ENGINEERING GRADUATES' EXPERIENCES OF CAREER PROGRESSION AFTER PARTICIPATING IN GRADUATE DEVELOPMENT PROGRAMMES

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ABSTRACT

This multiple case study critically investigates the career progression of engineering graduates following their participation in Graduate Development Programmes (GDPs) within the unique context of South Africa. It draws on Social Cognitive Career Theory (SCCT) as its guiding conceptual framework, facilitating a structured understanding of how self-efficacy beliefs, outcome expectations, personal goals, and contextual influences shape early-career development within engineering contexts.

To establish a robust theoretical foundation for the study, a systematised review was conducted. This review systematically evaluated the applicability of SCCT within the context of both GDPs and subsequent post-GDP career experiences. Findings from this review highlighted how GDPs serve as an institutionalised mechanism for fostering self-efficacy, enabling goal setting, and shaping career outcome expectations, all central to SCCT's explanatory framework. Critically, the review also identified significant gaps in existing literature, including limited research on the long-term influence of SCCT in the post-GDP phase, its underexplored intersection with socio-demographic variables like race and gender, and its role in the development of essential soft skills.

Building upon these insights, the study developed a specific conceptual framework that explicitly integrates key influencing factors. This framework maps the interplay between personal characteristics (such as race, gender, age, economic background, and language), organisational influences (including culture, leadership practices, and mentoring structures), and external disruptions (such as the COVID-19 pandemic and broader economic instability).

It posits how these dynamic factors collectively shape individuals' self-efficacy, outcome expectations, and personal goals, which in turn drive targeted career actions and ultimately influence diverse career progression pathways.

The empirical basis of this research lies in in-depth qualitative interviews conducted with a diverse cohort of 25 early-career engineers in South Africa who successfully completed GDPs and are now navigating the complexities of professional integration. A deductive thematic analysis, rigorously anchored in SCCT constructs, was employed to examine how participants made meaning of their GDP and subsequent workplace experiences, and how these influenced their skills development, career clarity, and strategic career behaviours.

The findings highlight the pivotal role of post-GDP learning experiences, including challenging projects, mentorship, formal training, feedback, and coaching, in facilitating mastery experiences and significantly enhancing professional self-efficacy among early-career engineers. These experiences also positively shaped career outcome expectations, leading participants to anticipate greater success in their professional endeavours and actively influencing their goal setting. The research confirms that engineers with higher self-efficacy are more likely to set ambitious and well-structured goals, which then drive proactive career actions such as pursuing promotions, seeking leadership roles, and acquiring advanced skills. Furthermore, mentorship, organisational support, and access to continuous learning opportunities consistently emerged as critical enablers of career advancement, fostering a crucial sense of purpose and direction.

Crucially, the study also illuminates how race, gender, institutional dynamics, and socio-economic context profoundly intersect with and often constrain career development processes in post-GDP transitions within the South African engineering sector. Participants frequently recounted facing identity-based barriers that hindered their progression, emphasising that career development is not purely self-determined but is significantly mediated by deeply ingrained systemic inequalities. The COVID-19 pandemic, acting as a significant career shock, forced many engineers to re-evaluate their aspirations and adapt to new, often precarious, labour market realities.

By providing theoretically grounded and contextually detailed insights, this research makes several significant contributions. Theoretically, it extends SCCT’s applicability to the

underexplored post-GDP career phase, incorporating the influence of socio-cultural, organisational, and structural dynamics into understanding early-career development, challenging assumptions of linear progression, and addressing the theory's underdeveloped engagement with systemic inequality. Empirically, it offers a richly textured, locally grounded account of the post-GDP phase in South Africa, documenting how macro-level disruptions and social identity profoundly shape engineers' trajectories. Finally, the study offers actionable implications and recommendations for the refinement of GDPs and for various stakeholders, including employers, HR practitioners, professional bodies, higher education institutions, and government departments, aiming to foster more equitable, structured, and supportive early-career pathways for engineering graduates in a transforming society

KEYWORDS: Graduate Development Programs (GDPs); Career Progression; Early-career Engineers; Social Cognitive Career Theory (SCCT)

Declaration

I declare that the Thesis entitled, “Engineering graduates’ experiences of career progression after participating in graduate development programmes”, which I hereby submit for the degree, Doctor of Philosophy at Rhodes University, is my own work. I also declare that this thesis/dissertation has not previously been submitted by me for a degree at this or any other tertiary institution and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Name Surname (*signed*)

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Firstly, I wish to thank my Lord and Saviour, Jesus Christ; when my strength failed me, He carried me through. But He said to me, *"My grace is sufficient for you, for my strength is made perfect in weakness." Therefore, I will boast all the more gladly about my weaknesses, so that Christ's power may rest on me"* (2 Corinthians 12:9). Secondly, I would like to extend my deepest gratitude to my supervisor, Prof. Noel Pearse, for his patience, mentorship, and guidance. I also wish to acknowledge the Engineering Council of South Africa (ECSA) for supporting my research and providing me with a broader pool of access to early-career engineers. My sincere thanks also go to the Department of Higher Education and Training (DHET) for awarding the University Staff Development Programme funding, which made this research possible. Furthermore, I would like to thank my family and friends for their unwavering support and motivation throughout my research. Lastly, and most importantly, I would like to express my heartfelt appreciation to the research participants who made themselves available and generously shared their experiences for this study.

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CHAPTER 1: Introduction and Project Overview

1.1 Introduction

Career development is a dynamic and multifaceted process, particularly for professionals transitioning from structured learning environments into autonomous roles within complex organisational settings. The period immediately following formal Graduate Development Programmes (GDPs) represents a pivotal stage in shaping long-term career trajectories, professional identity formation, and retention, especially in technical fields such as engineering (Rohde et al., 2019, Monteiro et al., 2019). While GDPs are increasingly leveraged as strategic tools to attract and nurture high-potential graduates (Ditlhale & van den Berg, 2024), the post-GDP phase, where individuals begin to operate with greater independence, is often marked by a decline in structured organisational support (Barbara et al., 2022). This abrupt shift requires early-career engineers to demonstrate heightened self-direction, navigate ambiguous organisational cultures, and align their professional aspirations with real-world constraints (Mpangeva & De Braine, 2024).

Understanding this transition is especially critical in contexts marked by socio-economic and structural inequalities, such as South Africa's engineering sector, where challenges around access, representation, and career progression persist (Fomunyam, 2017; Shaw & Kloot, 2025). The imperative to explore career development beyond initial training interventions, and through the lens of graduates themselves, is therefore particularly urgent. This study responds to that gap by examining the lived experiences of early-career engineers post-GDP, offering insight into how individual agency, organisational practices, and socio-cultural dynamics intersect to shape career outcomes. In doing so, it seeks to contribute to both scholarship and practice on graduate development, professional growth, and transformation in engineering workplaces.

1.2 Background and context

The transition from GDPs to independent professional practice represents a pivotal yet underexplored phase in the career trajectories of early-career engineers. While GDPs have been widely adopted as organisational tools to attract and develop talent, the moment graduates exit these programmes marks a shift from formalised support to self-directed career navigation. In this post-GDP phase, early-career engineers are expected to perform, progress, and professionalise, often without the structured mentorship, developmental clarity, and organisational investment that characterised their initial entry into the workforce (Naidoo, 2021). This stage is not merely transitional, it is formative. It is where engineers begin consolidating their professional identities, making consequential career decisions, and contending with organisational realities such as political dynamics, exclusionary cultures, or unclear promotion pathways. Yet, despite the career-shaping significance of this period, scholarly attention has remained concentrated on the design, implementation, and outcomes of GDPs themselves, rather than on what follows (Clarke & Scurry, 2020; Crowley-Henry et al., 2019). This leaves a critical gap in understanding how young professionals, especially those from historically disadvantaged backgrounds, navigate the evolving terrain of work after their formal development has ended.

In the South African engineering sector, the stakes of this transition are particularly high. The title "engineer" is not legally protected, but registration with the Engineering Council of South Africa (ECSA) is required to use professional designations such as Pr Eng, Pr Tech Eng, or Pr Eng Tech. Individuals with an accredited bachelor's degree may work as engineers, but only ECSA-registered practitioners may use protected professional titles (ECSA, 2020). The engineering profession plays a strategic role in national development and infrastructure delivery, yet it remains marked by racial and gendered inequities, with Black and female engineers underrepresented in leadership and technical decision-making roles (Steyn & Jackson, 2014; April & Govender, 2022). While transformative policies such as the Skills Development Act (1998) and Broad-Based Black Economic Empowerment (BBBEE) Act (2003) have sought to advance equity, the post-GDP period often exposes the limitations of such frameworks. Many early-career engineers face structural barriers, including limited access to mentorship, exclusion from informal networks, and racialised organisational cultures that hinder advancement (Visagie & Koekemoer, 2014; Sharma, 2016).

Compounding these challenges, the COVID-19 pandemic introduced further disruptions to early-career development. Social distancing protocols, remote work, and budgetary constraints disrupted hands-on learning and mentorship, weakening critical support structures and deepening existing inequalities (Guan et al., 2020; Woldegiorgis & Jonck, 2022). For engineers transitioning out of GDPs during or shortly after this period, the post-GDP phase has been experienced not only as a period of professional autonomy but also of precarity, uncertainty, and, in some cases, isolation.

Against this backdrop, the post-GDP phase emerges as a complex and consequential period, wherein early-career engineers must reconcile their professional aspirations, evolving self-concepts, and organisational realities without the structured developmental scaffolding typically provided during GDPs (Naukkarinen & Bairoh, 2022; Barbara et al., 2022). Understanding this phase requires a shift from programme-centric evaluations to a deeper engagement with the lived experiences of graduates navigating the uncertain, fluid, and often inequitable terrain of career progression (Shaw & Kloot, 2025; Larsen & Gärdebo, 2017). This study, therefore, redirects the analytic lens from GDPs as institutional interventions, to post-GDP career trajectories as critical spaces for identity formation, the enactment of agency, and the negotiation of structural barriers (Asfaw, 2022). By foregrounding the voices of early-career engineers in South Africa, the study aims to surface the ways in which emerging professionals construct meaning, exercise decision-making, and encounter constraint in the formative stages of their working lives, long after the structured pathways of GDPs have concluded (Ditlhale & van den Berg, 2024).

1.3 Problem statement

While GDPs are designed to launch the careers of young engineers, less attention is paid to the post-GDP phase, where engineers must independently manage their professional development. This phase is critical to long-term career success and retention in the profession, but empirical research on what enables or constrains progression beyond GDPs is lacking in both global and South African contexts (Patton & McMahon, 2014; Mphahlele & Diale, 2022). Moreover, South Africa's engineering sector continues to struggle with transformation imperatives. Early-career Black engineers, in particular, face challenges such as marginalisation, unequal access to mentorship, and limited representation in senior roles (Cloete et al., 2020). These experiences remain underrepresented in existing research, which often emphasises recruitment practices and

GDP design, rather than examining longer-term career development outcomes or post-programme trajectories (Murire, Cilliers & Chinyamurindi, 2024; Samuel et al., 2020. This study, therefore, investigates the lived experiences of early-career engineers post-GDP, with an emphasis on how race, organisational support, and self-efficacy shape their professional development trajectories.

1.4 Rationale and significance of the study

Graduate Development Programmes (GDPs) are widely adopted as strategic tools for talent acquisition, capacity building, and transformation, particularly in contexts like South Africa, where the imperative for redress is tightly interwoven with skills development. Despite their prevalence, there remains a significant paucity of empirical research on the long-term career progression of graduates beyond the structured confines of GDPs. While extensive international scholarship has explored various dimensions of GDPs, including programme design (Lv et al.,, 2023), return on investment (Clarke, 2017; Shibiti & Mulaudzi, 2024), graduate identity (Tomlinson, 2017; Tomlinson & Jackson, 2021), satisfaction levels (Jackson & Bridgstock, 2021; Brits, 2018), and the psychological contract (Clarke & Scurry, 2020; Deas & Coetzee, 2020), relatively few studies have tracked the transition into independent professional roles and the career progression that follows.

Furthermore, the literature is heavily skewed toward organisational perspectives, often adopting a unitarist approach that prioritises employer objectives over the lived realities of graduates (Clark-Ambrosini et al., 2022). This creates a critical gap that this study seeks to address by amplifying graduate voices and examining career development from the vantage point of early-career professionals. Such a graduate-centred lens allows for deeper exploration of self-efficacy, goal orientation, and developmental constraints, concepts that are central to the Social Cognitive Career Theory (SCCT), which underpins this study. The need for research contextualised within South Africa is particularly urgent. GDPs in South Africa are not merely talent management instruments but also vehicles for socio-economic transformation, aimed at redressing historical inequalities through affirmative action and Black Economic Empowerment (BEE) initiatives (Dunne & Bosch, 2015). As such, the factors influencing graduate career progression in South Africa are likely to differ markedly from those observed in developed economies, where much of the existing literature is situated (Coetzee et al., 2019, Mavutha, et al., 2024, Clarke & Scurry, 2020).

Moreover, while the broader concept of career progression has received substantial attention both locally and internationally (e.g., Doubell & Struwig, 2014; Jacob & Klein, 2019; Hansen, 2020; Mwashita, Zungu, & Abrahams, 2020; Kobus-Olawale et al., 2021), its specific application to early-career graduates remains under-theorised and empirically neglected. Kotylar (2018) posits that many organisations are hesitant to identify and nurture advancement potential in graduates due to their limited professional experience, a perspective that may hinder inclusive and future-oriented talent development. By focusing on early-career engineers who have completed GDPs in South Africa, this study makes three key contributions: (1) it expands the theoretical application of SCCT by exploring how self-efficacy, outcome expectations, and personal goals interact with structural and contextual variables in the post-GDP phase; (2) it offers a graduate-informed perspective that rebalances the dominant organisational narratives; and (3) it generates insights relevant to South Africa's policy context, particularly in relation to transformation, employability, and equitable career development.

