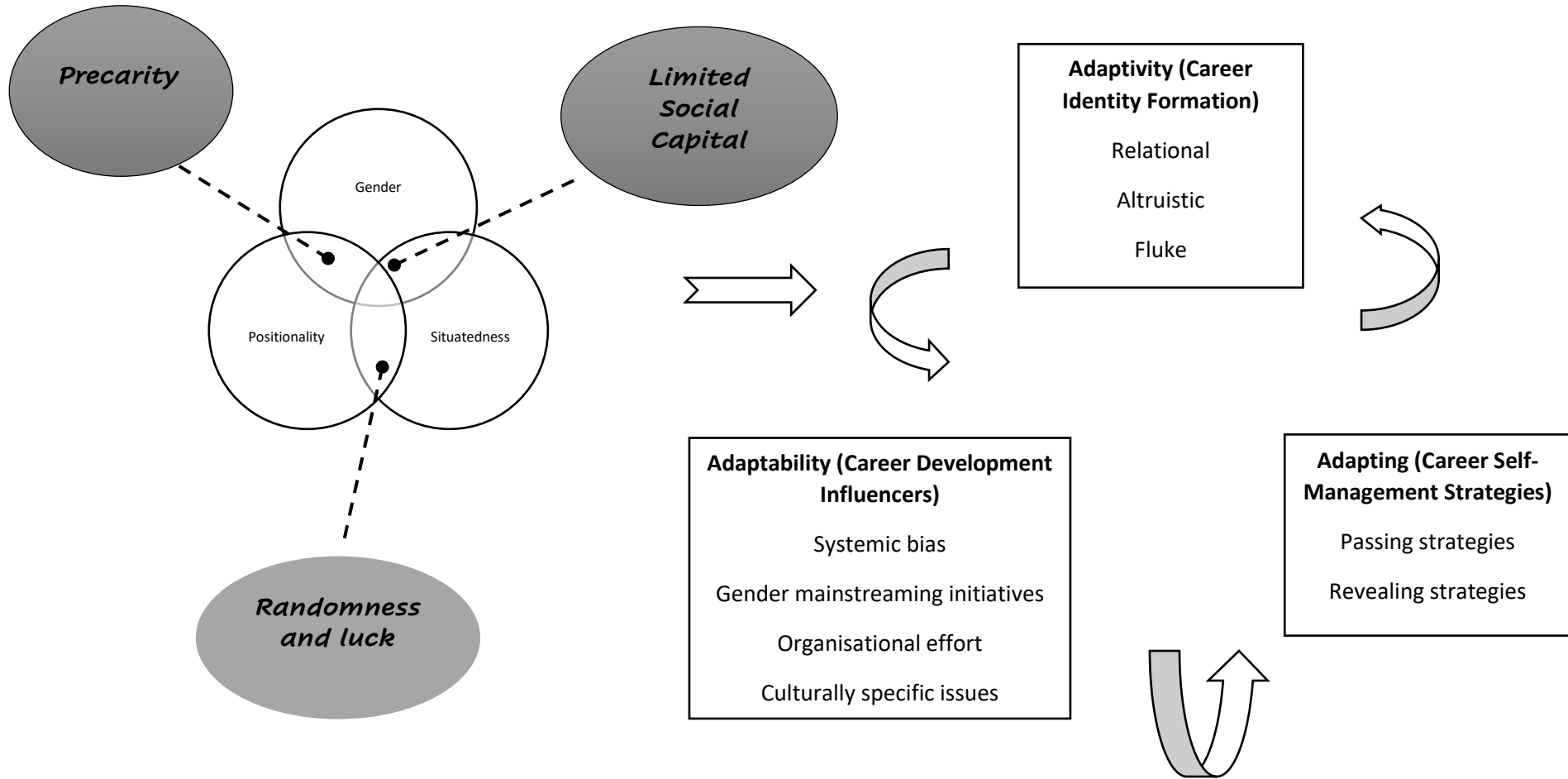
This thesis has sought to explore the making of careers, as enacted by 35 female early career research scientists (ECRs) in developing world contexts. In this section, the study draws on the overall framework related to career construction, the theorizing about the intersectional processes associated with the making and development of careers of female ECRs from the developing world, as well as extant research on career identity, decision-making, and self-management to explore, through an intersectional lens, the making of careers as enacted by past awardees of the OWSD-Elsevier award for women scientists from the developing world. In contrast to the racial, gender (Dickens, Womack, and Dimes, 2019; McCluney and Rabelo, 2019; Sang and Calvard, 2019; Wilkins-Yel, Hyman, and Zounlome, 2019), or religiosity (Tariq and Syed, 2018) constructs that are typically investigated in the literature from an intersectional perspective, this study has addressed the implications of the multiple identities of female ECRs from the developing world in the form of their gender (as females), their positionalities (as ECRs), and their situatedness (as nationals of developing countries), and how these identities ultimately coalesce to inform career choices, career decisions, management strategies, and career outcomes.

The study has thus attempted to answer the three proposed research questions: (1) How do gender, situatedness, and positionality shape career identity perception in the early career discourse of women scientists from developing countries? (2) What are the practices that enable/impede the careers of female ECRs from developing countries? (3) What strategies are drawn on by female ECRs from developing countries in self-managing their careers? This chapter thus begins with a synthesis of the findings and further sheds light on the contributions of the study. It then discusses the study's theoretical, practical, and policy-related contributions,

before moving on to highlight some of its limitations, which open new doors for future research.

Drawing on our findings, a framework was developed for a better understanding of the career construction of female early career scientists as seen below in Fig. 7.1

**Fig. 7.1 An intersectional model reinventing the career construction of female ECRs**



To demonstrate how female ECRs construct their careers, the study provides an overarching framework that connects its findings. Career construction theory posits that individuals cultivate an internal sense of agency (McAdams and Olson, 2010) and subsequently adapt to transitions, shocks, and trauma by aligning their inner needs with outer opportunities, thereby achieving adaptivity (readiness), adaptability (resources and responses), and adapting (results), as described by Savickas (2013).

The framework, viewed from an intersectional perspective, illustrates how the career construction process starts with the intersections of gender, positionality, and situatedness that prepare female ECRs for their careers. At this stage, they develop unique career identities, such as relational (related to relational ties like family, mentorship, and role modeling), altruistic (contingent on calling), or fluke (based on randomness, luck, and chance), upon which their sense of professional self is built. From here, they progress to the adaptability stage, which includes career development influencers that manifest as privileges and disadvantages, all of which contribute to the career development process. Finally, the adapting or results stage is where the agentic self realizes outcomes when they engage in coping behaviors that address their changing conditions.

However, this career construction process tends to be cyclical, as individuals go through different stages of their career lives. By articulating goals, directing adaptive behavior, and ascribing meaning to activities, the individual employs a self-sustaining narrative to make sense of their career and its construction dynamics.

## **7.1 Restatement of findings**

Although many countries have been resolute in their pursuit of gender parity (Fathima et al., 2020), inequities persist in a number of scientific career fields (Larivière et al., 2013). As women advance in their careers, their contributions to science decline, while the gender gap widens: a phenomenon metaphorically likened to a leaking pipeline (Berryman, 1983; Xie and Shauman, 2003). Researchers have employed sociological, psychological, and cultural perspectives, among others, to investigate this phenomenon (Gasser and Shaffer, 2014). Women's contributions to science and technology thus begin with an understanding of the challenges they experience in pursuing scientific education and careers, such as outdated traditions, culture, and overt prejudice.

