Understanding the experiences of female career advancement in the engineering field

Nina Jean[1,*], Mineshree Naidoo-Chetty[2]

[1] Industrial Psychology Department, University of the Western Cape, Cape Town, South Africa

[2] Industrial Psychology Department, University of the Western Cape, Cape Town, South Africa, Orcid: orcid.org/0000-0003-2914-8714

Keywords

Gender equity;

Career advancement;

Underrepresentation;

Engineering

Abstract

Despite living in what should be perceived as a gender-equitable society, women remain the minority in traditionally male-dominated fields such as the engineering sector. Women tend to experience unique challenges that affect their career advancement. Thus, the study aims to explore the experiences of women working in the engineering sector by examining the challenges they encounter, as well as potential strategies to overcome these difficulties, thereby enabling them to continue their career paths. Limited attention has been paid to understanding the career advancement challenges faced by women and the resultant gender misrepresentation. A qualitative research method was employed, using semi-structured interviews. A sample of 10 women employed in the engineering sector was selected. Thematic analysis was utilised to analyse the data with four main themes emerging from the data findings, that being male dominance, support from others, stereotypes and discrimination along with self-efficacy**.** This study thus contributes to the growing body of knowledge through understanding how gender equality issues impact women's workplace experiences and career advancement. Therefore, it underscores the importance for organisations to consider improving their policies and practices related to gender equity.

[1]*Corresponding Author

[2] E-mail address: minaidoo@uwc.ac.za

1. Introduction

1.1. Background

Since the end of apartheid numerous laws have been passed in South Africa, specifically to assist in facilitating the advancement of women in their careers. However, despite the implementation of policies and structures to enable women's career advancement, they still encounter challenges. As a result, women are still underrepresented in conventional male-dominated professions (Masters & Meltzoff, 2016; Smith et al., 2021). This pattern is notable in the engineering sector, which is still widely perceived as a male-dominated work environment (Makarem et al., 2020; Smith et al., 2021).

The challenges experienced by women have historical origins and demonstrate that traditional gender-hierarchies and societal gender-role expectations still prevail in the workplace (Akanji et al., 2024; Martin & Barnard, 2013). A potential reason for this is that men, who are often the policy makers, may not take into consideration women's career patterns or their need for work-life balance (Acker, 2012; Galsanjigmed et al., 2023). Moreover, the challenges women face in male-dominated fields are both a result and an indicator of patriarchal structures. These difficulties mirror women's subordinate status in broader society and within family units, as noted by Pearlman (2019).

Du Plessis and Barkhuizen (2015) indicate that women want to become engineers, however, when they enter the sector they are often discouraged from the more practical/technical side of work that the role entails. Instead they are pushed towards management roles or other areas in engineering.

The concept of the "leaky pipeline" as described by Dobson and Gurr, (2021) is used to discuss the decline of Women in Engineering (WiE), elucidating that although women are moving into the pipeline, they are not joining the STEM (science, technology, engineering, and mathematics) fields due to "leaks". These leaks include a lack of support in the working environment and a lack of training and development, which cause women to eventually leave the sector. Wilson and VanAntwerp (2021) highlight the invisible paradox barrier, whereby women are simultaneously highly visible as women but invisible as engineers. Yates and Skinner (2021) share the same notion of the paradoxical state of women. Even though women make progress they are still underrepresented by policies and organisations. This phenomenon is frequently rooted in conventional gender roles, which confine leadership concepts to a single gender. Organisations play a significant role in shaping the career paths and values of women by making decisions influenced by gender-based biases and stereotypes (Galsanjigmed et al., 2023). These circumstances can cause potential problems and become a disadvantage to the trade and country, consequently, indicating the need for further research and motivating for more women to consider a career in engineering.

Engineering forms part of the STEM fields that contribute to the countries technological and economic development (Barakabitze et al., 2019; Hill et al., 2010). Considering the rise in technology and other global changes, this field has become vital to sustain economic expansion and competitiveness (Martin & Barnard, 2013; Mthethwa, 2018). Hence it is even more important to encourage young girls and women to remain in the field of engineering (González-Pérez et al., 2020; Hill et al., 2010).

Even with legislative efforts from the South African Government to promote equity and eliminate discrimination and workplace disparities, challenges continue to emerge in the engineering fields. Additional effort and initiatives in and beyond the workplace may need to be considered to support the career advancement of women. The study, therefore, endeavoured to understand the challenges encountered by women who seek to advance in their engineering careers.

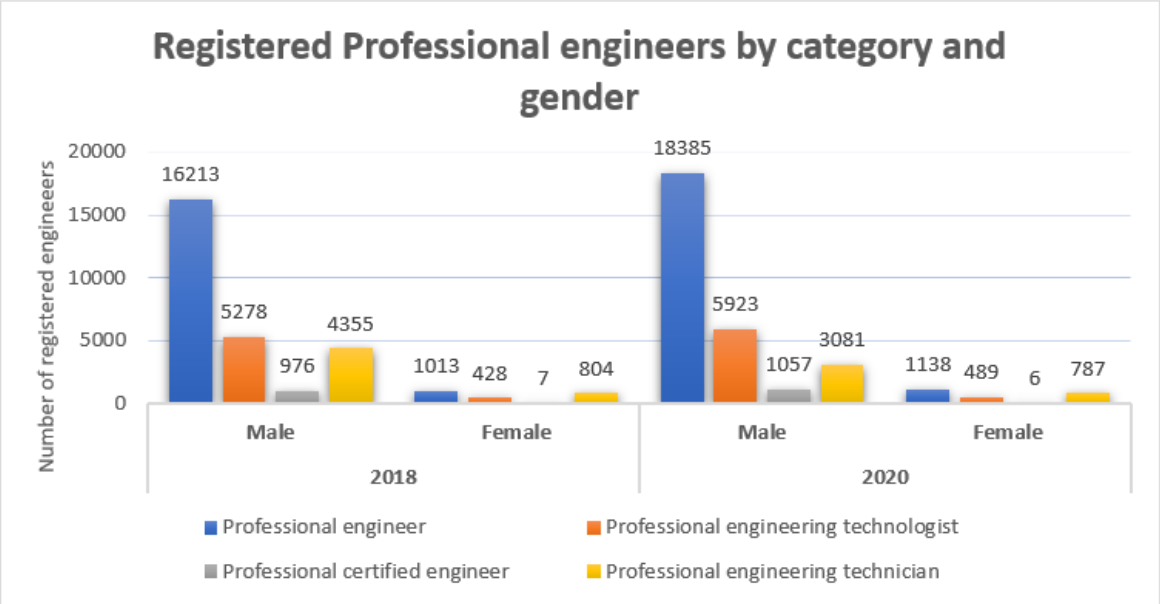
The paper provides some background to the study, including literature on career development and barriers to career development. Strategies to promote career advancement are presented in the form of workplace initiatives. The literature review is preceded by a statement of the main problem and research objectives. The findings articulating the barriers that are experienced by professional female engineers, as well as potential ways in which they overcome these challenges to progress in their careers. Finally, recommendations are made for workplace and future research.