1.5 Research Objectives

The primary aim of this study is to critically investigate the lived experiences and career progression trajectories of engineering graduates emerging from GDPs, with a specific emphasis on early-career engineers. To achieve this overarching goal, the study delineates the following specific objectives:

1. Conduct a systematic review of the SCCT theoretical framework to identify research gaps to be addressed in this study.
2. Explore the career progression experiences of graduates since they completed their GDPs, including the impact of COVID-19 and its associated lockdowns.
3. Identify the role of self-efficacy, goal-setting, and social support in helping graduates to develop new skills and competencies required as early-career engineers.
4. Examine the level of support the graduates of GDPs have received in their careers since the completion of the GDP.
5. Formulate recommendations on how early-career engineers can be supported after GDP participation.

1.6 Research Questions

This study is guided by the following central and subsidiary research questions, which aim to interrogate the complex and contextual dynamics shaping the post-GDP career trajectories of early-career engineers in South Africa:

1. How do early-career engineers experience the transition from GDPs into independent professional roles?
2. What personal and organisational factors support or constrain their career progression?
3. How do race, gender and socio-economic background influence access to developmental opportunities?
4. How do self-efficacy, outcome expectations, and personal goals influence career trajectories?
5. What are the policy implications of the research gaps identified in the systematic review of the SCCT for the design and implementation of GDPs?

1.7 Theoretical Framework

This study adopts Social Cognitive Career Theory (SCCT), developed by Lent, Brown, and Hackett (1994), as the guiding theoretical lens to understand the career progression of early-career engineers beyond GDPs. SCCT provides a robust framework for examining the interplay between personal, behavioural, and environmental factors in shaping career-related outcomes. Central to SCCT are three interlinked variables: self-efficacy beliefs, outcome expectations, and personal goals. These constructs influence how individuals form career interests, make decisions, navigate barriers, and persist in the face of challenges (Lent et al., 1994). In the context of post-GDP transitions, SCCT's emphasis on self-efficacy is particularly pertinent. As early-career engineers exit the structured environment of GDPs and enter more autonomous roles, their beliefs about their ability to succeed in new tasks and navigate workplace complexity become critical. The theory posits that mastery experiences, vicarious learning, verbal persuasion, and affective states contribute to the development of self-efficacy, which in turn influences persistence and performance (Bandura, 1986; Lent et al., 1994).

Furthermore, SCCT foregrounds the role of goal setting and outcome expectations in career development. Early-career professionals in the post-GDP phase often reassess or redefine their career aspirations, set new developmental goals, and seek alignment with long-term career visions. Understanding the formation and adjustment of these goals within the context of real-world work experience is essential for grasping the trajectory of career growth (Lent, 2020). Equally important are the social and contextual affordances or barriers that shape these career paths. SCCT explicitly acknowledges the influence of environmental factors, such as organisational culture, mentorship availability, and socio-economic constraints, in facilitating or hindering career progress. These dynamics are particularly salient in the South African context, where issues such as transformation, equity, and workplace inclusivity intersect with individual development pathways (Lent, 2020).

While SCCT has been widely employed in career development research across various populations and contexts, its application to the post-GDP phase of early-career graduates remains underexplored. Much of the existing literature utilises SCCT to study career interest development or educational transitions, with limited attention to how individuals sustain motivation, adapt to evolving career demands, or overcome systemic barriers once formal programmes end. Several studies highlight SCCT's versatility and applicability in diverse graduate populations. For instance, Dos Santos (2018) used SCCT to explore the career experiences of first-generation postsecondary graduates, highlighting the importance of social support and identity negotiation. In the South African context, Abe, Chikoko, and Lubinga (2021) applied SCCT to investigate the relationship between career outcome expectations and decision-making self-efficacy among STEM students. Similarly, Park and Park (2020) applied SCCT to examine how support for career development influences adaptability in South Korean engineering graduates. These and other studies (e.g., Metheny & McWhirter, 2013; Chan, 2018) demonstrate the relevance of SCCT in capturing the complexities of early-career development.

Despite these contributions, there is a notable gap in research that leverages SCCT to understand the post-programme career experiences of graduates who have completed structured interventions like GDPs. This study addresses that gap by applying SCCT qualitatively to explore how early-career engineers interpret their self-efficacy, construct outcome expectations, and set or revise career goals within real-world organisational settings. The qualitative orientation of this study

aligns with recent scholarship that emphasises the value of SCCT in exploring subjective experiences, contextual influences, and meaning-making processes (Lent, 2013). Overall, SCCT provides a theoretically rich and empirically grounded lens through which to examine the lived experiences of early-career engineers in South Africa, particularly in the post-GDP phase where support structures diminish, and personal agency becomes more pronounced. By integrating SCCT with qualitative inquiry, this research contributes to both theoretical advancement and practical understanding of how individuals navigate complex career pathways beyond structured graduate development.

1.8 Delimitation of the study

This study is deliberately focused on the post-GDP phase of early-career engineers within the South African engineering sector. The scope is limited to individuals who have either fully completed or partially exited GDPs and are navigating their early professional trajectories beyond these structured programmes. By concentrating on this specific transitional period, the research aims to provide in-depth insight into career progression challenges and enablers that emerge once formal developmental support diminishes. The study excludes analysis of the design, implementation, or effectiveness of GDPs themselves, as well as the experiences of graduates prior to or during their participation in such programmes. Additionally, the research is confined to the engineering discipline, acknowledging the unique professional registration processes and industry-specific contextual factors that influence career development in this field. Geographically, the study is situated within South Africa, thereby reflecting the socio-economic, racial, and legislative realities particular to this national context. As such, findings may not be generalisable to early-career engineers in other countries with different labour market structures, regulatory environments, or socio-political histories. Furthermore, the study adopts a qualitative research design focused on subjective experiences and perceptions, which means that while rich contextual understanding will be generated, statistical generalisation is beyond its scope.

1.9 Research Design and Methodology Overview

This study adopts a qualitative research methodology situated within an interpretivist paradigm to explore the career progression experiences of early-career engineers following their participation in GDPs. The interpretivist paradigm is underpinned by the assumption that reality is socially

constructed and that understanding individuals' lived experiences requires deep engagement with their subjective meanings and contextual realities (Kamal, 2019). This orientation is particularly well-suited for exploring how early-career engineers make sense of their professional identities, challenges, and developmental pathways in the post-GDP phase. A multiple case study design (Yin, 2018) was employed to enable an in-depth, comparative examination of engineers' experiences across different organisational contexts. This design choice enhances analytical generalisation and allows for the identification of both convergent and divergent themes across cases. The focus on multiple cases is especially relevant in the South African context, where race, institutional culture, and socio-economic background intersect in complex ways to shape access to developmental opportunities and career advancement (Carrim, 2021).

Data were collected through semi-structured interviews with a purposively selected sample of early-career engineers who had completed formal GDPs within the past 2-5 years. Purposive sampling ensured that participants had relevant post-GDP experience and were able to reflect critically on their developmental journeys. The interviews explored participants' transitions from structured development to independent roles, the influence of self-efficacy and goal-setting, the quality of organisational support received, and perceived barriers and enablers of career progression. Semi-structured interviews were chosen to allow for depth, flexibility, and responsiveness to the lived realities of participants while maintaining alignment with the study's conceptual focus on SCCT (Lent et al., 1994). Interviews were conducted virtually or in person, depending on participants' availability and geographic location, and were recorded and transcribed with informed consent.

In addition, the data were analysed using a deductive thematic approach, guided by the research propositions developed for this study. Initial codes were derived directly from these propositions, and related codes were then grouped to form categories. These categories were further refined and synthesised into overarching themes that reflected patterns across the dataset in alignment with the theoretical framework. This approach ensured that the analysis remained focused on the research objectives while maintaining methodological rigour.

Moreover, NotebookLM, an AI-powered research and writing tool developed by Google, was utilised to support the analytical process. While not a specialised qualitative analysis software such

as NVivo or ATLAS.ti, it assisted in organising notes, managing source material, and synthesising information, thereby enhancing the transparency and traceability of the analytical workflow. The chosen research design and methodology are aligned with the study's interpretive aims and theoretical commitments. By drawing on in-depth interviews, a case study design, and theoretically informed thematic analysis, the study produces context-sensitive insights into the career trajectories of early-career engineers (Yin, 2018). This approach provides a robust foundation for understanding how personal agency, organisational practices, and socio-cultural dynamics interact to influence career development in post-GDP contexts.

1.10 Terms and definitions

To aid clarity, key terms and definitions used throughout the thesis are provided in a dedicated section. This ensures consistency in meaning and helps the reader navigate the subsequent chapters.

Term	**Definition**	**Chapter**
Early-career Engineers	Engineers within the initial stages of their professional journey, often transitioning from education or training into full professional practice.	Chapter 1,2, 4, 5, 6
Post-GDP phase	The stage in an engineer's career following the completion of a GDP, characterised by increased responsibility, autonomy, and the need for continued professional development.	Chapter 1,2,4, 5
Career Progression	The process of advancing and developing one's career over time, often involving moving from lower-level to higher-level positions, acquiring new skills, and taking on increased responsibilities	Chapters 1, 2, 3, 4, 5, 6
Graduate Development Programs (GDPs	Structured initiatives designed to support recent graduates in their transition from education to the workforce, typically involving training, mentorship, skill development, and exposure to various aspects of a profession	Chapters 1, 2, 3, 4, 5, 6

Lived Experiences	The unique, personal, and subjective encounters, feelings, and perspectives individuals have in their daily lives, which shape their understanding and worldview	Chapters 1, 2, 3, 4, 5, 6
Self-Efficacy	A person's belief in their capability to successfully perform specific tasks or achieve particular goals. In the context of career progression, self-efficacy relates to an individual's confidence in their ability to navigate challenges and reach career objectives	Chapters 1, 2, 3, 4, 5, 6
Goal-Setting	The process of defining specific and measurable objectives that an individual aspires to achieve within a particular timeframe. In career progression, goal-setting involves planning and working towards professional accomplishments	Chapters 1, 2, 3, 4, 5, 6
Social Cognitive Career Theory (SCCT)	A theoretical framework that emphasises the interplay of self-efficacy, outcome expectations, goals, and social factors in shaping an individual's career decisions and actions	Chapters 1, 2, 3, 4, 5, 6
Mentorship	A supportive relationship between an experienced individual (mentor) and a less experienced individual (mentee), aimed at providing guidance, advice, and knowledge transfer to support the mentee's personal and professional growth	Chapters 1, 2, 3, 4, 5, 6
Networking	The process of building and maintaining relationships with individuals who share common interests or professional goals. Networking can provide opportunities for learning, collaboration, and career advancement	Chapters 1, 2, 3, 5, 6
Organisational Support	The resources, assistance, and encouragement provided by an organisation to its employees to facilitate their job performance, career development, and overall well-being	Chapters 1, 2, 3, 4, 5, 6
Professional Growth	The ongoing process of enhancing one’s knowledge, skills, and experiences to advance in a chosen career path, achieve personal goals, and contribute effectively to one's field	Chapters 1, 2, 3, 5

Mastery Experiences	Recognised as the most influential source of self-efficacy development, these occur when individuals successfully complete complex projects, lead initiatives, or solve critical problems, thereby gaining confidence in their ability to handle future challenges	Chapters 3, 6
Social Persuasion	The encouragement and feedback received from peers, supervisors, and mentors, which enhances an individual's confidence in their abilities and motivates them to take on increasingly complex responsibilities	Chapters 3, 6
Career Shock	An unexpected, high-intensity event that necessitates a reassessment of career trajectories and professional goals, often leading to significant disruptions in professional progression. The COVID-19 pandemic is cited as an example	Chapter 3, 5, 6
Career Adaptability	The ability to proactively navigate labour market shifts and continuously adjust to evolving industry demands, technological advancements, and organisational structures, and involves flexibility in setting and revising professional goals	Chapter 2, 3, 5, 6
Linear Career Growth	Characterised by upward mobility within predefined hierarchical structures, where individuals advance through designated career stages, typically accompanied by increased leadership responsibilities and financial incentives	Chapter 3
Lateral Movement	A career strategy involving transitioning into roles with similar levels of responsibility but in different technical areas, industries, or functions, allowing engineers to diversify their skill sets	Chapter 3
Spiral Career Progression	A career approach that refers to a combination of lateral and upward moves, where professionals cycle through various roles, accumulating diverse experiences before potentially moving into a senior leadership position	Chapter 3

Hybrid Career Paths	Career models that allow engineers to transition between technical, managerial, and project-based roles, offering flexibility and exposure to various facets of the profession by integrating elements of both technical and leadership trajectories	Chapter 3
Professional Certification	The process of acquiring industry-specific accreditations (e.g., ECSA Professional Engineer Certification) to enhance credibility and career prospects within an engineering field	Chapter 3
Organisational Culture	The collective values, norms, beliefs, and behaviours that greatly influence how work is conducted, how employees interact, and how individuals progress in their careers within a company	Chapter 3
Self-Direction	The heightened autonomy required by early-career engineers to navigate ambiguous organisational cultures and align professional aspirations with real-world constraints, particularly in the post-GDP phase, where structured organisational support declines	Chapter 1, 3, 5
Transformation	In the South African context, this refers to the imperative to redress historical inequalities through affirmative action and Black Economic Empowerment initiatives, promoting equity and professional growth within the engineering sector and broader workplaces	Chapter 1, 3, 6
Contextual Disruptions	A major theme in the study, which refers to broader socio-economic, political, and global events (like the COVID-19 pandemic and economic instability) that significantly influence career opportunities and progression	Chapter 5
Professional Identity Reconstruction	A process during which graduates renegotiate their self-concept and professional roles in response to workplace expectations, often after formal training, to integrate knowledge, skills, and values relevant to their profession	Chapter 6

Organisational Navigation	Refers to the strategic interpretation of informal norms, power dynamics, and institutional constraints in complex workplace environments, an area often left unaddressed by structured programs and requiring high levels of self-agency	Chapter 6

1.12 Thesis structure

This section provides an overview of the thesis structure and how it is organised. This section is essential in presenting the research and findings in a coherent and organised manner.