While existing literature on the experiences of women in scientific careers addresses the issue of women's struggle for equality in the workplace, the real gap lies in focusing on the stories of minority voices – in this case, women from developing countries – and addressing how these women in STEM careers develop their career aspirations and expectations, how the essential components of career development influence their experiences within the pipeline, or how counsellors and institutions support their development (Gasser and Shaffer, 2014). Through an intersectional lens, the study explored the narratives of female ECRs from thirteen developing countries who have made a name for themselves in the international scientific community despite their intersectional disadvantages. The research findings were thus divided into three chapters, each serving as a response to one of the above research questions.

### **7.1.1 Crafting an avatar of self: The call to do science**

The first findings chapter sought to unpack the dynamic interplay of the various antecedents of career choice and career decision-making. Participants' narratives demonstrated the

construction of a career identity that originated from their joint experiences as student scientists and early career professional scientists. This is presented through three key themes: (1) Getting in (subthemes: introjecting guides and incorporating models; chance events; science for affirmative action; show of grit and grace under pressure); (2) Getting on (subthemes: brilliant student *en route* to a gleaming scientific career; laissez-faire careerists; the dreamers and (un)likely pioneers; the charismatic, uncompromising fighters), and finally (3) the labelling and identification of scientific careers (subthemes: relational career identity; fluke career identity; altruistic career identity). First, participants underwent a career decision-making process (Holland, 1997; Lent and Brown, 2020) where they made the choice to pursue science and more specifically a career as a research scientist.

Career decision-making has been identified as one of the most challenging and often stressful decisions people have to make in their lifetime, often having the potential to lead to career inaction (Argyropoulou, Sidiropoulou-Dimakakou, and Besevegis, 2007). As such, in making such all-important decisions, participants recounted the influence of guides and various motivating factors that informed their decision to embark on the scientific research career journey. For those who entered into science through ‘guidance’, four temporal themes were uncovered. These were emboldening (entry into science and eventually into scientific research careers as a result of the encouragement and motivation of parents, guardians, and mentors); *faits accompli* (these are individuals who had their careers decided for them, mostly by parents, and were told quite simply to do their parents’ bidding); collateral damage (these individuals were from ‘scientific homes’ and entered into science because science was inherent in their family ‘bloodline’); and idolization (entry into science was influenced by people other than their parents, whose lives and activities inspired their decisions to do science).

Although the above finding supports prior research on the role of family in the career decision-making process (Agger, Meece and Byun, 2018; Akosah-Twumasi et al., 2018), the four sub-



themes proved a rather interesting find, as while entry into science was a result of guidance and familial influence, there was not one universal blueprint to which participants could subscribe. Guidance and influence, although present, were manifested through positive, somewhat negative, or a combination of both approaches. Yet these findings reveal context at play in the career decision-making process among female ECRs from developing countries. For those who got into science by chance, their narratives revealed that although they were already into science, their mobility into their present careers involved an element of randomness, luck, or chance. It was found that chance phenomena could be easily identified not only at the individual level, but also in the broad social and cultural structure, as well as at the institutional level.

Nonetheless, it became apparent that participants capitalized on these otherwise unplanned events that emerged in their lives and utilized these chances with a positive attitude and a set of creative skills: what Krumboltz (1979) calls “planned happenstance”. The key tenet of this concept is that individuals have to capitalize on the unplanned events that occur in their lives. Planned happenstance is thus the human intentional action to use these life events in an optimal manner (Krumboltz, 1979). Another interesting finding was the decision to enter into science for affirmative reasons. Indeed, the participants in this category used their strength of character to break the cycle of stereotypical bias towards science and scientific careers that existed within their small spaces. In the first instance, participants were resilient and displayed courage to enter into science. This further emphasizes the complex interplay between the personal aspirations of individuals in their career choices and decision-making and the external influences which act upon them to shape career outcomes (Akosah-Twumasi et al., 2018). Thus, the identification of these external factors, which affect the career decision-making process of female ECRs, lends credence to the current study on career decision-making by showing how, in such developing world contexts, people pay significant attention to both internal and external loci of control when it comes to making career decisions. As Blustein

(2011) and Richardson (2012) firmly echo, career development is understood as occurring within a network of relationships, with the emergence of vocational interests, choices, decisions, and opportunities to access and advance in the workplace deeply entrenched in culture and relationships.

Second, participants' experiences as student scientists and later as professional research scientists continued to evolve around their family and collegial support, emphasising the important role of networking in career development (Ayyala et al., 2019). Participants recounted moments where they had benefited from a collegial support system that eased their transition from student scientists to professional scientists. Although it was unclear what exactly this type of support entailed, participants acknowledged that the support they received made their work much easier and at times validated their efforts as new entrants into the profession. Likewise, participants also identified teamwork – that is, being able to mutually give and receive assistance – as invaluable. This further demonstrates that having a supportive partner, family, or group of co-workers is insufficient on its own. The interplay between the various organisational and familial support networks has the greatest impact on the career advancement of female ECRs. This illustrates that for greater career success, individuals require support from a variety of life spheres.

Third, findings support prior studies on career construction and the development of the self (Savickas, 2003; Maree, 2019; Zhu et al., 2019). Specifically, participants showed an enhanced sense of self-identity through the identification of key life themes that enabled them to find meaning and a sense of purpose in their career choices (Maree, 2019). Savickas (2011) maintains that whatever happens during the early years of a person's life strongly influences their career life-story. From a very early age, children begin to fulfil a wide variety of roles and take part in a broad array of behaviours and dialogues that gradually enable them to pursue meaning and purpose in their lives. Doing so promotes their self-understanding and clarifies

their sense of identity. Thus, by giving a historical account of their early years, participants were able to collectively constitute their career life-stories to ultimately make sense of their careers.

In this section, the salience of identity is explored in relation to how participants perceived their identity positions from their experiences as ECRs from developing countries. Three distinct, yet interrelated trajectories emerged to label how female ECRs from developing countries identify their careers: A. Relational career identity (dependent on the support and opinions of others, especially family, mentors, and role models); B. Altruistic career identity (contingent on self-resilience); and C. Fluke career identity (based on fate, luck, chance). Taken as a whole, this aggregate dimension has helped to form a more concrete understanding of the career experiences of female ECRs from developing countries pertaining to how their career identities are formed. Thereby, this answers the first research question: ‘How do gender, situatedness, and positionality shape career identity perception in the early career discourse of women scientists from developing countries?’

### **7.1.2 Exploring the privileges and penalties of intersectionality**

The second research question was concerned with ‘what’ enables and impedes the careers of female ECRs and ‘how’ their positionality, situatedness, and gender intersect to impact how these enablers and impediments play out. This chapter addressed social inequities for female ECRs and explored the unique barriers this group faces at the intersection of gender, positionality and situatedness. Participants highlighted several unique barriers and success factors in the areas of mentoring, opportunities, research, and academia. The need for mentorship conflicts with the lack of representation of women in STEM. Most participants argued that not seeing someone who looked like them or had similar experiences impacted their career trajectory. One of the most noted success factors for the participants in this study was

their passion for scientific research and the desire to give back to their community by way of mentoring young women or joining hands with various bodies to advocate for a change in the status quo. While they may not see themselves fully represented in the field, that is partly what motivates them to persevere and continue their education in STEM in the hope to diversify a field that is severely lacking in diverse perspectives (Guy and Boards, 2019). Findings thus support prior studies on the experiences of women in STEM careers, reflecting on both the unique barriers and success factors (Banerjee et al., 2018; Guy and Boards, 2019; Elliott, Mavriplis, and Anis, 2020).