1.2. Problem Statement

Engineering has historically marginalised women due to male dominance, gender imbalance, and segregation within the industry (Cheryan et al., 2017; Dasgupta & Stout, 2014). Although more women in South Africa are pursuing engineering careers, they still constitute a small percentage of students enrolled in engineering programs (Martin & Barnard, 2013; Msosa et al., 2022).

Figure 1.1

Professional Registration Statistics by Gender and Category



Error: Reference source not found is adapted from the Engineering Council of South Africa Annual Report (2018) and the Engineering Council of South Africa Annual Report (2020).

Figure 1.1 shows the distribution of registered professional engineers in South Africa by category and gender. Men continue to constitute the majority of registered engineers, while women represent only a small fraction despite some increase in this figure over time. This data indicates that while women have made progress in the field, they remain significantly underrepresented compared to their male counterparts. Only a small percentage of women succeed in registering as professional engineers (Wilson & VanAntwerp, 2021).

The failure to attract WiE can be attributed to several factors: lack of career counselling, limited awareness, discouragement, gender stereotyping, and restrictive gender-role expectations. These issues hinder the advancement of young girls and women in engineering careers. Further, women face additional challenges, including unsupportive environments, diminished interest in engineering, and low self-confidence in their abilities and skills (Campbell-Montalvo et al., 2022; Masters & Meltzoff, 2016).

Thus, this study, in exploring the reasons for their continued underrepresentation in practice, aimed to examine the challenges women engineers face in their career advancement. To achieve this the study explored their experiences over the course of their career, with a view to identifying the challenges that hinder their progress in the industry.

1.3. Research objective

The primary aim of this study was to explore the challenges that are experienced by professional female engineers in their career advancement as well as identify how they overcome these challenges to progress in their careers.

2. Literature Review

WiE face career advancement challenges due to subtle or unseen barriers often embedded in workplace structures, policies, and organisational cultures (Yates & Skinner, 2021). While many engineering firms claim to be gender-neutral, underlying assumptions about the ideal worker—typically male—persist. Although organisations may assert that their advancement processes and promotion opportunities are unbiased and transparent, the perception of an ideal worker often puts women at a disadvantage. This idealised notion makes it less likely for women to be seen as meeting the perceived standard of excellence in the field (Yates & Skinner, 2021).

Therefore, to gain insight into women's experiences of career advancement in the engineering sector, career advancement is examined from a career development perspective. This examination serves to establish the role of career advancement in an individual's life.

2.1. Career development

Career development is an essential component of human development, necessary for progressing through life. It is recognised as an ongoing process that enables individuals to advance, grow, and transition throughout their lifespan (Botha et al., 2011). Women encounter diverse career barriers throughout their professional development stages. Therefore, it's crucial to comprehend these challenges and their impact on women's career progression. Super's theory will be further elaborated on to support this notion.

2.2. Super's self-concept theory of career development

Super (1990) conceptualises career development as learning and implementing self-concept, referring to how individuals observe themselves and their situations. Super (1990) developed a career stage theory by providing insight into how individuals experience various stages in their career development and explaining how each stage allows an individual to aspire towards a successful career. These life stages comprise growth—ages (4-13), focusing on developing ideas about self-worth, discovering personal abilities, interests, talents, and physical growth. Exploration—ages (14-24) discourses developing an individual's skills and learning about various career options while

selecting or making a career choice. Establishment ages (25-44) addresses when an individual acquires experience and experience in their chosen career choice. Maintenance—ages (45-65) discourse the maintenance of leaving a career and ongoing development/adjustment to improve the individual's position. Disengagement —ages (65 years and over), concerns the gradual withdrawal from the working world and preparing for retirement (Schreuder & Coetzee, 2011).

Acker (2012) remarks that, concerning career development and lifestyle stages, men and women have various work experiences. Astin (1984) indicates that work motivation is the same for both men and women; however, due to early socialisation and structural opportunities for women, their choices are ultimately different. Women, therefore, have a wider range of roles and responsibilities than men; this creates a wider range of career forms and lifestyle choices (Schreuder & Coetzee, 2016). Women are, therefore, more inclined to make career transitions for their families than their male counterparts. Research indicates that men and women experience similar stages of stability and transition; however, women have "split dreams" compared to men, focusing on "the dream" (Schreuder & Coetzee, 2016). For women, "split dreams" refer to women who enter a period where they encounter a delicate balancing act between motherhood and pursuing their careers (Schreuder & Coetzee, 2016). This situation may stem from childhood socialisation, causing women to maintain societal norms or traditional family roles (Orr, 2011). Schreuder and Coetzee (2011) emphasise that some women fear career success because they believe it might lead to isolation. Those who pursue their careers in their twenties may have children at a later stage when they feel the pressure of their biological clocks. Although men and women share ideals about their careers and family life, women are often positioned in a predicament concerning biological timelines and societal norms (Schreuder & Coetzee, 2011). Concurring, Mavin's (2001) notion about traditional models of career development that is based on the experiences of men, indicates a lack of women's experiences in existing models, therefore, affecting organisations and how they operate and approach career development for women. Through their career development process and stages, women experience various career barriers, discussed further. Thus, career barriers and their implications on career development for women must be understood.

2.3. Career barriers

According to early career development theorists like Crites (1969), career barriers are defined as factors that impede an individual's progress toward achieving their professional objectives. While research has identified a number of factors that could affect an individual's professional development, there is no consensus on how to categorise these barriers. Previous empirical studies suggest a division between internal and external barriers (Urbanaviciute et al., 2016). Internal barriers are person-centered (intrapersonal) factors which include, motivation levels, career interest and perceived

lack of ability. External barriers on the other hand are environment-related factors, such as, family responsibilities, financial constraints and employment limitations. This internal-external classification helps in understanding the diverse nature of career obstacles (Urbanaviciute et al., 2016).

2.4. Workplace barriers

Despite recent improvements in the labour market, societal gender-role expectations continue to adversely affect both men and women in their professional lives (Du Plessis & Barkhuizen, 2015; Schultheiss, 2020).

Barriers experienced are elements such as lack of work-life balance. Although the labour market has improved in recent years, gender-role expectations still negatively influence men and women in society (Du Plessis & Barkhuizen, 2015; Zorotovich et al., 2021). Attaining more WiE is challenging as they encounter factors reducing their presence in career stages. These factors include their work environment, maternal/glass ceiling wall, performance evaluation criteria, a lack of recognition, and biases (Huyer, 2015; Zhang 2024). Starting a family affects women's STEM careers as work-life policies with family responsibilities affect job satisfaction more than they would for men, as women are perceived as caregivers (Dasgupta & Stout, 2014). Coinciding with this notion, Thébaud and Taylor (2021) indicate that women spend an inequitable amount of time on family responsibility and childcare, as they are perceived as the primary caregivers in households.