Chapter One: Introduction and Project Overview This chapter introduces the study by providing background and context on the career progression of engineering graduates after Graduate Development Programmes (GDPs) in South Africa, highlighting the problem statement and the study's rationale and significance. It outlines the research objectives and questions, presents Social Cognitive Career Theory (SCCT) as the guiding theoretical framework, and offers an overview of the research design and methodology.

Chapter Two: Literature Review – Career Development This chapter provides an overview of foundational career development theories, with a specific focus on the Social Cognitive Career Theory (SCCT) and its components. It presents a systematised review that evaluates the applicability of SCCT within Graduate Development Programmes (GDPs) and post-GDP career experiences, identifying key insights and gaps in the existing literature.

Chapter Three: Literature Review - Social Cognitive Career Theory and Early-career Engineers This chapter synthesises literature on the career development of early-career engineers in the post-GDP phase, particularly in South Africa, anchored in Social Cognitive Career Theory (SCCT). It explores how personal attributes, learning experiences, and contextual factors (including external disruptions like COVID-19) interact with SCCT constructs such as self-efficacy, outcome expectations, and goal setting to shape career progression and actions taken.

Chapter Four: Research Methodology This chapter details the systematic framework used to address the research problem, outlining the qualitative research methodology within an

interpretivist paradigm. It explains the multiple case study design, data collection through semi-structured interviews, sampling design and procedure, and the thematic analysis approach used for interpreting findings. Additionally, it addresses ethical considerations, ensuring the validity, reliability, and integrity of the study.

Chapter Five: Findings and Discussions This chapter presents the empirical findings from the in-depth qualitative interviews with early-career engineers, organised into ten data-driven propositions. It discusses how external disruptions (like COVID-19), personal characteristics, post-GDP learning experiences, and organisational influences shape career outcome expectations, self-efficacy, and goal setting, highlighting both supporting and contradictory evidence. The chapter also aligns these findings with the study's research objectives and conceptual framework.

Chapter Six: Conclusion and Recommendations This final chapter synthesises the study's key insights, contributions, and implications. It restates the research aim and objectives, summarises the major findings, and articulates the theoretical and empirical contributions of the study to the field of career development, particularly extending SCCT. Crucially, it formulates evidence-based recommendations for various stakeholders to enhance post-GDP career support and foster more equitable pathways for engineering graduates in South Africa

CHAPTER 2: Literature Review – Career Development

2.1 Introduction

Chapter 1 established the research problem, highlighting the pivotal yet underexplored nature of the post-Graduate Development Programme (post-GDP) phase in the career progression of engineers, particularly within South Africa's context of transformation and systemic inequality. Chapter 2 lays the theoretical foundation for the study by first reviewing foundational career development theories and then focusing intensively on the Social Cognitive Career Theory (SCCT), which serves as the guiding conceptual framework. A key feature of this chapter is a systematised review conducted to critically evaluate the existing application of SCCT in GDP and post-GDP contexts, culminating in the identification of critical gaps that necessitate further empirical investigation.

The chapter explores five influential career development theories; Theory of Work Adjustment (TWA), Holland's Theory of Vocational Personalities, Super's Self-Concept Theory, Gottfredson's Theory of Circumscription and Compromise, and SCCT; to provide a comprehensive understanding of how individual, social, and environmental factors interact to shape career paths. These frameworks offer valuable insights into how early-career professionals navigate their trajectories, particularly in the post-GDP phase, where individuals transition from structured development into more autonomous and strategic career decision-making.

The systematised review further evaluates SCCT's applicability in the post-GDP phase, with particular emphasis on factors shaping the career trajectories of early-career engineers. Through a structured synthesis of existing literature, the review uncovers patterns, insights, and gaps, demonstrating the relevance of SCCT in informing career development practices beyond structured GDP environments. Ultimately, Chapter 1 bridges theoretical frameworks with real-

world application, offering a nuanced understanding of how career development unfolds once formal graduate programmes conclude, particularly within the engineering context.

2.2 Career Development Theories

Career development theories provide critical frameworks for understanding how individual, social, and environmental variables interact to influence career trajectories. As Yates (2025) outlines, five dominant theoretical approaches underpin the field of career development: the Theory of Work Adjustment (Dawis, 2002, 2005), Holland's Theory of Vocational Personalities in Work Environment (Holland, 1985), Super's Self-Concept Theory of Career Development (Super, 1980), Gottfredson's Theory of Circumscription and Compromise (2002), and the Social Cognitive Career Theory (Lent, Brown & Hackett, 1994). These frameworks offer models for synthesising research, guiding inquiry, and developing strategies to optimise career outcomes.

The Theory of Work Adjustment focuses on the alignment between an individual's skills, interests, and values and the demands of a job and the work environment. Successful alignment, or "work adjustment," is linked to higher job satisfaction and career success (Dawis, 2002, 2005). Holland's theory emphasises the relationship between personality types and occupational environments, suggesting that congruence between the two leads to enhanced job satisfaction and career achievement (Holland, 1985). Super's Self-Concept Theory highlights the role of self-concept in vocational behaviour, identifying five career stages - growth, exploration, establishment, maintenance, and decline - that reflect changes in self-concept over time (Super, 1980). Savickas (1997) extended this theory by emphasising the importance of a personal narrative in shaping vocational identity, arguing that individuals construct meaning in their careers through storytelling and self-reflection. Gottfredson's (2002) Theory of Circumscription and Compromise addresses the social and cognitive processes influencing career aspirations, highlighting how individuals limit their career options based on self-perceptions and societal expectations, and make compromises in response to perceived barriers and opportunities. This theory emphasises the adaptive nature of career decision-making as individuals navigate constraints in their environments.

Finally, the Social Cognitive Career Theory (SCCT), as elaborated by Lent, Brown, and Hackett (1994), integrates personal, environmental, and behavioural factors to explain career development processes. SCCT identifies self-efficacy, outcome expectations, and goal-setting as key determinants of career behaviour, making it particularly relevant for examining how Graduate Development Programmes (GDPs) influence the career trajectories of early-career engineers. Through skills development, expanded social networks, and exposure to diverse opportunities, GDPs have the potential to enhance graduates' self-efficacy and facilitate their career progression. The application of SCCT is central to this study, providing a lens through which to explore the subjective experiences of graduates as they transition from structured development into autonomous professional roles. This theoretical framework enables an in-depth analysis of how personal factors, such as self-efficacy beliefs, interact with organisational support structures and environmental barriers to shape career progression.

SCCT also offers valuable insights into how GDPs contribute to career development by fostering observational learning, skill acquisition, and the cultivation of career-related self-efficacy; elements that are particularly critical in the post-GDP phase. Each of the career development theories discussed provides valuable insights into the mechanisms that influence career progression. While TWA, Holland's theory, Super's model, and Gottfredson's framework contribute essential perspectives on career decision-making, SCCT offers a particularly comprehensive approach by integrating individual, environmental, and social influences. This makes SCCT especially relevant for exploring the role of GDPs in supporting graduate career development. By emphasising the importance of self-efficacy and experiential learning, SCCT aligns with the broader aims of this study, which seeks to provide an in-depth understanding of how GDPs shape the career trajectories of graduates.

2.3 A Systematised Review of Social Cognitive Career Theory and Graduate Development Programmes

To establish a robust foundation for this study, a systematised review was conducted to evaluate the applicability of Social Cognitive Career Theory (SCCT) within the context of Graduate Development Programmes (GDPs) and post-GDP career experiences. Systematised reviews, while not as exhaustive as full systematic reviews, adhere to structured methodologies to ensure rigour,

transparency, and reproducibility in synthesising existing literature (Phillips & Barker, (2021). This approach was employed to critically assess the extent to which SCCT's core constructs (i.e. self-efficacy, outcome expectations, and personal goals) are reflected in the experiences and career trajectories of early-career engineers who had been enrolled in GDPs.

Guided by the PRISMA framework (Sataloff, Bush, Chandra, Chepeha, Rotenberg, Fisher & Welling, 2021); Sarkis-Onofre, Catalá-López, Aromataris & Lockwood, 2021), this review systematically identified, screened, and analysed peer-reviewed studies that examined the intersection of SCCT and structured career development initiatives. The primary objective was to ascertain theoretical alignment, evaluate empirical support, and identify existing gaps in the literature concerning the role of SCCT in facilitating career progression for early-career engineers. Findings from the review provide critical insights into the applicability and limitations of SCCT in structured early-career development settings. Specifically, the review highlights how GDPs serve as an institutionalised mechanism for fostering self-efficacy, enabling goal setting, and shaping career outcome expectations; all of which are central to SCCT's explanatory framework. Additionally, the analysis highlights the potential of SCCT in addressing key challenges such as skills acquisition, career adaptability, and systemic barriers (e.g., gender and organisational culture) that influence the longer-term career trajectories of early-career engineers.

By systematically evaluating the relevance of SCCT in the context of early-career engineers who have participated in GDPs, this review offers both a theoretical and empirical foundation for examining the effectiveness of career development interventions in engineering. The findings contribute to ongoing discussions on how structured programmes can apply SCCT principles to support the professional growth, retention, and advancement of engineering graduates, while also promoting greater workforce diversity within the discipline.

2.3.1 Research Methods

This systematised review employed a structured and transparent search strategy to explore the applicability of SCCT in shaping the career trajectories of early-career engineers who had participated in GDPs. A systematised review includes key elements of a systematic review, such as a clearly defined research question, comprehensive literature search, and structured synthesis, while allowing greater flexibility in scope, process, and inclusion criteria. Unlike traditional

narrative literature reviews, which are often more subjective and descriptive, systematised literature reviews follow a systematic process with clearly defined methods for identifying, selecting, and analysing relevant studies (Sataloff et al., 2021). However, they differ from full systematic reviews in that they may be conducted by a single researcher, may not involve exhaustive database searches or double screening, and often have more pragmatic constraints in academic contexts.

To ensure broad coverage of relevant literature, the review utilised multiple academic databases, including Web of Science, EBSCOhost, and Google Scholar. The initial search yielded 162 studies. After removing duplicates and applying a rigorous screening process guided by predefined eligibility criteria, the final dataset was refined to 41 high-quality sources. These studies were then categorised by research design (qualitative, quantitative, and mixed methods) and career stage (educational preparation, experience within GDPs, and post-GDP early-career integration). This classification enabled a nuanced exploration of SCCT's application across different phases of early-career engineering development.

To enhance methodological rigour, various appraisal checklists were applied to assess the quality and potential bias across the selected studies. The review adopted a manifest qualitative content analysis approach (Graneheim, Lindgren & Lundman, 2017), which allows for the identification of explicit themes, patterns, and categories within textual data; particularly useful in synthesising how SCCT informs career decision-making, self-efficacy, goal-setting, and career outcomes in early-career engineers. The structured synthesis facilitated the identification of shared themes and divergent findings across the literature, enriching the theoretical and practical implications of the review.

In line with best practices, the review process and results are reported following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Sarkis-Onofre, Catalá-López, Aromataris & Lockwood, 2021). A PRISMA flow diagram, included in this chapter, provides a visual summary of the identification, screening, eligibility, and inclusion stages, enhancing transparency and enabling replication.

Despite its methodological strengths, certain limitations are acknowledged. While every effort was made to include a comprehensive range of relevant studies, some literature may not have been captured due to database constraints or search term limitations. Furthermore, the specific focus on early-career engineers within the context of GDPs may limit generalisability to other engineering or professional contexts. Nevertheless, this review makes a valuable contribution to the theoretical and applied understanding of SCCT in structured early-career development interventions.