The findings reported in this paper illustrate a range of inputs towards enhancing gender-equitable scientific career development. Institutional reforms and policy interventions are required to enable female ECRs to achieve sustainable transformation of the structural and systemic barriers to career advancement (Okeke et al., 2017). Participants in the current study emphasised that, in the absence of such changes, clear gendered policies and practices would be necessary to establish an inclusive environment (Assié-Lumumba, 2006). In the global North, it has been widely urged (Ackers, 2004; Bates et al., 2016; Mavriplis et al., 2010) that workplace policies be revised to incorporate family-friendly measures to suit women's dual productive and reproductive roles. This proposal may also be applicable to the global south. Ackers (2004) suggested, for instance, that institutions should heavily publicise and promote family-friendly policies, such as the availability of childcare facilities at scientific conferences and workshops, to persuade other universities and research institutes to review and improve their current policies. It has been acknowledged that promoting institutional collaborative science research efforts in developing nations is one of the most essential and frequently mutually beneficial approaches for exporting best practices abroad (Okeke et al., 2017). Female ECRs, who are frequently unable to stay away from their families for extended periods, are

deemed open to flexible collaborative programmes that provide international training or research on a short-term basis (Okeke et al., 2017).

The study findings thus echoed many experiences widely reported in the literature and presented a glimpse into the realities of what many female ECRs experience while pursuing careers as scientific researchers in developing world contexts. Although the narratives of the 35 female ECRs from thirteen different countries may not reflect the experiences of other female ECRs from similar backgrounds, voicing their experiences with structural inequalities, unconscious bias and career enablers spoke volumes about the character strengths, grit, and resilience they leveraged to enable them to succeed. The study findings are thus consistent with previous studies in sharing the voices of STEM women, and further impact our understanding of the experiences of females from developing countries in careers where they are highly underrepresented (Wright-Golightly, 2021). Experiences shared by participants in this study were nonetheless unsurprising, as they only reinforced what the extant literature says (Guy and Boards, 2019; Leaper and Starr, 2019; Ferguson and Martin-Dunlop, 2021; O'Connell and McKinnon, 2021) and underscored the need for ongoing conversation on how marginalized groups experience work.

In light of the above, it became apparent that distinctive enablers and barriers were present at the individual, organisational and institutional levels. At the individual level, the narratives of respondents revealed that, at the beginning of their careers, their intersecting identities as women, ECRs, and nationals of developing countries were, in various ways, both a privilege and a disadvantage. At the organisational level, female ECRs described themselves as fortunate to be among the few women making progress in their fields. However, many felt as though they were being punished for having this privilege due to the numerous obstacles they confronted daily within their organisations. At the institutional level, participants recognized the effort that many developing countries are putting in place to support the 'Women in STEM'

agenda. However, they also explained that policies were mostly focused on how to recruit girls into science, with little attention paid to how to nurture and develop their capacities once they were in science.

Indeed, it has been found that women in male-dominated careers must carry the burden of identities that render them both visible and invisible, thus creating paradoxical tensions to feel that they belong to, yet are distinct from others (McCluney and Rabelo, 2019). The privileges and penalties as manifested in the accounts of the study's participants have thus been useful in uncovering the identity paradox with which female ECRs must contend. Embracing a new identity as a research scientist often came with conflicting identities. While trudging forward toward the verge of perfection, participants reported feeling 'stuck' at some points, especially when they felt pressured to conform. Their sense of self failed to keep up with their new role as professional scientists. Consequently, in structuring the female ECR role identity, the individual must find the middle ground between their self-identity as prodigies and their social identity as mavericks and nonconformists.

Overall, the study has been able to answer the second research question – 'What practices enable/impede careers of female ECRs from developing countries?' – by demonstrating the unique barriers and impediments that manifest to influence the career trajectories of female ECRs from developing countries by taking cognisance of the intersecting identities which enable certain privileges while also inhibiting some aspects of their career development. Importantly, this section has given insight on how institutional power dynamics interact with social structures and individual agency to confer distinct privileges and penalties on individuals.

### **7.1.3 Strategies to self-manage careers**

Through the identification of a wide range of career self-management (CSM) behaviours, categorised under the broad themes of passing and revealing strategies, the third section of the study findings focused on examining in depth the strategies and coping mechanisms for self-managing a scientific research career as a female ECR from a developing nation. Although participants faced cultural and institutional impediments in their career advancement, they exerted individual control over their career growth and career transitions, which determined how they responded to both anticipated and unanticipated career events, challenges, and transitions (Wang and Wanberg, 2017). It became apparent that their intersecting identities of gender, positionality, and situatedness enabled unusual methods at every stage of the early career process. While participants described an engagement of passing strategies such as impression management and career distancing at the very outset of their careers, these appeared to have changed with time, with participants engaging in more revealing strategies such as building social capital and showing high levels of voicing at the latter stages of their early career lives.

Additionally, it was observed that the pattern of CSM behaviour in which a participant engaged was in some way related to the level of career satisfaction they were experiencing at the time. Those who were dissatisfied with their careers were more likely to engage in tactics such as drawing up exit plans, whereas those who appeared to be highly content with their careers engaged in strategies such as coping with career shocks and being highly adaptable. To manage their careers, participants utilised one or more strategies, some revealing and others passing. The self-narratives provided by the participants in the study revealed that arriving at a somewhat settled understanding of their career contexts triggers a process whereby individuals attempt to locate their agency with respect to the characteristics of their contexts. This process entails micro attempts to figure out the territories and boundaries of their agency with respect

to changing their contexts or coping with the harsh realities of their careers. Although these processes may at times look like random attempts in diverging directions, they gradually converge into a set of CSM strategies. The study findings revealed that the embodied experiences of precarity (e.g., unconscious bias and unfriendly work policies) disrupt any preconceived notion of a career in scientific research (steady, rewarding, universalistic) that participants previously held, and instead trigger the process of formulating a CSM strategy in those individuals.

First, individuals wake up to the harsh realities of their context and engage in a sensemaking process aimed at understanding their precarious work context. This entails comparative elaboration where they continuously compare different aspects of their work context with other jobs, particularly those that are outside the domains of academia. When they have arrived at a somewhat settled understanding of the different dimensions pertaining to their career contexts, they then begin to engage in agentic experimentation, aimed at figuring out their boundaries in dealing with their careers. Through these agentic experiential learning processes (Politis, 2005), individuals gradually adjust to situations by finding measures that enable them to cope with their career contexts, thus forming CSM strategies. According to the sensemaking perspective, individuals draw on their prior experiences, beliefs, and contexts to interpret and construct the meaning of a new phenomenon (Weick, Sutcliffe, and Obstfeld, 2005, Maclean, Harvey and Chia, 2012). This study has examined how participants' explanations of CSM strategies were reflected in their prior views about being a female scientific researcher in a developing country.