A second barrier is salary inequality, although there has been substantial improvement regarding gender equity, the gender pay gap remains indicates that women remaining in engineering tend to earn less than men in the field. Despite engineering being a lucrative profession with higher salaries, women are inclined to earn less than their male counterparts (Zhang, 2024).

The final barrier, lack of opportunities and social isolation is often experienced by women in the engineering environment. this is because the engineering field is described as hegemonically masculine. Being able to form part of a community and obtaining mentorship is often challenging for women (Benedict et al., 2018). The prevalence of informal, predominantly male-dominated networks and connections within companies often leads to preferential treatment for male candidates who are part of these circles. Conversely, women may find themselves excluded or face significant challenges in accessing these networks. This disparity ultimately restricts women's visibility in the workplace, reduces their mentorship opportunities, and limits their access to vital information and resources crucial for career advancement. Such systemic barriers contribute to persistent gender inequalities in professional development and leadership opportunities within organisations (Holgersson & Romani, 2020; Zhang, 2024).

2.5. Workplace strategies to promote career advancement

Despite the influx of women into traditionally male-dominated sectors, including the engineering sector, women encounter challenges in terms of their career advancement due to the role played by the challenges described. To this end it is the responsibility of both organisations and women themselves to develop strategies and interventions to promote career advancement. Some of the interventions are described below.

The National Gender Policy Framework (2003) exemplifies South Africa's vision and plans by providing broad guidelines for organisations to follow. It emphasises that women should be actively involved in designing, developing, and implementing ideas or projects to enhance performance and motivation within industries (Huyer, 2015; Yan et al., 2024). This involvement can be facilitated through affinity groups or non-profit organisations, such as Women in Engineering (IEEE) and South African Selection. These groups aim to promote global recruitment and retention of women in technical disciplines (IEEE South Africa, 2017).

Additionally, due to the significant transformation that has occurred in South Africa's driven by globalisation and Fourth Industrial Revolution (4IR), necessitated increased support for women in STEM through improved education and training. Despite ranking 19th in global gender equality, only 13% of STEM graduates are women (Letsebe, 2018). Empowering women in STEM is vital for economic growth (Makarem, & Wang, 2020).

The Accelerated and Shared Growth Initiative for South Africa (ASGISA), launched in 2006, aimed to boost economic growth. This was created in an effort to address critical challenges to South Africa's economic development (ASGISA annual report, 2007).

Additionally, in 2006, the Joint Initiative on Priority Skills Acquisition (JIPSA) was launched to complement ASGISA. Furthermore, the initiative also works to align national policies with these goals (JIPSA Annual Report, 2006). JIPSA thus aims to increase the number of engineering students, along with the number of graduates registering as professionals with ECSA.

3. Research Methodology

Research design, approach and method

An interpretative phenomenological and qualitative research approach was adopted to address the objectives set of this study that sought to investigate the career challenges experienced by women. It aimed to understand the factors contributing to these challenges and their significance from the participants' perspectives. To explore this subject, the study relied on firsthand accounts from women who had previously encountered or were currently experiencing such barriers.

3.1. Participants and setting

The research focused on a group of ten professional qualified women engineers working in Cape Town's engineering industry. A professional engineer is one who is certified and registered as such with the Engineering Council of South Africa as defined by the Engineering Profession Act (Act No. 46 of 2000, as amended. This study was conducted using a non-probability and purposive sampling method, thus participants were selected purposefully to support the aims and objectives of the study.

The study aimed to understand why some women have endured in the industry while others have left. By including both current and former female professionals, the researcher sought to determine why certain women have exited the profession while others have been retained in the sector. Through sharing their lived experiences, it was hoped that the study would provide insights into the organisational and personal dynamics influencing women's career trajectories. Women from all engineering fields were considered to allow for variation and opportunity. Table 1 provides a breakdown of the demographics of the participants in terms of job title, qualification and age.

Table 1: Demographic information of participants (n = 10)

Participant (P)	Job title	Qualification	Age
Participant 1	Industrial Engineer	BTech engineering	(31-40)
Participant 2	Chemical Engineer	BTech and MTech Chemical engineering	(41-50)
Participant 3	Civil Engineer	BTech Civil Engineering	(21-30)
Participant 4	Industrial Engineer	BTech Industrial Engineering	(21-30)
Participant 5	Industrial Engineer	BTech Industrial Engineering and MTech Mechanical Engineering	(31-40)
Participant 6	Chemical Engineer	BSc Chemical Engineering	(21-30)
Participant 7	Civil Engineer	BTech Civil Engineering	(31-40)

Participant 8	Mechatronic Engineer	BSc (Eng) Mechatronics	(21-30)
Participant 9	Electrical Engineer	BTech Electrical Engineering	(21-30)
Participant 10	Chemical Engineer	BTech Chemical Engineering	(31-40)

3.2. Data collection and procedure

Semi-structured interviews were implemented to collect rich data and information from the participants with the assistance of an interview guide. Due to COVID-19 restrictions at the time of data collection, interviews were conducted via an online platform. While not face-to-face, these one-on-one, virtual and semi-structured interview sessions allowed for the discussion of sensitive and confidential information, which might have been challenging in an online focus group setting. This approach provided a consistent framework and protocol across all interviews.

The interview guide was developed by creating a mind map focused on the main research question and objectives, incorporating input from other researchers involved in the study. Questions were sequenced logically to flow from one topic to the next. Examples included: “What is your field of engineering, and why did you make that career choice?” and “Do you think there is a stereotype attached to a female engineer?”.

The online interviews were recorded with participant consent, to facilitate transcription, scheduled at the participants' convenience, and lasted between 30 and 40 minutes.

3.3. Trustworthiness considerations

As per Lincoln and Guba, (1985) to ensure credibility of the data, researchers ensured that they had the required knowledge and research skills to execute their roles. The researchers conducted one or two pilot interviews to refine the overall process using the interview protocol, time-management and the overall running of the interviews. There were also debriefing sessions that took place with all researchers involved in the study, this was done to allow for reflection on the learnings and findings from the interviews. For dependability the researchers also ensured that detailed drafts of the study protocol were reviewed throughout the study. The data collection process was also recorded and tracked in detail. Finally, when analysing and coding the data, at least two researchers coded the data, with a third researcher was appointed to cross check and to ensure alignment in themes and to resolve any issues. Thus, the analysis was conducted by the research team who brought different perspectives to the data interpretation.