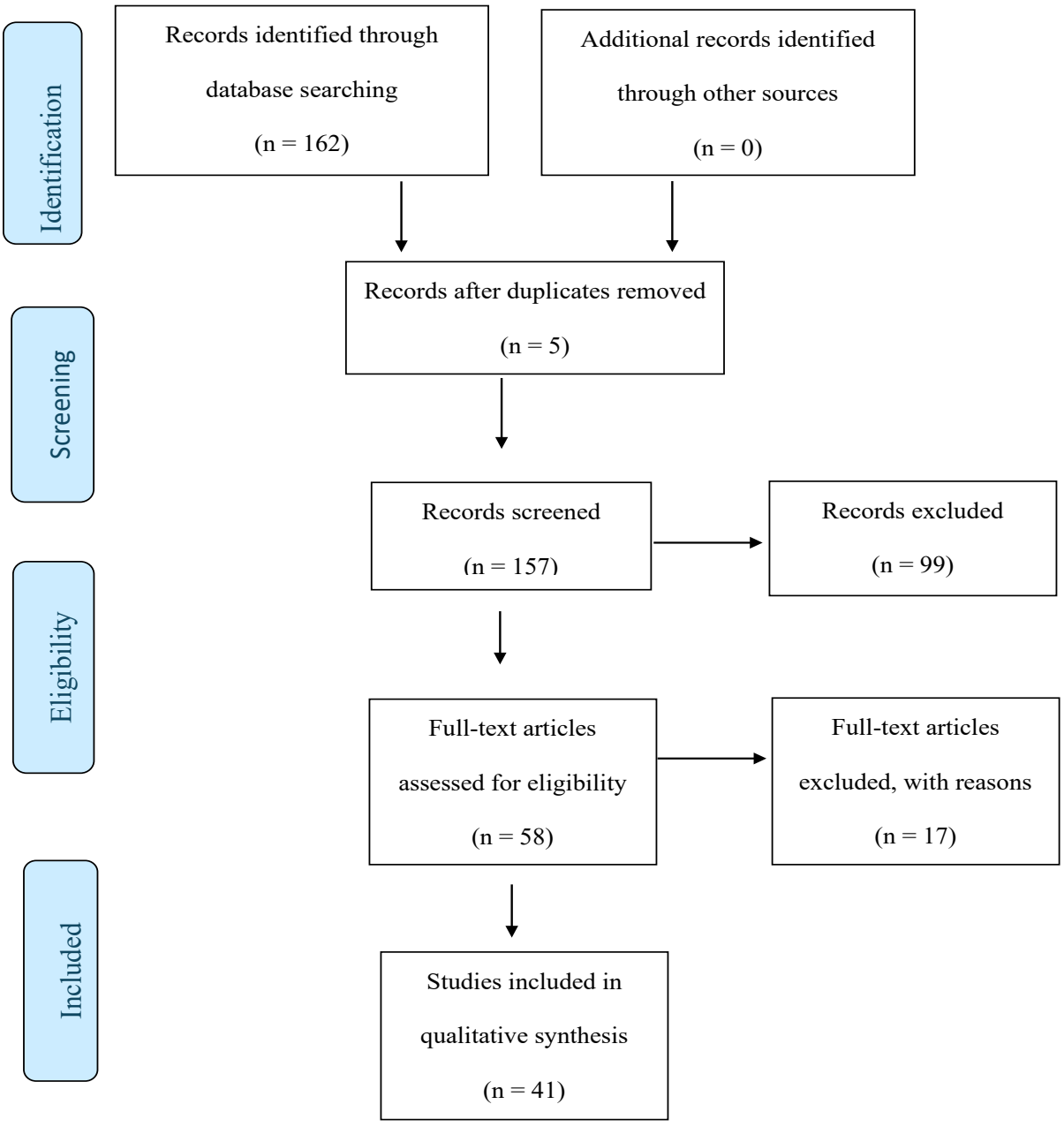
By employing a systematised approach to literature retrieval, appraisal, and synthesis, this study offers a robust, transparent, and replicable investigation into how SCCT can illuminate the career development experiences of early-career engineers in the post-GDP phase. The findings not only inform academic discourse but also offer practical insights for designing and evaluating career development programmes in the engineering sector.

2.3.2 Eligibility Criteria

In this review, the inclusion criteria were: (1) peer-reviewed journal articles and conference proceedings that meet the criteria of rigour and relevance, (2) studies published from 2014 onwards, (3) studies that focus on early-career engineers, entry-level engineers or graduates of engineering programmes, (4) studies applying SCCT principles or interventions related to SCCT in the context of career development and (5) research on GDPs. The exclusion criteria were: (1) studies published before 2014, (2) studies that do not focus on early-career engineers, entry-level engineers or graduates and (3) articles published in non-English languages.

A systematised review was employed, and it was aimed at analysing the role of SCCT in shaping the career trajectories of early-career engineers emerging from GDPs. A literature search across various scientific databases and libraries was conducted using the inclusion criteria to identify relevant publications. Electronic databases, including Web of Science, Emerald, SABINET, and EbscoHost (specifically Academic Search Complete, APA PsycArticles, Business Source Complete, and MasterFILE Premier) were utilised, along with SocINDEX with Full Text, and ScienceDirect. The search strategy incorporated keywords such as ‘social cognitive career theory’ and ‘graduates,’ ‘early-career engineers’ or ‘entry-level engineers’ or ‘junior Engineers,’ ‘career development’ and ‘graduate engineers,’ and ‘graduate development programmes’ or ‘development programs’ and ‘career development.’ This method yielded a total of 162 records.

Figure 2.1: PRISMA Flow Diagram



2.3.3 Study Selection

The bibliographic data of the 162 retrieved records were exported into Rayyan to check and remove duplicates. A total of five duplicates were detected. These were removed, and 157 entries remained. The exclusion criteria of studies before 2014 and non-English publications were then

applied, resulting in fifty-eight remaining publications. Finally, the references used in the selected articles and their citations were reviewed manually to get further relevant papers. The screening of titles and abstracts was done to ensure relevance to the study, and a total of forty-one publications were found to be relevant. Figure 2.1 shows the PRISMA Flow Diagram for this selection process.

2.3.4 Data analysis

The manifest qualitative content analysis approach was used to identify the main themes and sub-themes concerning SCCT's influence on the career trajectories of early-career engineers participating in GDPs. In the manifest qualitative content analysis approach, researchers analyse the text's explicit, surface-level meanings and characteristics rather than interpreting underlying or latent meanings (Graneheim et al., 2017). Each research participant was treated as a single unit of analysis.

2.3.4.1 Results of the systematised review

After searching the databases and removing duplicates, forty-one studies were selected for inclusion in the review, comprising 25 qualitative, 14 quantitative, and two mixed-method articles, all retrieved from academic libraries. These articles were systematically categorised by research design and career stage to provide a structured analysis of engineering education, GDPs, and early-career experiences. The categorisation by research design included qualitative studies using interviews, focus groups, and case studies to gain in-depth insights into individual experiences and career trajectories of early-career engineers. Quantitative studies consisted of surveys, statistical analysis, and other methods to examine patterns and trends in the career progression of early-career engineers. The mixed-method studies combined both approaches for a comprehensive understanding. Tables 2.1 to 2.3 provide an overview of the studies included in the systematised review, categorising them according to the stage each study covers, namely the education, GDP, or post-GDP/early-career stage. The Tables detail the study design of each, as well as the themes explored.

Table 2.1: Results of the systematised review for the Education Stage (21 articles)

Methods/Design	Themes
Quantitative (9):	Career coaching
Handley & Berdanier, 2019	Career intentions/decision
Jelks & Crain, 2020	making/choices
Luo, Stoeger & Subotnik, 2022	Engineering education
Lv, Zhang, Liu, Wang & Wang, 2023	Gender stereotypes
Medugorac, Sverko, Babarovic, 2020	Identity
Ng,Trupp, Phongpanichanan, 2023	Social support
Pshembayeva, Pfeyfer, Uaikhanova &	STEM
Bubenchikova, 2022	
Udayanan, 2019	
Uwakwe, Okolie, Ehiobuche, Ochinanwata, Idike,	
2023	
Qualitative (11):	
Carpi, Ronan, Falconer & Lents, 2017	
Craps, Pinxten, Knipprath & Langie, 2021	
Craps, Pinxten, Knipprath & Langie, 2022	
Guo & Ayoun, 2022	
Jordan, Coates, Gottlieb, Soares, Shah & Love, 2021	
Olson, 2024	
Shi, 2023	
Vehmaa, Karvinen, & Keskinen, 2018	
Winters, 2012	
Wylie & Kim, 2022	
Young, Dawes & Senadji, 2024	
Mixed methods (1):	
Yoel & Dori, 2022	

Regarding the education category career stage, the 21 articles listed in Table 2.1 highlight undergraduate programmes and STEM education, examining the impact of education on students' perceptions, skills, and career readiness, as well as addressing issues like gender disparities and the integration of skills. This stage emphasised how early educational experiences shape students' self-efficacy, outcome expectations, and resilience, thereby developing crucial components of SCCT. Studies within this stage often examined how undergraduate education influences career intentions and the development of both technical and interpersonal skills, which are essential for future professional success.

Table 2.2: Results of the systematised review for the GDP Stage (15 articles)

Methods/Design	Themes
Quantitative (7):	Employability
Bennett, Knight & Bell, 2020	Graduate Development Programs (GDPs)
Chen & Lalovic, 2019	Mentoring
Clarke & Scurry, 2020	Psychological contract
Flening, Asplund & Grimheden, 2022	School-to-work transition
Gupta & Ansari, 2023	Skills mismatch
Hirudayaraj, Baker, Baker & Eastman, 2021	Talent management
Xin, Tang, Li & Zhou, 2020	
Qualitative (8):	
Clark-Ambrosini, Ashleigh, Higgs & Baruch, 2023	
Hawse & Wood, 2018	
Nwajiuba, Binuomote, Ehiobuche, Igu & Ajoke, 2020	
Trevelyan, 2019	
van der Marel, Björklund & Sheppard, 2024	
Woolnough & Lesley, 2014	
Woolnough & Fielden, 2017	
Dasgupta et al. (2015)	
Zhu, Hu, Li, Zhang & Li, 2022	

The GDP category included the 15 articles that are listed in Table 2.2 and explored the transitional phase from education to employment, emphasising the significance of employability, job search behaviours, and career decision-making confidence. Articles in this category examined how perceptions of employability and proactive career behaviours alleviate stress and improve job outcomes. The SCCT framework was particularly relevant here, providing insights into the interplay between personal values, systemic issues, and career decisions. Studies highlighted the importance of mentoring programmes, career counselling services, and tailored support in enhancing graduates' self-efficacy and career readiness. This stage also delved into the influence of personality traits, socioeconomic factors, and goal setting on career outcomes, highlighting the need for comprehensive support systems within GDPs to help graduates navigate the complexities of the job market.

Table 2.3: Results of the systematised review for the Post-GDP/Early-career Stage (5 articles)

Methods/Design	Themes
Qualitative (5): Björklund, Gilmartin, Sheppard, 2022 Huff, Smith, Jesiek, Zoltowski & Oakes, 2019 Jesiek, Buswell & Nittala, 2021 Naukkarinen & Bairoh, 2022 Osten, 2023	Engineering competencies Gender stereotypes Identity

The five articles listed in Table 2.3 that were relevant to the post-GDP or early-career stage focused on the experiences of early-career engineers, particularly those who participated in GDPs. These studies examined professional identity development, workplace integration, and the essential skills required for career advancement. Studies in this category addressed the challenges early-career engineers face in aligning with established engineering identities and overcoming gender-specific barriers. The SCCT framework was used to understand how self-efficacy, outcome expectations, and social support systems influence early-career success and job satisfaction. Articles emphasised the need for continuous professional development, mentorship, and support to help early-career engineers develop the technical proficiency, teamwork, communication, and interpersonal skills necessary for effective collaboration and innovation in the workplace. Additionally, studies highlighted the importance of fostering an inclusive workplace culture that supports diversity and addresses systemic barriers to ensure the retention and success of early-career engineers.

2.3.4.2 Presentation of themes

The findings of the present systematised review revealed three main themes, each with accompanying sub-themes, which shed light on the role of SCCT in shaping the career trajectories of early-career engineers from GDPs. The main themes reflect the stages of graduates' early-career development under three categories: education, GPD and post GDP/early-career. The identified sub-themes are STEM, engineering education, career intentions/decision making/choices, career coaching, identity, gender stereotypes, social support, employability, skills mismatch, mentoring, school-to-work transition, psychological contract, GDPs and talent management, engineering competencies, race, gender, engineering identity development, and innovation in engineering practice. Based on the analysis of the findings, many studies focus on the education theme (21 articles), followed by the GDP theme (15), with the post-GPD/ early-career theme having the lowest frequency (5 articles). Studies have mainly employed qualitative methods and comprise twenty-five articles, followed by 15 quantitative studies and one mixed-method study. It should be noted that nothing was found in the reviewed literature concerning the application of SCCT on early-career engineers who have participated in GDPs. The few studies that closely relate to the research study have been found to be on the post-GDP/ early-career theme, which indicates that the application of SCCT on early-career engineers after GDPs is a neglected research area.

2.3.4.3 ***Education***

The reviewed studies shed light on the multifaceted influence of undergraduate programmes on students' perceptions and their subsequent ability to gain valuable work experience (Wylie & Kim, 2022). Notably, undergraduate participation significantly shapes students' perceptions of their expertise and collaborative abilities, laying the groundwork for their transition into the professional realm. This highlights the importance of early educational experiences in shaping future career trajectories. In STEM education, considerable attention has been directed towards understanding the factors influencing students' intentions regarding their future work duration within the field (Međugorac, Šverko & Babarović, 2020). This scrutiny reflects a broader effort to comprehend the dynamics of career decision-making among STEM undergraduates and the factors that drive their career aspirations. Moreover, the evolving landscape of engineering education has seen a notable shift towards emphasising both hard and soft skills, recognising the multidimensional demands of the engineering profession in contemporary society (Vehmaa, Karvinen & Keskinen, 2018). This shift indicates the need for engineering graduates to possess technical prowess and

interpersonal competencies essential for effective collaboration and problem-solving in diverse professional settings. The studies also indicate that gender disparities persist within STEM education and careers, with pervasive stereotypes continuing to influence girls' decisions to pursue STEM degrees (Luo, Stoeger & Subotnik, 2022). The pervasive societal beliefs regarding girls' perceived aptitude in mathematics and science contribute to their underrepresentation in STEM fields, necessitating the imperative for targeted interventions aimed at fostering diversity and inclusivity.