Interestingly, some findings from this section revealed that some participants – albeit only a select few – were quite happy to 'conform' to unfavourable pre-existing conditions. They narrated doing science 'for the love of it' and described getting on with the job by working hard and going with the rules. Findings show that these participants were motivated to retain a



positive self-image when confronted with a novel or disruptive proposition. As extant literature suggests that people are more likely to recall only those aspects of their own beliefs and practices that are consistent with a new reform idea and are less likely to initially engage with ideas that threaten their sense of self (Gregoire, 2003; Spillane et al., 2002), these participants, by engaging in the ‘hard work’ rhetoric and keeping a ‘stiff upper lip’ to safeguard their careers, provide findings that are consistent with prior research on sensemaking, which posits that people are unlikely to reconsider their own mindset unless they feel that their professional identity is at stake (Gregoire, 2003; Maitlis and Christianson, 2014). Consequently, the study has been able to answer the third research question – ‘*What strategies are drawn on by female ECRs from developing countries in self-managing their careers?*’ – by illustrating how female ECRs engage in a process of self-managing their careers at various stages of their early careers. The study has shown that while they take on passing strategies at the initial stages, they are more likely to engage in more revealing strategies as they progress and become accustomed to their work environments.

## **7.2 Study contributions**

The research generally answers the call for more research to understand how women’s intersecting social locations influence work, particularly among women belonging to multiple marginalized groups (Flores et al., 2021). The study thus makes a significant contribution to knowledge through the use of career construction theory and intersectionality scholarship to shed light on the experiences of those whose perspectives have been largely overlooked in existing management and organisational research (Chrispal, Bapuji, and Zietsma, 2020). The study demonstrates the intersectional identities of participants and how these coalesce to ground and empower female ECRs from developing countries. By making sense of these multiple identities, the female ECRs achieved positive subjective career outcomes despite the

daunting biases and inequalities that persisted. The study further attempts to reveal how these intersecting identities influence the formation of career identities, account for the peculiar enablers and impediments to career development and influence the self-management strategies used in coping with their careers as ECRs.

Again, the study makes significant contributions by moving from a single-axis analysis to focus on other forms of disadvantage that may not be apparent, such as being an early careerist from a developing country. Indeed, intersectionality as a meta-theoretical lens has enabled the analysis of the intersectional privilege and disadvantage of this demographic group, which has some of the lowest representation numerically in the area of scientific research careers. Thus, by focusing on developing countries as the empirical research context, the study is one of the first to investigate how successful women in such circumstances make sense of their careers, and what this implies for the 'Women in STEM' development agenda. Finally, the study makes significant contributions to our understanding of how ECRs employ various strategies at different times to self-manage their careers.

If, as has been established in the literature, one of the primary functions of human resources is to attract, develop, and retain top talent, then the requirements, desires, and goals of each employee must be completely recognised and taken into account. To achieve this, it is necessary to respond to the call for a critical focus on the subjective work experiences of individuals in order to establish a meaningful knowledge of career. The current research contributes to this purpose.

### **7.3 Contribution to knowledge and theory**

By drawing on the overall framework related to career construction, theorising about the intersectional processes associated with the making and development of careers of female

ECRs from the developing world, and existing research on career identity, decision-making, and self-management, the study generates four theoretical contributions to the literature on career studies, career construction theory, and intersectionality.

### ***Career construction and the development of the self***

First, the study extends knowledge on career construction theory (Savickas, 2013) by contributing to a process-based understanding of how female ECRs construct their careers. While existing research provides insight into career choice and decision-making (Holland, 1997), career adaptability (Savickas, 1997), CSM (Lent and Brown, 2013), and subjective career success (Arthur, Khapova, and Wilderom, 2005), among others, the current study incorporates these constructs as part of the overall process of career narrative construction (Modestino, Sugiyama and Ladge, 2019).

By so doing, the study further extends the literature on identity construction by emphasising how career construction enables the development of the self-concept through career identity formation (Erikson, 1980; Maree, 2021). It offers a possibility to explain how crucial the concept of a career is for the continual development and retention of a coherent self-concept that is adaptable (Savickas, 2013) in accordance with people's evolving strengths and weaknesses, changing perspectives and attitudes, and desired outcomes. From the identity construction literature, the study incorporates mechanisms of adaptability to make sense of how the career identities of female ECRs emerge and develop over time. Thus, it is plausible to envision the careers of female ECRs as a conduit for ongoing self-realization (Adamson, 1997): a process of developing one's self-image around a specific career within a social system through the inclusion of one's identity work (Riley and Burke, 1995).

The study therefore considers the internalisation of the motivational elements to pursue scientific research careers as necessary antecedents for adopting a distinct identity role towards

career, as these motivators present the raw materials for continuous identity work (Decelles and Aquino, 2017). Like other identities, the ECR identity can have psychological implications, as it can both elevate and undermine one's overall self-concept (Ford et al., 2020). Positive or negative utility derived from this identity can provide individuals with a source of personal meaning that will elevate their self-concept or cause retrogression of the same self-concept. By taking an intersectional approach, the study has been able to integrate these areas of research to present a more nuanced understanding of the career narratives of female ECRs from the developing world.

### ***Intersectionality in career studies***

The study contributes generally to the literature on intersectionality and more specifically to intersectional research on career development and vocational behaviour of socially underrepresented groups. By responding to calls to move beyond the favoured triumvirate of gender, race, class (Rodriguez, 2016) to explore other ways in which other social identities intersect with gender and race/ethnicity to shape career experiences, the study has highlighted the importance of occupational status (positionality) and situatedness on the experiences of women in non-traditional careers. Issues regarding the status of women in non-traditional careers have typically spurred serious conversations, and intersectionality (Crenshaw, 1991b) offers a logical framework for interpreting the experiences of female ECRs from developing countries. Its application in this study has enabled the presentation of participants' narratives without losing the complexity of their unique experiences and perspectives.

Utilizing the intersectional identity lenses of gender, positionality, and situatedness allowed for the identification of the dynamics intrinsic to the scientific career field that impacted the participants' sense of belonging (Morton, 2021). Overall, the study contributes to the literature

on intersectionality by offering information on the formation, development, and self-management of careers amongst early-career female researchers from developing nations. Intersectionality as a lens facilitated the evaluation of narratives from positions of both advantage and disadvantage, bringing insight on how the different identities of participants might be beneficial or detrimental.

Notwithstanding the fact that the focus of this study is on ECRs from developing countries, many of the issues raised, faced by these ECRs, are shared by a large number of female ECRs and academics, regardless of location. The intersectionality of the research lends weight and understanding to a conversation that has been prevalent in academic circles for decades. Ultimately, however, the relevance of this paper's addition to our understanding of ECRs is rooted in the tapestries and experiences of aspiring female scientists from underdeveloped nations who are able to succeed despite the hurdles they face.

### ***Intersectionality and the (in)visibility paradox***

The present study explores the paradoxical implications of intersectional (in)visibility for female early-career researchers (ECRs) from developing countries. While existing literature on intersectionality tends to focus on the negative challenges faced by women (e.g., Tariq and Syed, 2018; McCluney and Rabelo, 2019; Morgan, 2020), this study extends knowledge on intersectional (in)visibility (Purdie-Vaughns and Eibach, 2008) by emphasizing both the benefits and drawbacks of being (in)visible as an intersectional group. It further supports the notion that intersectional invisibility is neither positive nor negative, but rather creates a paradoxical effect (Smith et al., 2019).