3.4. Data Analysis

After all interviews were completed, each interview was transcribed verbatim and the resulting text was analysed using thematic analysis, using the steps recommended by Braun & Clarke (2006). Thematic analysis was employed to interpret and derive meaning from the collated data through the identification of themes and patterns emerging from the dataset.

3.5. Ethics

The study's data collection followed a structured process once ethical approval had been secured from the relevant Human Social Sciences Research Ethics Committee (HSSREC), (reference number HS21/3/19). Participants were then asked for permission to use their interview responses in the study. They were informed about the research's purpose, confidentiality measures, anonymity guarantees, data usage and their privacy rights and were required to provide their informed consent in writing.

4. Results and Findings

The superordinate themes, sub-categories and subordinate themes that emerged from the thematic analysis are presented in table 2. The superordinate themes revealed were:

- Male-dominance
- Support from others
- Stereotypes and discrimination
- Self-efficacy

Table 2: Superordinate Themes and Subordinate Themes

Superordinate theme	Sub-category	Subordinate theme
Male-dominance	Engineering culture	Logical vs technical
	Equal opportunities	Male-driven and supported
	Support/tworks	Difference in exposure
		Exclusion/isolation
		Implicit biases
		Lack of recognition
		Lack of female presence
Support from others	Parents/teachers/peers	Parental encouragement
		Supportive environments

Superordinate theme	Sub-category	Subordinate theme
Stereotypes and discrimination	Biases	Physical appearance
		Gender bias
Self-efficacy as a coping mechanism	Beliefs in female competence	Passion and interest
		Utilise skills and knowledge

4.1 Male dominance

The analysis revealed several sub-categories and subordinate themes within the broader context of male dominance.

4.1.1 Engineering culture

This sub-category emerged largely in response to participants views about their initial perceptions of engineering and how these views evolved throughout their careers. The findings reveal a perceived gap between engineering theory and industry practice, with participants responding as follows:

> "You don't always think you'll get your hands dirty", "many times I had to put on an overall and get dirty", "it's the things you are not told when you are studying. That you are not just using your brain there's a physical aspect to it to" (P1, 31-40, Industrial Engineer).

> "What I was taught versus the actual environment is, it is very different" (P2, 41-50, Chemical Engineer).

> "I think the main difference or shock to the system was when I had to work myself like that physical component in comparison to the theory" (P4, 21-30, Industrial Engineer).

> "I think varsity we are mainly taught the theory of engineering; we barely do any practical's that would be required in the workspace" (P5, 31-40, Industrial Engineer).

The results suggest that these female engineers experienced a form of reality shock when faced with the physical task performance without prior hands-on experience. Heilman (2012) supports this idea, noting that descriptive stereotypes foster negative expectations about women's capabilities, creating a perceived "lack of fit" within organisations. Weber (2018) adds that women are more likely to leave engineering careers because they are often viewed as less competent than their male colleagues. Some participants commented:

> "When you get here in the workplace you are expected to know each and everything, how things work and all of that" (P5, 31-40, Industrial Engineer).

> "They withhold those opportunities from women to learn to do to something over and over again because they are deemed physically weak or unable to do something", "When you try things for the first time let's say it's working with your hands and it's your first attempt that might not be that great. They like to judge you on that and then the assumption is you can't do it" (P3, 21-30, Civil Engineer).

A common view expressed among participants was that engineering remains a male-dominated field, consistent with its historical roots. Participants 1, 3, 4, 7, and 10 expressed similar observations about the engineering workplace environment:

> "It's difficult for females in such a testosterone-driven environment" (P1, 31-40, Industrial Engineer).

> "My perception of engineering that it was very much male-dominated" (P3, 21-30, Civil Engineer).

> "It is deemed a masculine environment" (P4, 21-30, Industrial Engineer).

> "Before entering the workplace my perception of engineering was that it's pretty much a male-orientated industry and to an extent it still is" (P7, 31-40, Civil Engineer).

> P 10: "I definitely thought engineering was for a man and just a job most men do, just from what I saw and how I grew up" (P10, 31-40, Chemical Engineer).

This perspective aligns with Campbell-Montalvo et al. (2020) observation that women continue to be underrepresented in male-dominated fields. Despite engineering being a financially rewarding career, it remains predominantly male-oriented.

4.1.2 Lack of equal opportunities

A general observation held by participants was that engineering was a male-driven and supported sector in relation to opportunities in the workplace. While engineering organisations depict themselves as gender-neutral working environments, there are expectations about an ideal worker, that is usually male (Yates & Skinner, 2021). Participants 1, 3, 4, and 9 echoed this opinion:

> "Think it's the olden day's preconceptions about that when it comes to males, that males know more" (P1, 31-40, Industrial Engineer).

> “I think boys are encouraged to be engineers or you know all those things because it's seen as like a very hands-on job. People assume that you don’t want to get your hands dirty” (P3, 21-30, Civil Engineer).

> “I think it’s harder for a woman” (P4, 21-30, Industrial Engineer).

> “I think as women we have to work very hard, we get respect but are still undermined, because you are a woman in comparison to your male colleagues” (P9, 21-30, Electrical Engineer).

This finding supports the notion that despite South Africa's efforts to address gender inequality through affirmative action and legislative measures (Naidoo & Kongolo, 2004), women continue to face obstacles in their professional advancement. Participants further expressed that they believed there is a difference in exposure and access between men and women and that this influences their career development.

> “I think the access is there but giving them the access doesn't mean that that it's equal, or an equal opportunity”, “think girl children are still encouraged to play with dolls and not with Legos. You know, so the basics of giving a child the option to play with both. So that when you start building blocks and building models with Lego, it stimulates different brain pathways to think different. And we wait too long to expose girls to those type of things” (P2, 41-50, Chemical Engineer).

> “The opportunities are equal; they are equal once you have the degree. But I think at maybe high school level or yeah, like Grade 10,11,12. But the exposure to engineering is not there” (P3, 21-30, Civil Engineer).

> “As a female you are undermined, and you don’t get a lot of opportunities because its most likely given to a man” (P10, 31-40, Chemical Engineer).

4.1.3 Support/networks

Hunt (2016) notes that unsupportive work environments contribute to a higher rate of women leaving engineering fields. This exodus is attributed to a lack of mentoring, limited professional networks, and discrimination from colleagues and superiors. Several participants in this study shared a common belief that they needed to exert extra effort to demonstrate their value and capabilities in order to gain workplace support and acknowledgment:

> “a woman has to work so much harder to have the same impact that a man would have. And to get to just get the cooperation and the input. So I have to now look at how I carry myself, put in more effort to prove a point and literally be willing to do more just to show that what I am presenting or suggesting is valuable and worth considering. It's exhausting” (P1, 31-40, Industrial Engineer).