It is evident from the current study that studies employing the SCCT framework provide valuable insights into the complexities of graduates' career decisions and trajectories. SCCT offers a comprehensive lens through which to examine the interplay of factors such as self-efficacy, outcome expectations, and resilience, particularly in the face of challenges such as the COVID-19 pandemic (Ng, Trupp & Phongpanichanan, 2023; Shi, 2023). By clarifying the cognitive processes and behavioural mechanisms underlying graduates' career decisions, SCCT enhances our understanding of how individuals navigate the ever-changing landscape of career opportunities. Furthermore, occupational stigma and the challenges associated with graduates' career choices, including perceptions of prestige and societal validation, remain significant barriers that require nuanced approaches for effective resolution (Lv, Zhang, Liu, Wang & Wang, 2023). Holistic career coaching programmes have emerged as a promising avenue for equipping graduates with the essential skills and support systems necessary to navigate the complexities of the modern job market (Pshembayeva, Pfeyfer, Uaikhanova & Bubenchikova, 2022). It has also been indicated that graduates' engineering identity experiences throughout their undergraduate journey play a pivotal role in shaping their professional self-perception and long-term career commitment (Young et al., 2024). Engineering identity encompasses a myriad of factors influenced by academic, personal, and professional experiences, highlighting the importance of fostering a sense of belonging and purpose within the engineering community (Young et al., 2024). By nurturing a strong engineering identity among students, educational institutions can cultivate a pipeline of resilient and committed professionals poised to tackle the challenges of the future.

In addition, the findings from the studies reveal that engineering graduates have diverse career aspirations shaped by factors like faculty relationships, outcome expectations, and family

commitments (Winters, 2012). Economic fluctuations and geographic constraints also influence their career decisions, often favouring stability. Despite challenges, graduates demonstrate adaptability by widening their job searches to navigate market changes, which is crucial for career contentment in a dynamic job landscape. The changing engineering landscape demands integrating leadership and professional skills into undergraduate programmes (Handley & Berdanier, 2019). Based on the reviewed studies, undergraduate education should prioritise skills like problem-solving and teamwork, emphasising interpersonal aptitude. Effective engineering leadership requires technical proficiency and managerial skills (Handley & Berdanier, 2019). It is also noted that employers highly value various professional competencies in young engineers, but graduates often lack mastery of all required skills (Craps, Pinxten, Knipprath & Langie, 2021). Bridging this gap requires closer collaboration between employers and education providers. Moreover, despite advancements in engineering education, graduates still lack clarity on career paths. Overcoming these challenges is essential for adequately preparing them for their professional careers (Craps *et al.,* 2022).

2.3.4.4 *Graduate Development Programmes*

The plethora of research in the field illuminates the intricate dynamics surrounding employability and its profound impact on job search behaviours and stress management among graduates. Gupta and Ansari (2023) explain the pivotal role of employability perceptions, highlighting how they shape job search strategies and alleviate stress levels, particularly among proactive graduates who exhibit a clearer vision of their employment goals. Their study highlights the importance of proactive career behaviours and targeted job searches, which are posited to correlate positively with the quality of employment obtained, driven by anticipated outcomes and perceived opportunities. Furthermore, Okolie, Nwajiuba, Binuomote, Ehiobuche, Igu and Ajoke (2020) draw attention to a significant gap between the skills cultivated in Higher Education (HE) settings and the evolving demands of employers, advocating for comprehensive curriculum reforms and the integration of robust career development initiatives within HE programmes. Delving deeper into the intricacies of career decision-making processes, Xin et al., (2020) explore the multifaceted relationship between career decision-making confidence (CDSE), proactive personality traits, clarity of career success criteria (CSCC), and family socioeconomic status. Their findings emphasise the importance of proactive personality traits and a well-defined career orientation in enhancing CDSE, empowering individuals to navigate transitions confidently.

Similarly, Chen and Lalovic's (2019) examination of doctoral trainees' career trajectories sheds light on the challenges encountered within academia, emphasising the role of goal setting in positively influencing career outcomes amidst academic uncertainties. In response to these research insights, universities are proactively adapting by offering tailored career counselling services and refining training programmes to better equip graduates for the contemporary job market. The reviewed studies indicate that integrating the SCCT framework proves instrumental in understanding the nuanced interplay between personal values, systemic issues, and career decisions (Trevelyan, 2019). Additionally, there is a growing recognition of the pivotal role of self-efficacy in enhancing job search efficacy, particularly among underrepresented groups. Furthermore, the reviewed studies highlight the imperative of addressing socio-technical skills, productivity, entrepreneurship, and value generation within engineering education to bolster graduates' employability (Trevelyan, 2019). Mentoring initiatives led by experienced professionals emerge as vital conduits for socialisation and skills development, particularly for early-career engineers who may initially resist non-technical coursework but ultimately require collaboration skills for workplace success (Trevelyan, 2019).

Graduate Development Programmes (GDPs) emerge as crucial platforms for nurturing future leaders; however, challenges in aligning graduate and employer expectations may impede programme effectiveness (Clark-Ambrosini, Ashleigh, Higgs and Baruch, 2023). Effective talent management strategies necessitate clear communication and aligning participant expectations with organisational realities (Clarke & Scurry, 2020). Moreover, mentoring programmes are instrumental in breaking gender stereotypes and fostering career progression within engineering. For example, Dasgupta et al. (2015) found that same-gender peer mentoring improved women's motivation, verbal participation, and career aspirations in engineering.

Whether targeted at women or graduate engineers, these programmes serve as integral components of talent management, preparing graduates for sustainable and successful careers (Clarke, 2017). The significance of both technical (hard) and interpersonal (soft) skills in engineering careers cannot be overstated.

While technical skills have traditionally been emphasised, there is a growing recognition of the importance of soft skills such as communication and adaptability (Hirudayaraj, Baker, Baker and Eastman, 2021). Labour economists observe an increasing demand for these social skills, even within technical fields, signalling a shift in priorities. Personality traits like conscientiousness and sociability significantly impact success (Flening, Asplund & Grimheden, 2022). Based on the reviewed studies, the labour market increasingly values social and interpersonal skills, necessitating tailored training for technical professions (Hirudayaraj, Baker, Baker & Eastman, 2021). A common theme in the studies is the discourse on engineering skills. A study by Flening et al., 2022) emphasises the importance of non-technical skills, noting challenges for new engineers transitioning to engineering practice due to a lack of professional skills, alongside technical expertise.

There is an emphasis in the research on the integration of technical and social skills as being essential for effective collaboration (Flening *et al.,* 2022). The reviewed studies also emphasise organisational induction programmes as playing a crucial role in preparing engineering graduates for the demands of professional practice (Hawse & Wood, 2018). These programmes can facilitate the transition from university to work, addressing aspects like workplace expectations, professional identity development, and skills models. The studies indicate that young graduates, especially in developing countries, encounter numerous job market challenges, leading to high unemployment rates (Hawse and Wood, 2018). Some of the challenges identified in engineering education include the perceived lack of practical skills among graduates (Zhu, Hu, Li, Zhang and Li, 2022). The reviewed studies also focus on graduate decision-making. It is argued that understanding factors affecting career decisions, especially regarding gender and race, is vital for promoting diversity in engineering (van der Mare et al., 2024).

The studies highlight the importance of development programmes for graduates. These programmes address technical competencies and emphasise the development of personal traits and psychological resilience, which are essential for thriving in dynamic professional environments. Moreover, the pivotal role of mentoring and social connections in promoting STEM retention and supporting underrepresented groups cannot be overstated (Jelks & Crain, 2020). Mentorship programmes provide invaluable guidance and support to students, helping them navigate the

complexities of their chosen career paths and overcome barriers to success. Similarly, GDPs have emerged as effective platforms for equipping students with the requisite skills and competencies to succeed in today's competitive job market (Pshembayeva, Pfeyfer, Uaikhanova & Bubenchikova, 2022). These programmes offer targeted interventions aimed at addressing personal traits, skills, and psychological factors critical for graduates' professional development and long-term career success.

2.3.4.5 *Post-GDP/ Early-career*

Studies examining post-GDP and early-career engineers highlight the significant influence of identity development on early-career engineers, with challenges arising from aligning with the prevailing engineering identity (Huff, Smith, Jesiek, Zoltowski & Oakes, 2019). The studies also reveal that women engineers encounter stereotypes and barriers in teamwork, impeding their workplace integration (Naukkarinen & Bairoh, 2022). Often, efforts aimed at promoting diversity overlook systemic barriers. Therefore, addressing biases and fostering inclusivity is paramount for supporting women in engineering. Workplace culture, work-life balance, and equitable treatment are identified as critical factors for retaining women in engineering (Osten, 2023). Moreover, the studies highlight the importance of technical proficiency, teamwork, communication, and interpersonal skills for early-career engineers (Jesiek *et al*., 2021). Early-career professionals driving innovation face obstacles such as limited supervisor support and networks (Björklund, Gilmartin & Sheppard, 2022). There is an emphasis that addressing biases and power dynamics is imperative for cultivating a culture of innovation within organisations.

2.3.5 Gaps Identified through the Systematised Review

Drawing on Sandberg and Alvesson's (2011) typology of research gaps, this review identifies several significant gaps that warrant further investigation in the context of post-GDP career trajectories of early-career engineers, particularly through the lens of SCCT.

The first gap, a lack of empirical support, is evident in the limited research examining the long-term influence of SCCT on engineers' career development following their participation in GDPs. While SCCT has been widely used to understand career entry and early development, there is a scarcity of empirical studies that explore how its key constructs (i.e. self-efficacy, outcome expectations, and personal goals) continue to shape professional growth, leadership development, and sustained career satisfaction in the post-GDP phase. Addressing this gap would deepen our

understanding of how early-career engineers navigate complex professional environments beyond initial structured support.

Secondly, an empirical multiplicity gap is identified in the underexplored intersection of SCCT with socio-demographic variables such as gender, race, and socioeconomic background. Although some literature addresses disparities in engineering education and career access, there is insufficient exploration of how these intersectional identities interact with SCCT constructs to influence post-GDP career trajectories. Investigating this interaction is essential for informing equity-driven interventions and creating inclusive career development frameworks within the engineering sector.

Thirdly, a theory application gap emerges from the insufficient attention paid to how SCCT can explain or inform the development of soft skills - such as communication, teamwork, and adaptability - during the early career phase. As engineering careers increasingly require hybrid technical and non-technical competencies, the absence of research linking SCCT constructs to the acquisition and application of soft skills limits the theory's utility in reflecting the multidimensional demands of modern engineering roles.

Collectively, these gaps highlight the need for nuanced, theory-informed research that advances both the practical application and theoretical development of SCCT within the context of post-GDP career trajectories for early career engineers.

2.3.6 Research Implications

This systematised review highlights the need to apply SCCT more explicitly within the context of early career engineers, especially those emerging from GDPs. The insights gained can enhance our understanding of how self-efficacy, outcome expectations, and goal setting influence the career trajectories of these professionals. The findings emphasise the importance of career development tailored to the unique needs of early career engineers. Career development practitioners can use SCCT to better support individuals in identifying their career interests, setting achievable goals, and developing strategies to overcome obstacles. This tailored approach can improve career satisfaction and professional success among early-career engineers. In addition, organisations can design GDPs that integrate SCCT principles to foster career development more effectively. By focusing on self-efficacy and outcome expectations, these programmes can better prepare

graduates for the challenges of their professional journeys, enhancing their readiness and confidence in navigating their careers.

Moreover, the review highlights the need for policies that support integrating technical and interpersonal skills in engineering education. Educational institutions and policymakers can use these insights to develop curricula that focus on technical expertise and foster soft skills such as communication, teamwork, and leadership, which are critical for career advancement. The persistent gender disparities and stereotypes highlighted in the review point to the need for targeted interventions to foster diversity and inclusivity within engineering fields. Policies and programmes designed to support underrepresented groups, such as women in engineering, can help mitigate these disparities and promote a more inclusive professional environment. The review also identifies a significant gap between the skills developed in higher education and those demanded by employers. This calls for closer collaboration between educational institutions and industry to ensure that engineering graduates possess the competencies required for professional success. Practical initiatives such as GDPs and industry partnerships can bridge this gap effectively.

The review highlights the critical role of mentoring and support systems in career development. Organisations should implement structured mentoring programmes to support early career engineers, facilitating professional growth and workplace integration. These programmes can help bridge the gap between academic preparation and real-world engineering practice. The findings suggest the need for continuous professional development opportunities for early-career engineers. Employers should provide ongoing training and development programmes to help engineers adapt to evolving industry demands and technological advancements. This approach can enhance career resilience and long-term employability. The scarcity of studies focusing on the post-GDP/early career stage indicates a neglected research area. Future research should explore how SCCT can be applied to understand and support the career development of early career engineers after completing GDPs. This can provide valuable insights into the long-term impacts of GDPs on career trajectories. By addressing these implications, the review contributes to the academic discourse on career development and provides actionable insights for universities, policymakers, employers, and future researchers. This holistic approach ensures that the findings have a meaningful impact on improving the career trajectories of early-career engineers.

2.3.7 Conclusions

The systematised review highlights the intricate role of SCCT in shaping the career trajectories of early-career engineers from GDPs. The findings emphasise the need for a focused application of SCCT to this specific population, revealing notable gaps in the existing literature. The three main themes, education, GDP experiences, and post-GDP/early career stages, highlight distinct aspects of career development. Yet, they also expose the dearth of research on how SCCT directly influences early-career engineers' trajectories post-GDP. This gap signifies a critical area of research to explore, particularly given early-career engineers' unique challenges and opportunities in transitioning from tertiary education to industry. The review highlights the significant impact of undergraduate education on career intentions and decision-making, emphasising the importance of technical and soft skills. It also highlights the persistent gender disparities and stereotypes within STEM education, suggesting the necessity for targeted interventions to foster diversity and inclusivity. The role of employability perceptions, proactive career behaviours, and the alignment of skills cultivated in higher education with employer demands are crucial in shaping graduates' job search strategies and stress management. The importance of mentoring, social support, and tailored career development initiatives is also highlighted, particularly in enhancing self-efficacy and job search efficacy among underrepresented groups. The least explored area, the post-GDP/early career stage, reveals the influence of identity development, workplace culture, and systemic barriers on career progression. Women engineers face significant challenges due to stereotypes and a lack of inclusivity. The studies reviewed suggest that fostering a strong engineering identity and promoting a culture of innovation and support are essential for retaining diverse talent in engineering fields.