Specifically, the study illuminates how the identity of an ECR, a woman, and a scientist can be viewed as a significant triumph by certain stakeholders, such as governments and advocates

for women in STEM. This perception allows individuals to distance themselves from the stereotyped identity group they belong to (Rosette et al., 2016). However, female ECRs still confront societal and institutional biases that impede their career advancement. Consequently, they are not entirely free from the stigma attached to being a woman, particularly when compounded by the identity of an ECR from a developing country. This novel perspective of intersectional (in)visibility creates advantages and disadvantages for this group.

The study uncovers the range of self-management approaches female ECRs employ in dealing with intersectional (in)visibility. Participants in the study presented passing and revealing strategies, such as planning exit alternatives and impression management, as well as individual agentic attributes, including resilience. The findings suggest that these coping mechanisms do not negate institutional constraints but provide female ECRs with the means to maximize their success without waiting for systemic change (Bernstein, 2011). In sum, this study offers a theoretical foundation for comprehending the intersectional experiences of female ECRs and emphasizes the importance of adopting a nuanced approach to intersectionality that acknowledges both the advantages and disadvantages of (in)visibility.

### ***Use of model on career construction of female ECRs***

Using career construction theory (Savickas, 2013) and intersectionality scholarship, a new theoretical framework for understanding career construction amongst female early career research scientists has been provided. By incorporating the intersectional lens into the framework, the model highlights the interactions between multiple identities and social structures that shape meaning that female ECRs give to their careers through identity formation, career development barriers and enablers as well as the self-management behaviours to manage their careers. This integration provides a more comprehensive theoretical foundation

for understanding the unique challenges and opportunities that individuals from diverse backgrounds encounter in their career journeys. The new theoretical framework also has implications for practice, as it provides guidance for career counsellors, educators, and policymakers on how to better support individuals from diverse backgrounds in navigating their career pathways. Specifically, the model emphasizes the importance of taking a holistic and context-specific approach to career development that considers the intersecting identities, cultural values, and socio-economic factors that influence career decisions and outcomes. Thus, building on the work of Savickas (2013), the model brings clarity by first realizing that one's present vocational situation evolved from past experiences and then connecting these experiences through the present intersectional situations to a preferred future.

#### **7.4 Implications for policy and practice**

Corley and Gioia (2011) argue that making a theoretical contribution necessitates both scientific and practical relevance. This study's theoretical contributions thus have ramifications for policy and practice on multiple levels.

##### ***Making a case for diversity and inclusion in organisations***

First, for any organisation or industry to remain competitive in our increasingly diverse, global world, it must recruit, retain, and enable the development of employees from underrepresented groups such as females into occupations that have historically been male territory. The theoretical understanding of the development of the self-concept pertaining to the formation of the female ECR's identity in the workplace can be useful for managers, and organisations seeking to promote diversity and inclusion within their jurisdictions. The study indicates that an inclusive workplace can help mitigate the identity paradox that arises among female ECRs and other minority groups while also fostering work satisfaction. Stevens, Plaut, and Sanchez-Burks (2008) propose the idea of an all-inclusive multiculturalism which challenges

organizational institutions to cultivate inclusivity among their employees rather than taking a colourblind approach (e.g., ignoring race and racism). By applying the same logic to this situation, the study suggests that organisations in developing world contexts recognise that, in addition to the highly visible attribute of gender, an otherwise invisible and ignored characteristic such as being a ‘newbie’ can promote segregation and dissent in the workplace if measures are not taken to strategically orient and absorb these talented, yet frequently bemused newcomers, transitioning from students into professionals, into the organisation.

Establishing an inclusive working environment can reduce experiences of discrimination among members of underrepresented groups, hence reducing the need for identity modifications in the workplace. In addition to these opportunities, resources must be provided to address the psychosocial and emotional needs of ECRs and young girls in STEM (Alexander and Hermann, 2016). As some participants in the current study reported experiencing negative social climates in their departments (Rincón and George-Jackson, 2016), both as students then, and as professionals now, organisations and institutions should aim to mitigate these experiences by making efforts to promote inclusive learning environments and creating student support groups at all levels throughout the educational pipeline.

### ***Shifting from push to pull factors***

The responsibility of addressing the dynamics that disadvantage female professionals in general, and ECRs in particular, should move from being anchored on those who have been marginalized to the very institutions that have the power and privilege to change the status quo in the field. While the resolution of governments and institutions to promote the pursuit of more female representation in STEM careers is highly commendable, the narrative is in dire need of a change from an overemphasis on push factors to include pull factors. Throughout the



interviewing process, participants stressed the need for governments and policy-makers to actually focus on providing reasonable work conditions for women in STEM, rather than merely putting in measures to attract more females. For instance, participants from Ghana, West Africa, narrated how the government aims to attract more females into STEM through the reduction of cut-off aggregate scores needed to enter into STEM courses in public universities for girls. While such initiatives are laudable, the real problem, it appears, is not only limited to ‘What can we do to push more females into STEM?’ but also encompasses the question ‘What can we do for those females already in STEM to make their careers attractive enough to attract more female talent?’

In light of this, the first approach should be the inclusion of approaches that are needed not only to ‘push’ more females into STEM, but to equally create ‘pull’ factors such as career development support programmes and resources aimed at increased retention of women, conducive environments, and the review of female-centric policies such as maternity leave policies accommodating the peculiar needs of women.

### ***Career counselling in developing countries***

Counselling was one thing that was entirely absent from participants’ narratives about their scientific career lives. It time for educational institutions to incorporate counselling resources into their mainstream activities and subsequently to take it upon themselves to encourage students who are having difficulty navigating the social aspects of their educational environments or having problems making the right career decisions to utilise these services. Developing nations can incorporate career guidance and counselling into their education systems by making the necessary structural and systemic modifications, and where funding and

resources are scarce, teachers can be professionally trained to assume additional responsibilities in career guidance and counselling

Insights into the subjective views of what is normal or expected within a specific career context can help shape vocational training and counselling to prepare people before they enter a profession by supporting study choices and career entry decisions, as well as supporting their later transition and socialization into that profession. By acknowledging both predictability and unpredictability in careering when working with individuals to communicate their career self-concepts, career counsellors may better support young professionals especially by allowing some chaos and unpredictability to be part of their narrative and thus enabling individuals to be more flexibly minded.

### ***International mobility fund for female ECRs in STEM***

In practical terms, the study has the potential to shed light on how to create development programmes tailored to the specific needs of women under such contexts: that is, those who are talented but have unequal access to opportunities. Women's performance and accomplishments in STEM need to be publicly recognized to address misperceptions that women are less capable, skilled, or have less expertise, as awareness of other women's success has the potential to retain women in STEM who might instead pursue other fields of study (Bloodhart et al., 2020). International agencies and institutions that support the 'Women in STEM' agenda may emulate the steps taken by the OWSD and Elsevier to shine a light on the work of these phenomenal women, by coming together to create an academic mobility fund, and making it available to early career female researchers and specialists from developing countries. While the majority of participants pursued their PhDs abroad, upon returning to their home countries, they realised that they lacked the resources and equipment to do ground-

breaking research, despite possessing a number of novel ideas. Some were cut off from cutting-edge research due to limited access to publications and, in some cases, a lack of funding to attend foreign conferences. These targeted mobility funds could enable them, for instance, to fly like bees inside the western laboratory nest to periodically sip on some nectar that could benefit their career advancement.