> “And yeah, and then the reality is, then you unfold, fortunately, or unfortunately, when you're working, you have to kind of prove that what you’ve done is adding value, people give you more responsibility” (P2, 41-50, Chemical Engineer).

> “I think the support depends on the relationships formed in the workplace and like on your way towards being an engineer, you know. It really depends on the relationships and the bonds and the networks you formed throughout your university and within the workplace” (P3, 21-30, Civil Engineer).

Research by Tokbaeva and Achtenhagen (2021) suggests that the presence of support networks can enhance the professional experiences of women working in male-dominated fields. Participants also noted a lack of female presence in engineering, which affected their motivation and encouragement in the field:

> “Ok so in my office space in terms of support from a woman no, I don’t have support from a woman, but I do feel my boss supports me. My boss is male by the way. So, I’ve mainly built support and relationships from previous things like high school and university” (P3, 21-30, Civil Engineer).

Doubell and Struwig (2014) indicate that organisational cultures lacking female mentors and role models, can increase barriers for women in their careers.

4.2 Stereotypes and discrimination

Persistent negative perceptions about women's abilities, performance, and skills continue to hinder their career progression in engineering (Zhang, 2024). These gender biases often lead to feelings of inadequacy among women, contributing to their departure from the field (Fouad, 2020).

4.2.1. Gender bias

Although women have made significant strides in both involvement and achievement in engineering, unfavourable stereotypes regarding their competence and job performance continue to persist. Participants expressed doubts about whether they were physically fit enough to perform their duties, and highlighted the perception that women are perceived as emotional. The following participant responses illustrate the experiences and perceptions of women engineers regarding these gender-based prejudices.

> “The assumption that we can’t do the job. As they assume that a woman is too weak to do something. That's the first barrier because then they assume that you’re too emotional” (P3, 21-30, Civil Engineer).

> “That we are too emotional to lead. Like we, I don’t know, I say that because every time we prove a point” (P5, 31-40, Industrial Engineer).

> “there’s this assumption that you are too emotionally weak, or you won’t get your hands dirty to get the job done” (P7, 31-40, Civil Engineer).

Weber (2018) describes this phenomenon as a "stereotype threat," which discourages women from pursuing or remaining in engineering. This threat stems from the unfounded assumption that female engineers possess less knowledge or lack essential skills compared to their male counterparts.

4.3 Support from others

Stead and Watson (2017) highlight the critical role that parents, peers, and teachers play in supporting women in male-dominated fields. Their perceptions and attitudes serve as key motivating factors, helping women persevere and pursue their career goals in these environments.

4.3.1 Parental encouragement

Hill et al. (2010) and Masters and Meltzoff (2016) note that women face obstacles when entering STEM fields. These barriers are often reinforced by the attitudes of parents, teachers, and others who view these disciplines as more appropriate for men. The following examples illustrate common perceptions on this matter:

> “My teachers were very happy, especially when I qualified to actually like study that in university” (P3, 21-30, Civil Engineer).

> “Well, my mom was very supportive of it, I’m the first child to have an engineering degree in the family. High school teachers were also supportive; they knew that I loved- my favourite subject is physics so they would always motivate me to go into the engineering field” (P5, 31-40, Industrial Engineer).

> “So my dad is an electrical engineer, and when I wanted to do it he was over the moon because my brother chose the accounting route, so he was definitely supportive. The rest of the family because I’m Indian were shocked because why did I not decide to become a doctor, they call me sparky” (P8, 21-30, Mechatronic Engineer).

Participants 6 and 7 reported similar experiences regarding parental and teacher support. Amegah (2024) note that supportive environments can positively influence women's decisions to pursue non-traditional career paths. Furthermore, Green (2024) emphasise the critical role that family plays in fostering interest and development in STEM subjects, which significantly contributes to women's experiences in these fields.

4.4. Self-efficacy as a coping mechanism

Participants identified self-efficacy as a crucial coping strategy for overcoming the challenges and barriers they encounter in engineering. This trait emerged as a significant positive factor, motivating participants and bolstering their determination to persist in their engineering careers.

4.4.1 Belief in female competence

This theme shared commonality among participants as they all shared the belief, they were more than capable and able to perform their functions as engineers:

> "But at the same time you believe you are capable, so I was willing to put in the hard work" (P1, 31-40, Industrial Engineer).

Mamaril and Royal (2008) argue that women's perceptions of their own skills and abilities significantly impact their success in engineering. They suggest that a lack of self-confidence can lead to feelings of isolation and heighten women's awareness of their minority status in the industry. In this study, participants reported that their self-efficacy was driven by their passion and interest in STEM subjects, which fueled their desire for success:

> "So yeah I was more interested in that, and I was good at science and wanted to utilise my skills and knowledge I guess" (P2, 41-50, Chemical Engineer).

> "I knew I wasn't good at languages but more interested in organising and I was passionate about science and maths" (P4, 21-30, Industrial Engineer).

Participant 5 offered insights into how women perceive their roles in engineering. She noted that other professions are often glamorised, leading women to make career choices based on perceived attractiveness rather than personal interest or aptitude. This observation aligns with Martin and Barnard's (2013) assertion that psychological barriers and gender-role expectations often prevent women from realising their full potential. Masters and Meltzoff (2016) further argue that negative experiences create additional obstacles for women, impacting their skills, abilities, and self-confidence.

5. Managerial Implications

The purpose of this study was to explore career advancement and the challenges to career advancement among female professional engineers based in Cape Town, South Africa. Literature and reports on the state of gender equity within the engineering profession suggest that the environment is still dominated by males which may hold implications for the development and progress of the increasing number of women who choose to enter the profession. The demand for STEM talent in South Africa makes this study important in creating the enabling conditions that will both attract and retain women engineers in practice.

In this study a number of factors emerged as influencing women engineers' career advancement. These included male dominance, support from others, stereotypes and discrimination and also self-efficacy. On the basis of these findings a number of recommendations are made for organisational practice.

This research advocates for the implementation of formal and equitable hiring practices to ensure equal opportunities for all aspiring engineers (Piwowar-Sulej, 2021). This includes line and HR managers identifying talent management requirements for professionals and aligning these requirements with the company's goals and strategies. While labour legislation provides for employment equity, this may not be evident in hiring and talent management practices that may unconsciously be driven by hidden biases and stereotypes (Campbell-Montalvo, 2020). This would further suggest that line and HR managers are exposed to relevant training to question these unconscious assumptions about the role and competence of women within the engineering profession (Venkatesan, 2020).