2.4 Chapter Summary

Chapter 2 provided an overview of career development theories, with a focus on Social Cognitive Career Theory, which integrates personal, environmental, and behavioural factors that shape career development. Theories like the Theory of Work Adjustment, Holland's Vocational Personality Theory, Super's Self-Concept Theory, and Gottfredson's Circumscription and Compromise contribute insights into job satisfaction, self-concept, and career decision-making, while SCCT emphasises self-efficacy, goal-setting, and outcome expectations, which are central to career behaviour.

In addition to these theoretical perspectives, the chapter presented a systematised review of the application of SCCT within Graduate Development Programmes, specifically for early-career engineers. This review critically evaluated how the SCCT's constructs of self-efficacy, outcome expectations, and goal setting, align with the experiences and career trajectories of graduates. Findings from the review highlight how GDPs foster self-efficacy and support career goal development, which are crucial for career progression. It also identified gaps in the literature, including a lack of research on the long-term impact of SCCT post-GDP and the intersectionality of gender, race, and socio-economic factors in engineering careers.

Ultimately, this chapter highlighted the importance of integrating SCCT into GDPs to enhance career development, with a particular emphasis on self-efficacy and goal setting as key drivers of career success. The review provides the empirical foundation for examining how SCCT informs the career trajectories of early career engineers and sets the stage for the study's further exploration of these dynamics.

CHAPTER 3: LITERATURE REVIEW - Social Cognitive Career Theory and Early-career Engineers

3.1 Introduction

Chapter 2 concluded by confirming that, while Social Cognitive Career Theory (SCCT) is a relevant framework, significant gaps remain, particularly regarding its long-term influence in the post-GDP phase and its interaction with socio-demographic variables such as race and gender. This chapter addresses these theoretical and empirical gaps by providing a comprehensive synthesis of literature that integrates the core SCCT constructs; self-efficacy, outcome expectations, and personal goals; with the lived experiences of early-career engineers. Crucially, the synthesis incorporates key contextual factors, including personal characteristics, organisational influences, and external disruptions such as COVID-19, to build the Conceptual Framework and derive the ten research propositions guiding the empirical analysis of this study.

The transition from structured graduate development into independent professional practice marks a critical juncture in early-career engineers' trajectories. While GDPs provide foundational skills and organisational orientation, they represent only the initial phase of career formation (Ye, Liu, & Tan, 2022). The post-GDP phase, characterised by reduced formal support, greater professional autonomy, and heightened performance expectations, demands deeper scholarly attention (Abe & Chikoko, 2020). In this phase, early-career engineers must navigate a complex landscape shaped by individual agency, organisational dynamics, and broader socio-economic and political forces. Yet, literature capturing these nuanced experiences, particularly in the Global South and racially stratified societies like South Africa, remains limited.

This chapter critically synthesises literature on the career development of early-career engineers beyond structured training, with a particular focus on the post-GDP phase. Anchored in SCCT, the review examines how personal attributes, such as self-efficacy and career outcome expectations,

interact with learning experiences and contextual affordances to shape goal-directed behaviour and long-term career outcomes. While SCCT is widely applied in career studies, few investigations extend the model to the post-GDP environment in engineering or adequately consider the role of race, structural inequalities, and macro-level disruptions such as COVID-19 (Akkermans, Seibert, & Mol, 2018; Yin, 2018; Ye, Liu, & Tan, 2022).

The literature further shows that post-GDP learning experiences; mentoring, informal coaching, workplace exposure, and continuing professional development; play a critical role in enhancing self-efficacy and recalibrating career expectations (Abe & Chikoko, 2020; Ye, Liu, & Tan, 2022). At the same time, external disruptions such as economic volatility, policy shifts, and transformation agendas, particularly in South Africa's post-apartheid labour market, impose unpredictable constraints on perceived opportunity structures (Mabugu & Hlongwane, 2025). These factors interact to influence not only engineers' motivation and confidence but also the goals they pursue and the career actions they are willing or able to take.

Against this backdrop, the chapter explores the interrelations among self-efficacy, outcome expectations, goal setting, learning experiences, and career behaviours, highlighting how these constructs manifest uniquely in the South African engineering context. Race is foregrounded as a persistent structural variable shaping access to developmental opportunities and perceptions of fairness within organisations. The review also challenges assumptions of linear career progression, proposing a more fluid understanding that encompasses lateral moves, adaptive responses, and non-traditional trajectories. By integrating insights from career theory, engineering education, organisational psychology, and transformation studies, this chapter lays the conceptual groundwork for the study's propositions, illuminates existing knowledge, and identifies critical gaps; particularly the limited theorisation of post-GDP career development in racially diverse, economically volatile settings. These gaps underscore the importance of a contextually grounded understanding of how early-career engineers develop, adapt, and progress amid internal ambition and external constraints.

3.2 Social Cognitive Career Theory

Social Cognitive Career Theory (SCCT) is an extension of Social Cognitive Theory (SCT), which was originally formulated by Albert Bandura in 1986 (Lent, Brown, & Hackett, 1994). However, the conceptual origins of SCCT can be traced back to Social Learning Theory, which Bandura introduced in the 1970s (Lent & Brown, 1996). A significant development in this theoretical framework occurred in 1977 when Bandura introduced the concept of self-efficacy, a key construct within behavioural Change Theory. Self-efficacy was identified as a critical factor in enabling individuals to develop confidence, enhance abilities, and trust in their competencies, forming a foundation for personal and professional growth (Lent & Brown, 1996). By the early 1980s, Social Cognitive Theory had evolved to place greater emphasis on self-efficacy as a determinant of career development and professional excellence (Damodar, Shetty, Dsouza, Prakash & Gudi, 2024). Further refinements and revisions to SCCT led to its expansion to account for the influence of genetic predispositions, learning experiences, and environmental factors on career decision-making (Lent et al., 1994). This broadened scope allowed SCCT to move beyond a purely psychological framework and integrate sociological and environmental considerations, ultimately positioning it as a comprehensive career development model (Lent et al., 1994, 1996).

SCCT draws from foundational career development theories, including the work of Super (1980), Krumboltz (1976), Lofquist & Davis (1978), and Lent & Brown (2006, 2008, 2013), to explain the complex interplay between educational experiences, career interests, and occupational behaviour (Lent, Brown, & Hackett, 1994, 2000). The primary aim of SCCT is to provide a theoretical framework for understanding how individuals develop career aspirations, make career-related decisions, achieve professional success, and experience workplace satisfaction and well-being. A fundamental premise of SCCT is that individuals possess a degree of personal agency in shaping their career trajectories. However, career development is not purely self-determined; rather, individuals must navigate external influences that either facilitate or constrain their agency. SCCT identifies three core constructs that govern individual agency in career development (Lent et al., 1994):

a) Self-Efficacy - The belief in one's ability to successfully perform tasks and achieve career goals.

b) Outcome Expectations - The anticipated consequences of engaging in particular career-related actions.
c) Personal Goals - The aspirations that individuals set to direct their career progression and motivation.

By integrating these components, SCCT provides a robust explanatory model that connects educational and work-related behaviour, offering insights into how individuals develop career interests, navigate challenges, and attain long-term career success. This theory has been widely applied across disciplines to examine career decision-making, workplace engagement, and professional fulfillment, making it one of the most influential models in career development research (Brown & Lent, 2019).

3.2.1 Self-Efficacy Beliefs

Self-efficacy is a fundamental construct within SCCT, first introduced by Albert Bandura as a key determinant of human motivation, behaviour, and self-regulation (Klassen & Klassen, 2018). Bandura (1994:72) defines self-efficacy as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives." This definition highlights three core elements that underpin self-efficacy:

a) Subjective Nature and Self-Appraisal - Self-efficacy is highly subjective, relying on an individual's beliefs and perceptions about their competencies rather than objective measures. Through a process of self-assessment and reflection, individuals construct beliefs about their ability to execute specific tasks successfully.
b) Performance Standards and Goal Orientation - Self-efficacy is closely linked to goal-setting and performance expectations. Individuals who hold strong self-efficacy beliefs set challenging goals and exert greater effort to achieve performance objectives. In contrast, individuals with low self-efficacy may experience self-doubt, lack of motivation, and avoidance behaviours.
c) Resilience and Adaptability - A strong sense of self-efficacy influences how individuals approach challenges and failures. Those with high self-efficacy perceive setbacks as opportunities for learning and growth, whereas those with low self-efficacy may view failure as a fixed limitation of their abilities (Bandura, 1994).

Individuals who possess high self-efficacy demonstrate greater perseverance in the face of obstacles, actively seeking ways to overcome barriers rather than succumbing to discouragement. For instance, in a professional setting, an individual with high self-efficacy would perceive career advancement barriers as temporary challenges that can be navigated through strategic effort and skill acquisition. On the other hand, those with low self-efficacy may feel overwhelmed by external challenges, leading to disengagement from career progression initiatives (Klassen & Klassen, 2018). Beyond professional performance, self-efficacy also has significant implications for mental well-being. Research suggests that individuals with low self-efficacy are more susceptible to stress, anxiety, and depressive symptoms, primarily due to their tendency to view setbacks negatively and struggle with self-doubt (Klassen & Klassen, 2018).

3.2.2 Outcome Expectations

Outcome expectations are a central construct in SCCT and are defined as the anticipated consequences of engaging in a particular behaviour or action (Lent, Brown & Hackett, 2000). These expectations shape an individual's motivation, effort, and persistence in career-related activities by influencing their perception of potential rewards or consequences. In essence, individuals evaluate the likely outcomes of their actions based on their past experiences, social influences, and the contextual information available to them. Within professional settings, individuals frequently assess the potential benefits and risks of their behaviours. For instance, an early career engineer who consistently delivers high-quality work may expect career advancement, salary increments, or professional recognition based on the established performance-reward structures within their organisation. These expectations are formed through personal experiences, vicarious learning, and organisational norms regarding career progression (Lent et al., 2000). Outcome expectations are closely intertwined with self-efficacy beliefs, as individuals tend to engage in activities where they anticipate positive and valued outcomes (Lent et al., 2000). These outcomes may include tangible rewards such as financial compensation, career mobility, and job security, as well as intangible benefits such as job satisfaction, skill enhancement, and professional recognition. Consequently, individuals are more likely to commit to tasks and persist in the face of challenges when they foresee desirable career outcomes as a result of their efforts.

3.2.3 Goal Setting

Personal goals are intentional and purposeful objectives that individuals set to guide their professional trajectories and enhance their performance within their respective fields (Chan, 2020). These goals serve as self-regulatory mechanisms that shape behaviours, sustain motivation, and influence the degree of effort exerted towards achieving career-related aspirations (Chan, 2020). Within the context of engineering, personal goals may encompass technical proficiency, leadership development, innovation, or contributions to strategic organisational projects. Personal goals are inherently linked to self-efficacy and outcome expectations, as they provide a structured framework through which individuals organise, direct, and maintain their career efforts even in the absence of external feedback (Chan, 2020). The alignment between an individual's competencies and aspirations plays a crucial role in reinforcing or adjusting self-efficacy beliefs and shaping perceptions of anticipated career outcomes. Thus, goal-setting is not only instrumental in defining one's career path but also in sustaining resilience when encountering setbacks (Chan, 2020).

3.3 Career Actions Taken

Career actions taken by engineers play a crucial role in shaping their professional development, career trajectory, and overall career success. Engineers with high career self-efficacy actively engage in skill-building and competence enhancement (Quinn, Bowers, Hadiandehkordi & Garst, 2021). These individuals are more likely to engage in career development activities such as networking, technical training, and participating in Graduate Development Programs (GDPs) or other professional development initiatives (Lent, Ireland, Penn, Morris & Sappington, 2017). Career self-efficacy also encourages engineers to make informed and confident decisions regarding their career paths, leading them to pursue roles that align with their skills, interests, and aspirations (Wu et al., 2020). Moreover, engineers with high self-efficacy are more resilient when facing career challenges, such as professional uncertainty or complex decision-making (Chiesa, Massei & Guglielmi, 2016).

In addition to technical skill-building, engineers often seek professional certification (e.g., Project Management Professional (PMP), Six Sigma, or industry-specific accreditations) to enhance their credibility and career prospects (Nguyen et al., 2020). In South Africa, professional registration through the Engineering Council of South Africa (ECSA) represents a critical career milestone for engineers. ECSA, a statutory body established under the Engineering Profession Act (Act No. 46

of 2000), is responsible for regulating the engineering profession and ensuring adherence to standards of professional competence and ethics (ECSA, 2020). The process of registration typically begins with graduates entering the profession as Candidate Engineers after completing an accredited engineering degree. During this phase, candidates undergo a structured period of workplace training and experiential learning, often spanning three to four years, under the supervision of a registered Professional Engineer. This stage is comparable to graduate development programmes (GDPs) and is intended to bridge the gap between academic knowledge and professional practice.