### *A useful tool for all stakeholders*

The study began with an overview of antecedents to choosing a career as a research scientist within various socio-economic settings, and thus posited that understanding the origins of the concept of career formation is critical to understanding its manifestation across the societal, organisational, and individual levels of analysis. In order to appreciate the policies and processes designed to assist the career development of women, it is vital to pay close attention to the function of deeply ingrained traditions and value systems. For instance, the study revealed a number of distinctive characteristics among the participants. For example, the idea of role-based honour in Sub-Saharan Africa suggests that a woman's value is still largely determined by her place in the family and less by her success in the workplace. Because of this, not conforming to cultural expectations of the role of the woman was still viewed negatively. Because Sub-Saharan Africans place high value on family ties and obligation, policies that acknowledge women's home duties and create a better work-life balance may be well received amongst employees.

In contrast, participants from Southern Asia, for instance, emphasized the impact of religion on their working lives. Even in professional settings, women, particularly those from Muslim origins, narrated experiences of situations where people still perceive close proximity to the opposite gender, even in professional settings, as some form of 'taint' to their reputation as respectable women. In such contexts, for example, policy should focus on boosting the number

of female mentors for individuals just beginning their careers, rather than focusing solely on work–life balance measures. In light of these illustrative discrepancies, the study provides a very exhaustive and socially conscious method for examining the experiences of women in science research careers across various geographic contexts. This may be particularly useful for global business actors, policy-makers, and organisations leading the charge in tackling difficulties associated with expanding religious and cultural diversity, as well as those striving to integrate immigrants into their respective systems. The ways in which female ECRs from developing countries experience work are unique. Consequently, interventions enacted by governments, institutions, organisations, and other relevant stakeholders must consciously consider intersections of positionality and situatedness alongside gender. Moreover, studies have shown that when crucial intersectionality indicators are accounted for in the design and implementation of intervention programmes, women are more likely to flourish professionally and feel a sense of belonging within the organization.

### **7.5 Research limitations and direction for future research**

While the study is not exempt from limitations, it nonetheless opens up important avenues for future research.

#### ***Issues of generalisability***

The narratives of 35 female ECRs from thirteen different countries may not reflect the experiences of other female ECRs with dissimilar backgrounds, experiences, and perspectives. Neither do these findings imply that the career formation, enablers and barriers to careers, and CSM strategies, as identified by the participants of this study, are indicative of the experiences of all female ECRs from developing countries. The sample size does not lead to a saturation of

data that could be utilised to form a theory applicable to all female ECRs from the developing world.

The study thus opens up important new avenues of research. First, future researchers should conduct additional studies to determine whether the experiences of female ECRs from developing countries as seen in this study's participants are applicable to female ECRs in other fields of study, such as social sciences, humanities, and the like. Again, results from the interviews conducted are limited to one point in time. Future research may seek to engage in longitudinal studies to fully illuminate the career formation, development, and management of female ECRs as they progress from early career positions through their mid and senior careers.

### ***Multiple group study***

Another interesting question pertains to the use of male ECRs as a control group. What would be the experiences of male ECRs from developing countries regarding their career formation, career development and CSM strategies and how does this differ from or augment the narratives of female ECRs? Based on extant literature and this study's own findings, it can be speculated that strict adherence to the 'masculine' modus operandi at various organisations affects the way in which males and females distinctively perceive and experience work. Hence, it is possible that the use of such organisational policies may have negative influences on the long-term career outcomes of female ECRs. A study into the actual policies used by these organisations and its subsequent consequences for male and female employees over time could provide insight into this matter. Furthermore, the study has demonstrated that there may be significant differences in the needs of female ECRs in STEM fields as compared to senior female researchers. Examining the distinctive experiences of these two groups may prove to

be an interesting sphere of research. The kaleidoscope career model may be particularly useful to undertake such a study. This model argues that over a career span, career choices are bound by the three parameters of authenticity, balance, and challenge (Sullivan and Mainiero, 2007). Individuals may seek one parameter more than another at different times during their career, while the influence of other parameters lessens in intensity (Sullivan and Mainiero, 2008). When a woman has children, for example, her quest may be more for balance rather than authenticity or challenge as she engages with the parental role. Therefore, it would be interesting to examine the complexity of women's careers at each stage of the career ladder.

### ***Intersectionality and (in)visibility***

The new way of seeing intersectionality as both advantageous and disadvantageous has allowed scholars to explore both aspects of the intersectionality coin and how they affect career outcomes. Although the focus of this study is on female ECRs from the developing world, future studies should focus on others (e.g., male ECRs) to examine how their intersectional attributes position them in places of advantage or otherwise. Further, while the study focuses on careers in scientific research, future studies could focus on female CEOs or executives who also struggle to make themselves visible in their peculiar niches.

### ***Network utilization***

The study has ramifications for research on how employees utilize their networks. The study's theoretical understanding has revealed that the ineffective utilisation of research may be one of the reasons why females in STEM careers in developing world contexts may experience a relatively slower rate of career development. However, the study does not address the processes through which these networks are effectively utilised. Neither does it address how the effective

utilisation of networks actually supports career development. Future research should therefore focus on addressing these concerns and further compare the relative efficacy of network utilisation for the career development of minority versus majority members in the organisation.

### ***Work–life policies***

Another interesting question pertains to the way in which individuals experience different work–life policies. What is the cumulative effect of enacting many policies, especially when some are permissive and others are restrictive? Future research should focus on determining how the work–life policies provided in such workplace settings (STEM occupations) influence the experience of women at work.

Despite their benefits, several research participants said that they did not exploit all offered work-life policies. They asserted that they did not implement these policies out of concern for their career and reputation. Thus, these unfavourable outcomes following the implementation of work–life policies and the subsequent positive or negative impact of implementing various work–life policies open up new research possibilities for the future.

### ***Employee voice***

In conducting future research, an important issue to consider will be to facilitate the development of the fields of management, Diversity, Equality and Inclusion (DEI), and vocational behaviour. One area of inquiry could concentrate on the voice of workers in scientific research careers, particularly those from socially disadvantaged communities. Existing literature suggests that employees are more likely to speak up when they feel psychologically safe and perceive opportunities for career advancement in their organisations

(Wang et al., 2019). In the current study, some participants mentioned focusing on their jobs, playing by the rules, and keeping quiet in order to safeguard their jobs. Identifying in much detail why and under what circumstances females may or may not speak up may reveal further prejudices that females in male-dominated careers must suffer in order to keep their careers alive. Future research may thus investigate the levels of voicing in male-dominated organisations within the peculiar contexts under study, with an emphasis on how perceived levels of voicing affect perceived psychological safety among female ECRs.