The study proposes that South African organisations should strive to change the current norm. They should aim to create engineering environments known for their ability to encourage and retain engineers of all genders. Suggested initiatives include, offering job shadowing opportunities, providing coaching programmes and increasing involvement in supporting both men and women in the engineering field (Kazim et al., 2021; Zhang, 2024). These efforts can contribute to creating more inclusive and supportive workplaces in the engineering sector. To ensure the success of these programmes, regular feedback should be encouraged from both managers and employees as to whether these initiatives are achieving the desired outcomes linked to career advancement (Bannay et al., 2020).

Organisations with the assistance of line managers and HR should implement formalised onboarding programmes that foster an inclusive work environment and integrate new engineers into the company culture. This includes familiarising them with shared values, rituals, and professional language (Du Plessis & Barkhuizen, 2015). Furthermore, to improve engineer retention, it's crucial to establish regular performance appraisals that, highlight achievements, identify areas for skill development and provide constructive feedback on areas needing improvement. These appraisals thus serve a dual purpose for women and interns beginning their careers. They allow these individuals to recognise their contributions to the organisation and identify opportunities for growth within the industry (Laguador et al., 2020).

Mentors and role models play a crucial role in motivating women to persist in their work environments. Organisations should implement formal mentorship programs that connect women with experienced female engineers. However, exposure should not be limited to only female mentors.

Instead, women should interact with diverse, like-minded individuals of all genders who share the goal of making a positive impact, allowing for learning from various perspectives (Kazim et al., 2021). To this end it may be plausible to assign each woman two mentors - one male and one female. This strategy aims to prevent reinforcement of gender norms and reduce the "us vs. them" mentality in the workplace (Du Plessis & Barkhuizen, 2015).

In addition to organisational interventions, HR, line managers and employees themselves should become well-versed in the important role that self-efficacy, an intrapersonal variable, plays in enabling career advancement (Halim et al., 2023). This would complement organisational initiatives as individual employees begin to see how these interventions provide opportunities for performance accomplishments, vicarious experiences, verbal persuasion and an awareness of the role played by emotional/affective state (Bandura & Wessels, 1997; Chen et al., 2023).

5.2 Educational implications

A key issue identified in the research was the delayed introduction of STEM subjects and related education to children. Peixoto et al. (2018) suggest that early childhood should be the primary focus for introducing STEM concepts. To improve later development and interest in these fields, parents, educators, and peers should play active roles in encouraging and promoting STEM subjects from an early age.

Societal norms and gender-role expectations perpetuate stereotypes about STEM subjects. Starr et al. (2023) note a prevalent stereotype that "boys are better at mathematics and sciences than girls," which is often ingrained in children from a young age. This narrative needs to be challenged. Instead, children should be taught that STEM skills are acquired through learning and practice, not innate abilities, and can therefore be developed and enhanced by anyone, regardless of gender.

Parents and educational institutions are encouraged to implement engaging activities that foster enthusiasm for science and mathematics through simple, accessible methods. These interactive and informative approaches can effectively stimulate interest in STEM subjects among young learners (Peixoto et al., 2024).

5. Conclusions, Limitations and Future Research

The engineering profession remains traditionally male-dominated, despite inclusion efforts (Maji, 2019). Evidence suggests that women engineers experience challenges to their career advancement which could ultimately lead to them exiting the profession. In this study examining these challenges four main themes were identified, these being male dominance, stereotypes and discrimination, support from others and self-efficacy. With the first theme of male-dominance participants revealed

that their pre-employment perceptions were of engineering as a male-dominated profession, this was consistent with studies by Zhang (2024) and Campbell-Montalv (2020). Despite awareness of male domination, participants pursued engineering careers but faced subtle advancement barriers. This included experiences of gender-based task reassignment, with male colleagues doubting their capabilities for even simple tasks.

The second theme of support from others highlighted the significant lack of female role models, mentors, and support networks in engineering. Amegah (2024) observed that supportive and encouraging environments can positively influence women's decisions to pursue non-traditional career paths. Building on this, Green (2024) emphasises the critical role that family plays in fostering interest and facilitating development in STEM subjects. This familial support significantly contributes to shaping women's experiences in STEM fields.

The third theme of stereotypes and discrimination related to women engineers being faced with assumptions that they are not ideal workers due to their traditional caregiving roles (Cheryan et al., 2017; Miner et al., 2018). To succeed, they indicated that they worked longer hours, asserted themselves more, developed resilience, and voiced opinions in order to adapt to the workplace. Participants also noted the role of gender bias in hiring, with males favored due to stereotypes about capabilities to overcome this, participants developed coping strategies including adopting a “code switching” approach through emulating male behaviour for acceptance (Du Plessis & Barkhuizen, 2015).

The final theme was self-efficacy. Most of the women in the study shared the belief that they were more than capable and able to perform as engineers. Chen et al. (2023) explain that how women feel and believe about their skills and abilities influences their success in engineering. Overall participants indicated that the main reason that they persevered and stayed within this field was for their passion and interest in the STEM field.

Some of the limitation experienced in this study included that the qualitative research approach is susceptible to biases. Participant bias may occur when respondents provide socially acceptable answers rather than their true feelings. Researcher bias can manifest in subjective data interpretation or leading questions designed to elicit specific responses. To overcome this the researcher ensured that credibility, transferability and dependability of the research data was managed accordingly. By addressing these aspects, the researcher aimed to maintain the highest level of data quality and trustworthiness.

References

Acker, J. (2012). Gendered organisations and intersectionality: Problems and possibilities. Equality, Diversity Inclusion: *An International Journal*, *31*(3), 214–224. https://doi.org/10.1108/02610151211209072

Akanji, B., Mordi, C., & Ajonbadi, H. A. (2024). Confronting social dominance ideology: how professional women manage career stereotypes in male-dominated occupations. Employee Relations: *The International Journal*, *46*(4), 913-933. https://doi.org/10.1108/ER-04-2022-0161

Amegah, A. (2024). A non-conformist choice: how young women studying science, technology, engineering, and mathematics in technical institutes in Ghana navigate their education and career decision. *Journal of Vocational Education & Training*, 1-23. https://doi.org/10.1080/13636820.2024.2330095

ASGISA Annual Report. (2007). Accelerated and shared growth initiative for South Africa. Retrieved from https://www.gov.za/sites/default/files/gcis_document/201409/asgisa-2007.pdf

Astin, H. S. (1984). The meaning of work in women's lives a sociopsychological model of career choice and work behavior. The counseling psychologist, 12(4), 117-126.

Bandura, A., & Wessels, S. (1997). *Self-efficacy* (pp. 4-6). Cambridge: Cambridge University Press.