Upon meeting the prescribed competencies, candidates may apply for registration as a Professional Engineer (Pr.Eng.), which requires the submission of a comprehensive portfolio of evidence, demonstration of independent problem-solving, adherence to ethical standards, and successful completion of a professional review process (ECSA, 2020). Registration confers professional recognition, enhances credibility, and is often a prerequisite for assuming senior technical and managerial responsibilities. Professional registration thus functions not only as a regulatory requirement but also as an important marker of career development, signalling the transition from early career engineer to an established professional with full accountability and authority.

Moreover, engaging in mentorship, both as mentors and mentees, provides valuable industry insights, supports career progression, and fosters knowledge transfer (Ragusa & Crampton, 2017). Furthermore, cross-disciplinary collaboration has become a key career action, as engineers increasingly work with professionals from other fields; such as business, data science, or sustainability; to develop innovative solutions and remain competitive in evolving industries (Chen, 2025). Career exploration, planning, and goal-setting become central actions for these engineers, enhancing their preparedness for entering the workforce or transitioning into more senior roles (Lent, Ireland, Penn, Morris & Sappington, 2017). These proactive behaviours not only build technical and managerial expertise but also increase engineers' marketability and adaptability, ultimately contributing to long-term career growth and satisfaction (Moin et al., 2019). Engineers who believe in their professional capabilities tend to take deliberate actions to enhance their career outcomes, engaging in a cycle of continual learning and career management to stay competitive in their field (Moin, Wei, Khan, Ali & Fang, 2019).

3.4 The influence of Self-efficacy and Outcome expectations on Goal Setting

Self-efficacy and outcome expectations are fundamental to the process of goal setting and career development. Engineers with high career self-efficacy tend to set ambitious career goals, believing in their ability to overcome obstacles and achieve success in their professional endeavours (Kleine, Schmitt & Keller, 2023). This confidence also influences the way engineers approach career planning, as they are more likely to actively engage in career exploration, training, and networking (Hackett & Lent, 2017). Furthermore, career self-efficacy serves as a protective factor against career-related anxieties, allowing engineers to make informed decisions without being overly influenced by doubt or uncertainty (Chiesa, Massei & Guglielmi, 2016). Outcome expectations further shape engineers' career goals. Engineers are motivated to pursue certain career paths based on their beliefs about the potential rewards (e.g., promotions, salary increases, or job satisfaction) that these paths will bring (Lent et al., 2000). Engineers who expect positive outcomes from their efforts; such as professional recognition or career stability; are more likely to invest greater effort into career development activities, including performance-based work, continuous learning, and active engagement in career progression opportunities (Lee et al., 2018). The interplay between self-efficacy and outcome expectations provides engineers with a sense of direction and motivation, guiding their goal-setting process and reinforcing their commitment to achieving their professional aspirations.

3.5The influence of Goal Setting on Actions Taken

Goal setting serves as a driving force behind the career actions engineers take. Engineers who set clear, measurable, and realistic career goals are more likely to engage in behaviours that align with those objectives. For example, engineers aiming for leadership roles are more likely to participate in managerial training, seek mentorship, and take on high-impact projects that develop their leadership competencies (Clarke & Scurry, 2020). Goal setting helps engineers structure their career paths, creating a roadmap that guides their actions and decision-making (Lent et al., 2000). These goals also serve as motivational tools, encouraging engineers to persevere through challenges and setbacks as they work towards their long-term objectives. The process of setting and refining career goals also encourages engineers to engage in continuous skill development, network strategically, and seek out new opportunities for growth (Clarke & Scurry, 2020). Engineers who engage in goal setting are more likely to make strategic career decisions that

support their upward mobility, including exploring lateral movements, taking on cross-functional projects, or pursuing new roles that align with their evolving aspirations (Han et al., 2021). Ultimately, goal setting encourages engineers to maintain a proactive approach to their careers, continually refining their goals in response to feedback, workplace changes, and industry shifts, which enhances their resilience and adaptability in a competitive environment.

3.6 Career Progression Outcomes

Career progression outcomes are influenced by engineers' career self-efficacy, goal setting, and the actions they take to advance their professional growth. The career paths of early career engineers vary, with some following a traditional linear trajectory, while others explore lateral moves, transitions between technical and managerial roles, or alternative career pathways. Additionally, adaptability, resilience, and professional identity development play significant roles in shaping long-term career success.

3.6.1 Linear career growth

The concept of a "career" has been extensively debated in scholarly discourse, reflecting evolving labour market structures and professional development paradigms. Greenhaus, Callanan, and Godshalk (2018) distinguish between two predominant conceptualisations; one views a career as an externally structured attribute of occupations or organisations; such as an engineering career within an industrial or corporate setting; while the other emphasises an individual's agency in shaping unique career pathways. Ultimately, Greenhaus et al. (2018) define a career as a lifelong sequence of work-related experiences that span multiple roles and developmental stages. For early career engineers who have completed GDPs, career trajectories can be particularly complex, shaped by the transition from structured, competency-based training programs to self-directed career navigation. Within traditional organisational structures, linear career trajectories remain a dominant expectation, particularly as engineers move from entry-level roles toward more senior technical or managerial positions. The hierarchical nature of many engineering organisations positions managerial ascension as a key marker of career progression, often associated with increased financial rewards and professional prestige.

However, research indicates that not all engineers aspire to managerial roles, with many prioritising technical mastery and domain expertise over leadership responsibilities (Gerwel, Chelin, & Rouvrais, 2018). To accommodate these differing aspirations, organisations have

implemented dual career ladder systems, allowing engineers to advance into either senior technical roles or managerial positions without limiting career growth opportunities (Gerwel et al., 2018). While dual career ladders address the needs of engineers who prefer technical specialisation, they do not fully capture the diversity of career trajectories that emerge post-GDP. Scholars have increasingly recognised non-linear career pathways, including entrepreneurial, project-based, and hybrid career models, which reflect the evolving nature of engineering careers (Cardador & Hill, 2018). For instance, entrepreneurial engineers often leave structured corporate environments to establish independent ventures, motivated by the limitations of traditional career advancement structures and the pursuit of professional autonomy (Elia, Secundo, & Passiante, 2017). Others engage in project-based work, leveraging interdisciplinary collaborations and short-term contracts to diversify their expertise and expand their career opportunities beyond conventional employment models.

Despite the growing recognition of non-traditional career pathways, linear career growth remains deeply embedded in organisational expectations. Linear career growth is characterised by upward mobility within predefined hierarchical structures, wherein engineers advance through designated career stages, typically accompanied by increased leadership responsibilities and financial incentives (Greenhaus et al., 2018). Engineers who actively engage in career planning, skills development, and leadership training are more likely to experience structured career progression (Lent et al., 2000). Moreover, career self-efficacy and positive outcome expectations reinforce linear growth, as engineers with strong confidence in their professional abilities are more likely to pursue leadership and advancement opportunities (Bond et al., 2017). For engineers transitioning from GDPs to independent career management, the shift from structured career development to self-directed progression introduces new challenges and opportunities. GDPs provide a clearly defined pathway for early career development, equipping engineers with technical competencies, exposure to leadership, and organisational integration (Oruç, 2022).

However, once these programs conclude, engineers must navigate career progression without the structured support mechanisms that previously guided their development (Oruç, 2022). Organisations that facilitate post-GDP career continuity through mentorship, competency-based progression models, and leadership training create environments where engineers can sustain

career momentum and effectively transition into long-term professional growth (Martins & Faciola, 2025). While traditional career models emphasise structured career trajectories, post-GDP engineers increasingly encounter diverse career pathways that challenge linear assumptions. The intersection of individual career agency, organisational structures, and evolving industry demands shapes the career actions and decisions of early career engineers, highlighting the need for more flexible, adaptive career models that extend beyond rigid hierarchical frameworks (Brunhaver, Jesiek, Korte & Strong, 2021).

3.6.2 Lateral movement / spiral careers

Not all engineers follow a strictly linear path; some choose lateral moves or spiral career trajectories to broaden their expertise and explore new career opportunities. Lateral movement involves transitioning into roles with similar levels of responsibility but in different technical areas, industries, or functions, allowing engineers to diversify their skill sets (Han et al., 2021). This career strategy enables engineers to build interdisciplinary expertise and enhance their problem-solving abilities by gaining exposure to different facets of engineering and business operations.
Spiral career progression refers to a combination of lateral and upward moves, where professionals cycle through various roles, accumulating diverse experiences before moving into senior leadership positions (Han et al., 2021). This approach benefits engineers seeking career variety, professional growth beyond technical expertise, and long-term career sustainability. Engineers who engage in lateral or spiral career movements often develop broader professional networks and are better positioned to transition into leadership roles that require a combination of technical and strategic expertise (Han et al., 2021).

Hybrid career paths, meanwhile, allow engineers to transition between technical, managerial, and project-based roles, offering flexibility and exposure to various facets of the profession (Adams, 2020). This approach integrates elements of both technical and leadership career trajectories, enabling engineers to leverage their expertise across multiple domains. Hybrid career paths are particularly beneficial for engineers who wish to balance hands-on technical work with broader organisational responsibilities, ultimately fostering career resilience and adaptability in an evolving job market (Adams, 2020). However, literature also highlights alternative career paths shaped by individual ambitions and preferences. For example, some individuals prioritise lateral movement or exploring other professions rather than pursuing upward mobility. Those who remain

within a single career path tend to achieve deep expertise but may forego management roles. In contrast, individuals with spiral careers explore related professions, acquiring diverse skills along the way, while those with transitory careers frequently change professions, gaining broad but less stable experiences (Greenhaus et al., 2018).

3.6.3 Transition from technical to managerial roles

A critical career progression milestone for many early-career engineers is the transition from technical roles to managerial positions. While some engineers prefer to remain in highly technical roles, others seek leadership opportunities that allow them to influence strategic decision-making, project execution, and team development (Clarke & Scurry, 2020). This transition requires the development of managerial competencies such as people management, business acumen, and organisational leadership. Early career engineers who participated in GDPs are more likely to make this transition successfully, as these programmes help to build the leadership skills necessary for management roles (Lang, Gehr, Handley, Park & Erdman, 2020). Engineers with high career self-efficacy and positive outcome expectations regarding leadership roles are more likely to pursue management pathways by engaging in leadership training, seeking mentorship, and demonstrating initiative in team-based projects (Lee et al., 2018). Furthermore, engineers who successfully navigate this transition often become key players in shaping engineering strategies and driving innovation within their organisations.

Although multiple career paths are available, much of the literature on engineering careers focuses on the transition from technical to managerial roles (Neneh, 2020; Adams, 2020; Nguyen et al., 2020; Cardador et al., 2022). After several years in technical roles, engineers often seek managerial positions for reasons such as higher compensation and the prestige associated with leadership roles. However, the transition from technical to management is often fraught with challenges, including increased responsibilities, new relationship dynamics, and the need for a different skill set (Efthymiou, Epaminonda & Ktoridou, 2021; Cardador et al., 2022). Early-career engineers who have participated in GDPs are better prepared to face these challenges. These programmes expose engineers to managerial responsibilities early in their careers, providing opportunities to develop critical leadership and decision-making skills.

Furthermore, engineers who have completed GDPs are more likely to have acquired important soft skills, such as communication, teamwork, leadership, adaptability, and strategic thinking. In addition, many GDPs provide exposure to professional practices like human resource management, project coordination, and finance, which combine technical knowledge with interpersonal competencies (Pons, 2015; Bucciarelli & Kuhn, 2018). Research has shown that early career engineers face significant challenges when moving from technical roles to managerial positions, including the increased priorities, responsibilities, and tasks that accompany management positions. Engineers must learn to delegate technical tasks, navigate new relationship dynamics, and manage increased stress levels while acquiring new managerial skills (Efthymiou et al., 2021; Cardador et al., 2022). By addressing these challenges proactively through the skills developed in GDPs, early career engineers are better equipped to handle the complexities of leadership roles and ensure a smoother transition into management (Efthymiou et al., 2021; Cardador et al., 2022).

While the transition from technical to management roles is often challenging, it can also be highly rewarding. Success in this transition depends not only on technical expertise but also on the acquisition of broader managerial competencies (Custovic, 2015). Early career engineers who have participated in GDPs are better prepared for these transitions, as these programmes help them integrate technical "know-how" with managerial "know-how" (Custovic, 2015). Ultimately, these early career experiences contribute to both individual career advancement and organisational success, ensuring that engineers are well-equipped to navigate the complexities of modern professional environments.

3.6.4 Adaptability/ Resilience

Adaptability and resilience are critical competencies for early-career engineers navigating the complexities of professional integration after completing GDPs. As these engineers transition from structured developmental environments into autonomous roles, they must continuously adjust to shifting industry demands, technological advancements, and evolving organisational structures (Johnston, 2018). The ability to adapt is not only a response to external change but also a proactive engagement with career development, enabling engineers to identify opportunities for growth, skill enhancement, and role expansion (Clarke & Scurry, 2020). Career adaptability, characterised by flexibility in setting and revising professional goals, becomes particularly salient in the post-GDP

phase. Unlike the structured rotations and predefined learning opportunities within GDPs, engineers must now exercise greater self-direction in navigating career pathways (Omar, Romli, Azeem & Zakaria, 2023). Those with strong career self-efficacy are more inclined to embrace new challenges, pivot when necessary, and pursue lateral or cross-functional career movements that enrich their professional portfolios (Rohde, 2022).