### ***Longitudinal studies of female ECRs***

The study included participants who are well known in the international scientific research academic field, and who by default may be at an advantaged position to experience certain privileges that are instrumental to their career development, in comparison with those ECRs who have not achieved the same feat. Future research might adopt more equal and diverse perspectives to analyse more profoundly the experiences of female ECRs regardless of their achievements or other categories of difference. Furthermore, since the experiences of people cannot be characterised as a fixed process, longitudinal studies of the experiences of female ECRs would provide important insight into how they transition from their positions as ECRs into mid-level and senior positions, and more so on how they transition into other careers should they choose to leave their present careers. Future research may thus explore how they experience these transitions, including the challenges and catalysts.

### ***Mixed-method approaches***



While this research, by taking a qualitative approach, has opened doors for a greater understanding of the subjective meanings that people attach to their careers, a combination of quantitative and qualitative approaches will be needed to conduct the most rigorous research and test some of the possible relationships that have been identified in this study. Findings from the study showed that participants, when they employed passing appeared more dissatisfied with their work, as opposed to when they engaged in more revealing strategies. Thus, such findings may infer that females may tend to use discrete strategies when they are less satisfied with work, and more revealing strategies when they are more satisfied or seek more satisfaction. In another observation, participants for whom the ‘fluke’ career identity was their dominant identity tended to be more satisfied with their careers. Future studies may consequently consider a mixed-methods approach to test the correlations among these variables.

## **7.6 Conclusion**

The aim of the current study was not to determine whether women face greater challenges than men in scientific research careers – this has already been well established in the literature. On the contrary, the goal has been the exploration of the nuances regarding the experience of work and the construction of career during the early career period – a challenging and often complex career stage where women transition from PhD students and sometimes postdocs to ‘full-fledged research scientists’ and thus attempt to secure their place in the scientific research community, amidst their intersecting multiple identities, which can sometimes be advantageous but are usually disadvantageous. This research has brought into sharp focus the construction of

career, as narrated by 35 recipients of the prestigious OWSD-Elsevier award for female ECRs from thirteen developing countries. Using career construction theory and intersectionality as lenses to investigate the experiences of these female ECRs enabled an understanding of the ways through which positionality and situatedness as markers of disadvantage intersect with gender to influence participants' career trajectory.

Findings from the study revealed three key themes through (a) the formation and identification of careers; (b) career enablers and barriers; and (c) CSM strategies, to advance knowledge on how participants experience career under contexts of underdevelopment, weak institutions, cultural limitations, and workplace biases. As members of multiple marginalised social identity groups, female ECRs face precarity at the intersection of gender (as females) and positionality (as early careerists) due to their inexperience in the workplace, needing guidance, mentorship and resources in order to 'fit in'. Again, they face limited social capital at the intersection of gender and situatedness (developing country context), which limits their access to, and utilization of, networks for their career development; limits their access to funding for conducting cutting-edge research; and often leads to a scarcity mindset – that their contemporaries in developed countries are seemingly better researchers than they are due to access to funds. In spite of these limitations, their positionality and situatedness enable chance factors to influence their careers, as they tend to benefit from random programmes, awards and recognitions that are instituted specifically to support and increase their participation and visibility in the scientific research community.

The study concludes that the way up may be taxing and stressful for female ECRs in STEM. However, female ECRs' career trajectory has been made possible through agentic experimentation and the support of mentors, partners, and family members. These experiences provide insights into the disposition of women in scientific research careers within the context of STEM in developing countries. The study further showed that female ECRs face enormous

challenges, ranging from discrimination to family demands, insubordination, underestimated ability, lack of cooperation, and culturally specific issues. These women's values and strategies often manifest in a desire to grow, hard work, self-actualization, sharing responsibilities, staying focused, driving state-of-the-art research, upholding integrity, and maintaining financial accountability. The study supports the notion that career performs a fundamental function in the continuous construction and maintenance of a healthy self-concept, congruent with individuals' changing strengths and weaknesses, shifting beliefs and attitudes, and future aspirations. Many important research advancements have contributed critical knowledge about women's experiences in the world of work. Today, women have a strong presence in the labour force, and their influence will only continue to grow as we spotlight and break down those organizational and societal structures that have limited their work participation, advancement, and fair treatment. The study thus concludes by offering suggestions for future scholarship that may guide work on STEM career women in the workplace in the next decade and beyond, and addressing recommendations for policy aimed at increasing women's participation and development in scientific research careers.

Overall, the study data suggest that there are still systemic issues, which one single policy initiative will be unable to solve. This strongly suggests that the issue of inequality and bias in STEM is not just a matter of numerical representation. There are cultural issues as well. This clearly underscores the importance of making structural and cultural changes to the way in which STEM operates, in addition to thinking about representation. The ways in which female early career research scientists from developing countries experience work are unique. Hence, interventions brought forth by governments, institutions, organisations, and all relevant stakeholders must intentionally account for the intersections of positionality and situatedness in addition to gender. Indeed, research has shown that when salient intersectionality markers

are accounted for in the creation and implementation of intervention programmes, women are more likely to thrive professionally and feel that they are part of the organisation.

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## Appendices

### Appendix A – BREO Ethics approval letter

3 June 2021

#### LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 03/06/2021 AND 28/02/2022

Applicant (s): Miss Mabel Kyeiwaa Torbor

Project Title: The Making of Scientific Legends: Career Narratives of Award Winning Early-Career Women Scientists in the Developing World

Reference: 30200-LR-Jun/2021- 32780-2

Dear Miss Mabel Kyeiwaa Torbor

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- On the Participant Information Sheet, for question "What if something goes wrong?" please also add that they should contact the Chair of the CBASS Ethics Committee, David Gallear, email [cbass-ethics@brunel.ac.uk](mailto:cbass-ethics@brunel.ac.uk), if they wish to complain.
- Approval is given for remote (online/telephone) research activity only. Face-to-face activity and/or travel will require approval by way of an amendment.
- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.
- In addition to the above, please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.

#### Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Professor David Gallear

Chair of the College of Business, Arts and Social Sciences Research Ethics Committee

Brunel University London

## Appendix B – Participant information form



### PARTICIPANT INFORMATION SHEET

#### **Study title:**

Career Narratives of Award Winning Early-Career Women Scientists from The Developing World.

#### **Invitation Paragraph:**

Thank you for your time – you are being invited to participate in a research study. Prior to making a decision, it is crucial that you are fully made aware of the purpose of the study and what it entails. The below information sheds further light on this and you are welcome to talk about it with others if you would like. What's more, please do not hesitate to ask me if you have any questions about the study to make an informed decision.

#### **What is the purpose of the study?**

By examining career narratives as a gendered discourse, the study identifies a gap in the area of career identity and construction by exploring the career trajectories of female early-career scientists from developing countries. Using Intersectionality as a theoretical lens, the study investigates how the multiple identities of these female early career researchers (gender as females, positionality as early career researchers, and situatedness as developing country nationals) coalesce to inform career satisfaction and outcomes.

#### **Why have you been invited to participate?**

You have been chosen to participate as you have met the following criteria for inclusion to take part in the study:

- 1) You are a woman scientist
- 2) You are from a developing country
- 3) You have been recognized to have made significant progress in your chosen field

#### **Do I have to take part?**

As participation is entirely voluntary, it is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

#### **What will happen to me if I take part?**

After gaining consent from yourself, you will be invited to take part in a telephone or video semi-structured interview at a set date and time that is convenient for yourself and the researcher. The interview will last between 45 -60 minutes. You will firstly be briefed. This involves being told that your voice will be recorded, and made aware you will be given a pseudonym in the write up of the report. You will also be told about your right to withdraw at any stage of the interview if you are feeling

## Appendix C – Consent form



### PARTICIPANT CONSENT FORM

**Project Title: Career Narratives of Award Winning Early-Career Women Scientists from The Developing World**

Please note that The College of Business, Arts and Social Sciences Research Ethics Committee has reviewed the study and granted myself as the researcher permission to conduct it.