Bannay, D. F., Hadi, M. J., & Amanah, A. A. (2020). The impact of inclusive leadership behaviors on innovative workplace behavior with an emphasis on the mediating role of work engagement. *Problems and Perspectives in Management*, *18*(3), 479. https://doi: 10.21511/ppm.18(3).2020.39

Barakabitze, A. A., William-Andey Lazaro, A., Ainea, N., Mkwizu, M. H., Maziku, H., Matofali, A. X., & Sanga, C. (2019). Transforming African education systems in science, technology, engineering, and mathematics (STEM) using ICTs: Challenges and opportunities. *Education Research International*, *2019*(1), 6946809. https://doi.org/10.1155/2019/6946809

Botha, E., Kiley, J., & Werner, A. (2011). *Introduction to work psychology*. Oxford University Press Southern Africa (Pty) Ltd.

Braun, K. & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3(2), 77-101. http://dx.doi.org/10.1191/1478088706qp063oa

Campbell-Montalvo, R., Kersaint, G., Smith, C. A., Puccia, E., Skvoretz, J., Wao, H., & Lee, R. (2022). How stereotypes and relationships influence women and underrepresented minority students' fit in engineering. *Journal of Research in Science Teaching*, *59*(4), 656-692. https://doi.org/10.3389/feduc.2022.780331

Chen, X. Y., Usher, E. L., Roeder, M., Johnson, A. R., Kennedy, M. S., & Mamaril, N. A. (2023). Mastery, models, messengers, and mixed emotions: Examining the development of engineering self-efficacy by gender. *Journal of Engineering Education*, *112*(1), 64-89. https://doi.org/10.1002/jee.20494

Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why are some STEM fields more gender-balanced than others? *Psychological Bulletin, 143,* 1-35. https://doi.org/10.1037/bul0000052

Crites, J. O. (1969). *Vocational psychology*. New York: McGraw-Hill.

Du Plessis, Y., & Barkhuizen, N. (2015). Exploring the career path barriers of women professional engineers in a South African context. *South African Journal of Labour Relations*, *39*(1), 38-57. https://hdl.handle.net/10520/EJC170749

Dasgupta, N., & Stout, J. G. (2014). Girls and women in science, technology, engineering, and mathematics: STEMing the tide and broadening participation in STEM careers. *Policy Insights from the Behavioral and Brain Sciences*, *1*(1), 21-29. https://doi.org/10.1177/237273221454947

Dobson, B., & Gurr, S. (2021). Advancing Women in Engineering and Technology (AWET).

Doubell, M., & Struwig, M. (2014). Perceptions of factors influencing career success of professional and business women in South Africa. *South African Journal of Economic and Management Sciences*, *17*(5), 531-543. https://hdl.handle.net/10520/EJC162638

Engineering Council of South Africa. (2018). ECSA Annual Report 2017-2018. Retrieved from https://static.pmg.org.za/1/ECSA_Annual_Report_20172018-Final.pdf

Engineering Council of South Africa. (2020). ECSA annual report 2019-2020. Retrieved from https://www.ecsa.co.za/about/pdfs/ECSA%20Annual%20Report%202021.pdf

Fouad, N. A., Kozlowski, M. B., Singh, R., Linneman, N. G., Schams, S. S., & Weber, K. N. (2020). Exploring the odds: Gender differences in departing the engineering profession. *Journal of Career Assessment*, *28*(3), 446-461. https://doi.org/10.1177/106907271987689

Galsanjigmed, E., & Sekiguchi, T. (2023). Challenges women experience in leadership careers: an integrative review. *Merits*, *3*(2), 366-389. https://doi.org/10.3390/merits3020021

González-Pérez, S., Mateos de Cabo, R., & Sáinz, M. (2020). Girls in STEM: Is it a female role-model thing?. *Frontiers in psychology*, *11*, 564148. https://doi.org/10.3389/fpsyg.2020.02204

Green, F. M. G. (2024). *The Influence of Women Engineers' Career Experiences on Career Decisions to Persist in Engineering* (Doctoral dissertation, Grand Canyon University).

Halim, L., Mohd Shahali, E. H., & H Iksan, Z. (2023). Effect of environmental factors on students' interest in STEM careers: The mediating role of self-efficacy. *Research in Science & Technological Education*, *41*(4), 1394-1411. https://doi.org/10.1080/02635143.2021.2008341

Heilman, M. E. (2012). Gender stereotypes and workplace bias. *Research in organizational Behavior*, *32*, 113-135. https://doi.org/10.1016/j.riob.2012.11.003

Holgersson, C., & Romani. L. (2020). Tokenism revisited: When organizational culture challenges masculine norms, the experience of token is transformed." *European Management Review, 17*(3), 649-661. https://doi.org/10.1111/emre.12385

Hunt, J. (2016). Why do women leave science and engineering?. *ILR Review*, *69*(1), 199-226. https://doi.org/10.1177/001979391559459

Huyer, S. (2015). Is the gender gap narrowing in science and engineering. *UNESCO science report:*

towards, *2030*, 85-103. https://doi.org/10.18356/9789210059053c009

Hill, C., Corbett, C., & St Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics*. American Association of University Women. 1111 Sixteenth Street NW, Washington, DC 20036. ISBN: 978-1-879922-40-2

IEEE South Africa. (2017). Women in Engineering. Retrieved from http://www.ieee.org.za/womenengineering

JIPSA Annual Report. (2006). Joint Initiative on Priority Skills Acquisition. Retrieved from https://static.pmg.org.za/docs/070326jipsa.pdf

Kazim, E., Koshiyama, A. S., Hilliard, A., & Polle, R. (2021). Systematizing audit in algorithmic recruitment. *Journal of Intelligence*, *9*(3), 46. https://doi.org/10.3390/jintelligence9030046

Laguador, J. M., Chavez-Prinsipe, N. H., & De Castro, E. L. (2020). Employability skill development needs of engineering students and employers' feedback on their internship performance. *Universal Journal of Educational Research*, *8*(7), 3097-3108. https://doi: 10.13189/ujer.2020.080738

Letsebe, K. (2018). *UN calls for added support of women in STEM. Business Technology Media Company*. https://www.itweb.co.za/content/G98YdMLxa3mMX2PD

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*, 1st ed. Newbury Park: Sage Publications Inc

Maji, S. (2019). "Doing Men's Jobs": A Commentary on Work–Life Balance Issues Among Women in Engineering and Technology. *Metamorphosis*, *18*(1), 68-75. https://doi.org/10.1177/09726225198548

Makarem, Y., & Wang, J. (2020). Career experiences of women in science, technology, engineering, and mathematics fields: A systematic literature review. *Human Resource Development Quarterly*, *31*(1), 91-111. https://doi.org/10.1002/hrdq.21380

Mamaril, N. J., & Royal, K. D. (2008). Women and Minorities in Engineering: A Review of the Literature. *Online Submission*. https://eric.ed.gov/?id=ED506512

Martin, P., & Barnard, A. (2013). The experience of women in male-dominated occupations: A constructivist grounded theory inquiry. *SA Journal of Industrial Psychology, 39*(2), Art. #1099,12 pages. https://doi.org/10.4102/sajip. v39i2.1099

Masters, A., & Meltzoff, A. N. (2016). Building bridges between psychological science and education: Cultural stereotypes, STEM, and equity. *Prospects-UNESCO, 46*, 215-234. https://doi.10.1007/s11125-017-9391-z

Mavin, S. (2001). "Women's Career in Theory and Practice: Time for Change?" *Women in Management Review 16*(4), 183-192. https://:doi.10.1108/09649420110392163.