<i>Please complete the whole of this sheet</i>		<i>Please tick the appropriate box</i>	
		YES	NO
Have you read the Research Participant Information Sheet?		<input type="checkbox"/>	<input type="checkbox"/>
Have you had an opportunity to ask questions and discuss this study?		<input type="checkbox"/>	<input type="checkbox"/>
Have you received satisfactory answers to all your questions?		<input type="checkbox"/>	<input type="checkbox"/>
Who have you spoken to?			
Do you understand that you will not be referred to by name in any report concerning the study?		<input type="checkbox"/>	<input type="checkbox"/>
Do you understand that you are free to withdraw from the study:			
• at any time?		<input type="checkbox"/>	<input type="checkbox"/>
• without having to give a reason for withdrawing?		<input type="checkbox"/>	<input type="checkbox"/>
• (where relevant) without affecting your future care?			
I agree to my interview being recorded.		<input type="checkbox"/>	<input type="checkbox"/>
I agree to the use of non-attributable direct quotes when the study is written up or published.		<input type="checkbox"/>	<input type="checkbox"/>
Do you agree to take part in this study?		<input type="checkbox"/>	<input type="checkbox"/>
<b>Signature of Research Participant:</b>			
<b>Date:</b>			





## Appendix D – Debrief Form



### PARTICIPANT DEBRIEF FORM

#### **Research Project Title:**

The Making of Scientific Legends: Career Narratives of Award Winning Early-Career Women Scientists in the Developing World

#### **Purpose/Background to study:**

There is increasing consensus that career cannot be understood as separate from one's personal life experiences (Collin and Young 2000). Recent career studies seem to pay significant amount of attention to the influence of non-work factors such as family and personal circumstance, on an individual's experience of career (Duberley, Cohen and Mallon, 2006). This study identifies a gap in this area by looking at the career construction of women career scientists from developing countries, through narratives. Specifically, the study hopes to explore how these women construct and make sense of their careers as women scientists in contexts often characterised by patriarchy, underdevelopment, and weaker institutions. Role stereotypes and unconscious bias are still at work in present times. The idea of science as a male bastion is well documented and the reasons for women's under-representation are also well researched. In this context, the accounts of highly successful women are particularly interesting especially from the perspective of developing countries. The study heightens awareness of the challenges and successes of women breaking barriers in male dominated fields.

#### **Confidentiality:**

Personal information about participants will be kept confidential in the following ways:

- Participants asked not to repeat what was said within the interview publicly.
- The participant's interview that has been recorded will be stored on a computer that is password protected. These recordings will be destroyed on a later date upon completion of the interview transcriptions.
- Pseudonyms will be also given to participants and no actual names or other identifying information will be used in the written report.

#### **Contact:**

If you are interested in knowing more information about the study or have any queries about it – please do not hesitate to ask either myself or my authorised supervisor. Below are our contact details:

## **Appendix E – Sample invitation Email**

### **Sample letter of invitation to potential participants**

#### **first approach Letter**

Date

{Name}

{Address}

Dear {Name},

#### **DOCTORAL RESEARCH ON WOMEN IN SCIENTIFIC CAREERS.**

I am a doctoral researcher with the Brunel Business School, Brunel University London. I am, as part of my studies conducting a research on women in scientific careers from developing countries. As a recipient of the OWSD-Elsevier Foundation Award for Early Career Women Scientists in the Developing World, it will be remarkably fascinating to hear more about the secret to your success in your chosen field. I am therefore contacting you to invite you to partake in my study and would be greatly humbled and privileged to have you on board.

All recipients of the award are also being invited for this study. If you agree to take part, I will be in touch to schedule a day and time, at your convenience, to conduct an interview via telephone, or video tools such as skype or zoom. The interview will take approximately 30- 45 minutes to complete. I have attached to this letter, a copy of the participant debrief/information form for your perusal.

I am happy to answer any further question(s) regarding this study in much detail.

Thank you.

Yours sincerely,

Mabel Torbor.

**Appendix F – Sample Interview questions**

## **The Making of Scientific Legends: Career Narratives of Award Winning Early-Career Women Scientists in the Developing World**

### **Interview Guide**

1. Formation of an ambition to pursue academic career
2. Family attitudes towards career goals
3. School and university experiences
4. Trajectory of career development
5. Relationship with other colleagues (males and females)
6. Mentorship
7. Work-life balance
8. Obstacles and challenges
9. Chance events

### **Interview Questions**

1. Career
  - ✚ Could you tell me about your current job title and how you got here (career trajectory)
    - What was your childhood experience
    - Has this career always been the career of your dreams?
    - What were the response of your teachers and parents especially towards this ambition?
    - What prompted you into this career path specifically, and not any other branch of science, say nursing, which is often considered to be more “feminine” inclined?
    - What were your expectations about this career before it was started and have these expectations been met?
    - Did you have any fears, or anxieties when you were about to take on this path as a full-time career?
    - Can you share some of the challenges you faced both as a student scientist and as a professional scientist?
      - ✓ Any peculiar challenges as a woman?
      - ✓ Any distinct challenges coming from a developing country?

- Looking back on your experience as a scientist, would you have gone down this path if you knew things were going to turn out the way that it did?
- ✚ Tell me about your relationship with other colleagues. How are you viewed by your colleagues of the opposite gender?
  - ✚ Do you consider yourself successful? What does success mean to you?
  - ✚ What impact did winning the Elsevier award have on your career?
  - ✚ What are your future plans, aspirations in terms of your career?
    - ✓ Do you see yourself going a different route, example leaving academia for industry?
1. Education and training
    - ✚ Have you had any formal education/training abroad?
      - ✓ If yes, where, and why did you choose to study abroad and not in your home country? Could you share the experience gained from living abroad.
      - ✓ How has this experience shaped your perspective on your career.
    - ✚ Did you receive any mentorship? Tell me about it and how this shaped your career.
2. Work-life balance
    - ✚ Has your career had any impact (positive, negative, or both) on your family and social life?
3. Developing country factors
    - ✚ Generally, what is the response to women in STEM from your country?
    - ✚ What has been your experience working as a female scientist from a developing country?
    - ✚ You are currently working (or not working) from your home country. Any peculiar reasons?
    - ✚ Describe pursuing a career as a female scientist from a developing country in three words.

1. Chance events

- ✚ Many young women, from developing countries like yourself, set out to pursue science as a full-time career but are unable to reach the end of their dreams due to country specific factors. In your situation, what do you believe worked out for you to get this far?
- ✚ Can you tell me about an unplanned circumstance that shaped/altered/influenced your path to this career?
  - ✓ Eg. Getting unexpected information about job openings/schooling/training/funding
  - ✓ Unexpected personal events

2. Can you share some of the most memorable experiences you have had as a woman scientist?

3. Any advice for young women aspiring to be like you?

Thank you very much for participating in this study.