Miner, K. N., Walker, J. M., Bergman, M. E., Jean, V. A., Carter-Sowell, A., January, S. C., & Kaunas, C. (2018). From "her" problem to "our" problem: Using an individual lens versus a social-structural lens to understand gender inequity in STEM. *Industrial and Organizational Psychology*, *11*(2), 267-290. https://doi.org/10.1017/iop.2018.7

Msosa, S. K., Ntshangase, B. A., & Mlambo, C. (2022). Gender parity among researchers in science, technology, engineering and mathematics. *Entrepreneurship and Sustainability Issues, 9*(4), 243-261. http://doi.org/10.9770/jesi.2022.9.4

Mthethwa, Z. (2018). *Engineering vital for the economy.* South African department of science and education. Retrieved August 08, 2024 from https://www.dst.gov.za/index.php/media-room/latest-news/2635-engineering-vital-for-the-economy

Naidoo, V., & Kongolo, M. (2004). Has affirmative action reached South African women? *Journal of International Women's Studies*, *6*(1), 124-136. https://vc.bridgew.edu/jiws/vol6/iss1/9

Orr, A. J. (2011). Gendered Capital: Childhood Socialization and the "Boy Crisis" in Education. *Sex Roles, 65*(3), 271–284.https//:doi:10.1007/s11199-011-0016-3

Pearlman, J. (2019). Occupational mobility for whom? Education, cohorts, the life course and occupational gender composition. *Research in Social Stratification and Mobility, 59* (4), 81-93, doi: 10.1016/j.rssm.2018.11.009

Piwowar-Sulej, K. (2021). Human resources development as an element of sustainable HRM–with the focus on production engineers. *Journal of cleaner production*, *278*, 124008. https://doi.org/10.1016/j.jclepro.2020.124008

Peixoto, A., González, C. S. G., Strachan, R., Plaza, P., de los Angeles Martinez, M., Blazquez, M., & Castro, M. (2018). *Diversity and inclusion in engineering education: Looking through the gender question*. IEEE. https://ieeexplore.ieee.org/abstract/document/8363494.

Peixoto, F., Mata, L., Campos, M., Caetano, T., Radišić, J., & Niemivirta, M. (2024). 'Am I to blame because my child is not motivated to do math?': Relationships between parents' attitudes, beliefs and practices towards mathematics and students' mathematics motivation and achievement. *European Journal of Psychology of Education*, *39*(2), 1561-1586. https://doi.org/10.1007/s10212-023-00774-6

Schultheiss, D. E. (2020). The role of gender in career development. *Career development and counseling: Putting theory and research to work*, 273-308.

Schreuder, A. & Coetzee, M. (2016). Careers: *An organisational perspective* (5th ed.). Cape Town: Juta and Company (Pty) Ltd.

Schreuder, A. M. G. & Coetzee, M. (2011). Careers: *An organisational perspective*. (4th edition). Cape
Town: Juta.

Smith, C. A., Wao, H., Kersaint, G., Campbell-Montalvo, R., Gray-Ray, P., Puccia, E., & MacDonald, G. (2021). Social capital from professional engineering organizations and the persistence of women and underrepresented minority undergraduates. *Frontiers in Sociology*, *6*, 671856. https://doi.org/10.3389/fsoc.2021.671856

Super, D. E. (1990). A life-span, life-space approach to career development. In D. Brown, L. Brooks, & Associates (Eds.), *Career choice and development: Applying contemporary theories to practice* (2nd ed). (197–261). San Francisco: CA: Jossey-Bass.

Starr, C. R., Gao, Y., Rubach, C., Lee, G., Safavian, N., Dicke, A. L., ... & Simpkins, S. D. (2023). "Who's Better at Math, Boys or Girls?": Changes in Adolescents' Math Gender Stereotypes

and Their Motivational Beliefs from Early to Late Adolescence. Education Sciences, 13(9), 866. https://doi.org/10.3390/educsci13090866

Stead, G. B., & Watson, M. (2017). The career development theory of Donald Super. *Career psychology in the South African context*.

Thébaud, S., & Taylor, C. J. (2021). The specter of motherhood: Culture and the production of gendered career aspirations in science and engineering. *Gender & Society, 35*(3), 395-421. https://doi.org/10.1177/08912432211006037

Tokbaeva, D., & Achtenhagen, L. (2021). Career resilience of female professionals in the male-dominated IT industry in Sweden: Toward a process perspective. *Gender, Work & Organization*, 30(1), 223-262. https://doi.org/10.1111/gwao.12671

Urbanaviciute, I., Pociute, B., Kairys, A., & Liniauskaite, A. (2016). Perceived career barriers and vocational outcomes among university undergraduates: Exploring mediation and moderation effects. *Journal of Vocational Behavior*, *92*, 12-21. https://doi.org/10.1016/j.jvb.2015.11.001

Venkatesan, V. (2020). *Breaking the Glass Ceiling: An explorative study to analyse if "Unconscious Bias" is slowing down the career advancement of women in the Irish corporate sector* (Doctoral dissertation, Dublin, National College of Ireland).

Weber, J. (2018). *Discrimination against Women in the Field of Engineering*. https://ecommons.udayton.edu/undergradvoices/3/

Wilson, D., & VanAntwerp, J. (2021). Left Out: A Review of Women's Struggle to Develop a Sense of Belonging in Engineering. *SAGE Open*, *11*(3). https://doi.org/10.1177/21582440211040791

Yan, D., Sunindijo, R. Y., & Wang, C. C. (2024). Analysis of Gender Diversity Initiatives to Empower Women in the Australian Construction Industry. *Buildings*, *14*(6), 1707. https://doi.org/10.3390/buildings14061707

Yates, J., & Skinner, S. (2021). How do female engineers conceptualise career advancement in engineering: a template analysis. *Career Development International*, *26*(5), 697-719. https:// doi: 10.1108/cdi-01-2021-0016

Zhang, Y. (2024). Discrimination against Women in the Workplace. *Journal of Education, Humanities and Social Sciences*, *27*, 135-140.

Zorotovich, J., Dove, M., & Myers, B. (2021). When Traditional Gender Roles Clash With Contemporary Expectations: A Call To Redefine Success in the Modern World. *Journal of Family & Consumer Sciences*, *113*(1), 62-66. https://doi.org/10.14307/JFCS113.1.62