Moreover, adaptability in the post-GDP stage is reinforced by engagement in lifelong learning, participation in industry networks, and responsiveness to feedback; factors that contribute to sustained career momentum in a rapidly changing engineering landscape (García et al., 2019). Resilience, defined as the capacity to recover from setbacks and persist in the face of adversity, is equally vital in this transition (Wint & Direito, 2024). Early-career engineers who have completed GDPs frequently encounter organisational pressures, high-stakes projects, and shifting role expectations as they move into permanent positions (Chance, Direito & Mitchell, 2022). While GDPs provide foundational exposure to workplace challenges, the absence of a structured support system post-GDP necessitates the development of individual resilience mechanisms. Engineers who demonstrate resilience are more likely to persist through professional uncertainty, take initiative in problem-solving, and leverage mentorship or professional networks to navigate workplace complexities (Moin et al., 2019). Beyond individual attributes, organisational culture plays a pivotal role in reinforcing adaptability and resilience among post-GDP engineers (Ateke & Nwulu, 2018).

Organisations that foster a learning-oriented work environment, encourage open communication, and provide ongoing developmental support - such as mentorship, leadership coaching, and competency-based career progression frameworks - empower engineers to effectively manage career transitions (Ateke & Nwulu, 2018). Engineers who perceive their workplaces as supportive are more likely to engage in proactive career management behaviours, leading to sustained career growth and higher professional satisfaction (García et al., 2019). In essence, engineers who cultivate adaptability and resilience post-GDP are better equipped to navigate non-linear career trajectories, capitalise on emerging industry trends, and maintain long-term career stability. These qualities not only enhance their employability but also ensure they remain agile contributors in an increasingly dynamic engineering sector (Omar et al., 2023).

3.6.5 Professional Identity

The evolution from a graduate identity to a professional identity has earned significant academic attention, reflecting its importance for both individual and organisational success (Herbert, Rothwell, Glover & Lambert, 2020; Atkins, 2017; Jackson & Edgar, 2019). Theories of identity, particularly in the professional context, can be traced back to the Scottish Enlightenment of the eighteenth century, during which moral philosophers posited that human nature is inherently social and that individuals form their identities through their relationships within society (Burke & Stets, 2022). Contemporary identity theories are underpinned by sociological and psychological perspectives and are heavily influenced by symbolic interactionism, which provides a conceptual framework for understanding self-identity in relation to society (Burke & Stets, 2022).

Professional identity, within the work context, is defined as the integration of self-image, encompassing knowledge, skills, and values relevant to a specific profession. It is conceptualised in two primary ways: first, as an individual's identification with a professional group, such as doctors or social workers; and second, as a distinction between professional roles and unskilled occupations (Katz, Elsaesser, Klodnik & Khare, 2019). The former emphasises shared purpose and professional affiliation, while the latter distinguishes roles based on expertise and responsibility. Reay, Goodrick, Waldorff, and Casebeer (2017) describe professional identity as an individual's self-definition as a member of a profession, characterised by strong affiliation with professional values and goals. Among various identities, professional identity often takes precedence due to its association with agency and power, which can offer protection and status in societal contexts (Gatwiri, 2021). For instance, when individuals negotiate multiple identities, such as race or gender, their professional identity frequently dominates, as it represents a source of esteem and authority.

Professional identity also integrates personal attributes and professional competencies, shaping attitudes, influencing interpersonal interactions, and providing individuals with a sense of purpose and meaning (Moss, Gibson & Dollarhide, 2014; Fitzgerald, 2020). The more individuals value their professional identity, the greater their sense of efficacy, self-esteem, and commitment to their work (Carter & Marony, 2021). The significance of professional identity extends beyond personal fulfilment; it also impacts workplace behaviour as professional values, attitudes, and norms shape

conduct and decision-making (Pohl, Bertrand & Ergen, 2016). The construction of professional identity, often used interchangeably with identity formation, is a dynamic process in which technical skills, life experiences, and social roles converge to form a coherent self-concept (Ashforth & Schinoff, 2016; Crocetti, 2017). This process involves repetitive identity construction events and longitudinal identity development as individuals adapt and grow within their professional roles.

The post-GDP period plays a central role in the professional identity development of engineering graduates by facilitating structured socialisation processes beyond initial graduate training. This transition period provides opportunities for deeper professional integration, enabling graduates to refine their competencies, expand professional networks, and take on increasing responsibilities within their fields. Through mentorship and coaching, graduates receive continuous feedback, guidance, and support, helping them navigate the transition from entry-level roles to more advanced professional identities (Mullen & Klimaitis, 2021; Ragins, 2016). Feedback from senior professionals is particularly impactful, allowing graduates to experiment with "provisional selves" and refine their identity through self-assessment and adaptive learning (Hirschy, Wilson, Liddell, Boyle & Pasquesi, 2015; Volpe, Hopkins, Haidet, Wolpaw & Adams, 2019). Professional identity development requires a merging of personal values, beliefs, and goals with discipline-specific professional requirements, ultimately fostering a cohesive professional self (Woo et al., 2017).

Research reveals a significant correlation between professional identity and self-efficacy, with this transition period providing multidisciplinary experiences that enhance the identity development process (Moss et al., 2014; Woo et al., 2017; Rønnestad et al., 2019). However, the development of professional identity is influenced by various factors, including the quality of training and the socialisation experiences provided during this phase. For example, McLean & Syed (2015) found that positive interactions with clients and high-quality training positively influence identity development, while negative experiences, such as poor training or stress related to role expectations, have the opposite effect. Professional identity formation plays a significant role in career satisfaction, motivation, and long-term success. Engineers with well-developed professional identities have a clear sense of their role, expertise, and contributions within their field (Lee et al., 2018).

Positive outcome expectations reinforce professional identity by shaping how engineers perceive their career potential and the impact of their work. Early career engineers who align their technical contributions with meaningful career outcomes exhibit higher levels of engagement, organisational commitment, and leadership ambition (Lee et al., 2018). Furthermore, professional identity development influences career decision-making, as engineers with strong identities are more likely to pursue career paths that align with their skills, values, and aspirations. Organisations that support engineers in defining and strengthening their professional identities through mentorship, career development initiatives, and leadership exposure contribute to a more motivated and high-performing workforce (Nganga, Bowne and Stremmel, 2024).

3.6.6 The influence of Actions taken on Career Progression Outcomes

The actions engineers take throughout their careers play a pivotal role in shaping their professional progression and long-term outcomes. Proactive career development behaviour, such as engaging in skill-building, networking, and leadership training, is strongly associated with favourable career trajectories. Engineers who take deliberate actions to enhance their technical, managerial, and interpersonal skills are more likely to experience career advancement, increased job security, and enhanced professional recognition (Lent et al., 2000; Oruç, 2022). These behaviours help engineers stay competitive in their field, adapt to changing industry demands, and build the expertise necessary for promotion within their organisations (Lent et al., 2000). Participation in structured developmental programmes, such as GDPs, serves as a catalyst for professional growth, accelerating engineers' development by providing exposure to various facets of the organisation, mentorship, and skill enhancement (Oruç, 2022). Such programmes often include technical training, leadership development, and cross-functional rotations that contribute to engineers' readiness for higher-level roles. By providing access to resources and support systems, GDPs help engineers cultivate a comprehensive skill set that is essential for their career advancement (Oruç, 2022).

Moreover, engineers who pursue high-impact work - whether through leading innovative projects, taking on challenging assignments, or securing leadership roles - tend to increase their visibility within their organisations. This heightened visibility is instrumental in advancing their careers, as it positions them as key contributors and potential leaders. The impact of such actions on career

progression is evidenced in research by Bond et al. (2017), which found that engineers who take on high-visibility projects are more likely to receive promotions and gain access to strategic career opportunities. Additionally, their involvement in such roles enhances their professional identity, making them more confident in pursuing further career advancements. Seeking mentorship and cultivating relationships with senior colleagues further enhances career progression. Mentorship provides engineers with guidance, career insights, and opportunities for skill development. As noted by Lee et al. (2018), mentors can offer valuable perspectives on navigating organisational structures, managing professional challenges, and making informed career decisions. These relationships are crucial for early-career engineers transitioning from structured GDP environments to more autonomous roles. Senior colleagues' insights can help mentees avoid common pitfalls, manage workplace dynamics, and strategically align their goals with long-term career outcomes.

Engineers who take risks, such as pursuing new roles, engaging in cross-functional projects, or exploring lateral career movements, also benefit from these actions. Risk-taking fosters adaptability and resilience, essential qualities that enable engineers to navigate career transitions and industry shifts. Han et al. (2021) highlight that engineers who are open to lateral moves or new responsibilities demonstrate greater adaptability, which enables them to thrive in different environments and continue advancing in their careers. These engineers are often more prepared to take on leadership roles, having gained a broad range of skills and experiences that enhance their problem-solving capabilities. Ultimately, the actions engineers take throughout their careers, from setting clear career goals to engaging in strategic career planning and embracing risk, significantly influence their professional development. The deliberate pursuit of career development opportunities not only enhances their technical and leadership skills but also contributes to job satisfaction and long-term career outcomes (Hollar, Kuchinka and Feinberg, 2022). By taking ownership of their career progression and continuously seeking ways to develop and improve, engineers are better positioned to achieve their career aspirations and sustain meaningful, high-impact careers. These actions contribute to the creation of a strong professional identity, increased job satisfaction, and a sense of accomplishment that aligns with their values and career aspirations (Craps et al.,2021).

3.7 Post-GDP Learning Experiences

As engineers transition out of GDPs, their career development continues through a variety of structured learning experiences designed to further cultivate their technical, managerial, and interpersonal skills. The post-GDP phase represents a critical stage in an engineer's professional journey, where continuous development is key to ensuring long-term career success and organisational contributions. During this phase, engineers encounter new challenges and opportunities that require ongoing learning, adaptation, and the refinement of existing competencies. To support their growth, organisations provide a combination of work assignments, training programs, mentoring, and coaching opportunities that align with both individual career aspirations and organisational goals.

3.7.1 Work assignments

In the initial stages of their careers, engineers undergo formative development through strategically designed work assignments that offer exposure to high-responsibility tasks across a spectrum of functions. These assignments are integral to structured development programs, such as GDPs, which facilitate the translation of theoretical knowledge into practical application. By engaging in projects spanning engineering, finance, IT, and other functional areas, engineers gain hands-on experience that is crucial for the refinement of their technical, analytical, and interpersonal competencies (Prospect, 2021). Structured rotations across various departments are common, enabling early-career engineers to acquire a diverse skill set, making them adaptable and proficient across different operational domains (Schreuder & Coetzee, 2016).

The core motivation driving engineers to engage in these development programs is the aspiration to acquire challenging assignments that contribute to both immediate learning and longer-term career growth. Career advancement is often tied to opportunities for visibility within the organisation, as engineers are keen to prove their competence and potential (Crowley-Henry, Benson & Al Ariss, 2019). By immersing themselves in projects that span multiple sectors, they accumulate a wealth of diverse experiences, which not only enhance their technical acumen but also allow them to refine critical managerial and problem-solving skills (Nguyen et al., 2020; Neneh, 2020). Engineers who are cognisant of the alignment between their personal career goals and their organisation's strategic objectives are more likely to achieve meaningful progression.

Engaging in initiatives that contribute both to personal development and organisational success increases their prospects for upward mobility, including access to leadership roles (DeLoach, 2020).

Furthermore, as engineers progress through their careers, their involvement in organisational activities that require decision-making and leadership plays a pivotal role in their development. Exposure to strategic initiatives such as high-level meetings, where key business decisions are made, provides engineers with critical insights into organisational dynamics and corporate governance (Posada, 2017). These engagements are often followed by coaching sessions, wherein engineers reflect on the discussions, analyse the decision-making processes, and receive targeted feedback on their contributions. This reflective process not only enhances their technical understanding but also fosters the development of soft skills, including communication, emotional intelligence, and interpersonal dynamics, which are essential for effective leadership (Posada, 2017; Wong et al., 2018).

In addition to these strategic exposures, rewarding engineers for mastering non-technical skills serves to reinforce their motivation for continuous professional growth (Posada, 2017). Opportunities to participate in strategic forums, interview processes, and performance evaluations provide a rich context for understanding people management, team dynamics, and organisational operations (Posada, 2017). This hands-on exposure to management functions lessens the need for formalised mentoring structures, as engineers gain practical insights into the broader operational mechanisms that drive organisational success. Nevertheless, providing constructive feedback on performance, particularly in areas that require improvement, remains essential. Feedback loops allow engineers to identify developmental gaps and engage in targeted actions to enhance their competencies (Posada, 2017; Wong et al., 2018). A critical factor in ensuring that engineers continue to evolve within the organisation is the establishment of clear, actionable personal development plans (PDPs). PDPs serve as a roadmap for aligning engineers' career progression with organisational expectations, creating a structured path to success that is both strategic and individualised (Saul, Binza and Moeti, 2023). These plans, combined with ongoing opportunities for feedback and growth, ensure that engineers remain engaged, motivated, and prepared for the challenges of more senior roles in the future (Saul et al., 2023).

Essentially, the work assignments given to early-career engineers, coupled with the development of both technical and soft skills, play a pivotal role in shaping their career trajectory. By strategically balancing project-based assignments, leadership exposures, and reflective learning processes, organisations can foster a generation of engineers who are not only technically adept but also capable of navigating the complexities of organisational leadership and business decision-making (Nguyen et al., 2020). This multifaceted development approach not only enhances their marketability and job satisfaction but also ensures that they are well-equipped to assume critical roles in an increasingly dynamic and competitive engineering landscape (Nguyen et al., 2020).

3.7.2 Training

Training plays a critical role in the continuous development of engineers as they transition out of GDPs and enter the next phase of their careers. Post-GDP engineers continue their professional development through various structured learning opportunities, including mentorship, on-the-job experiences, workshops, seminars, and online resources (Clarke & Scurry, 2020). This ongoing training focuses on refining both technical and non-technical skills to ensure engineers are prepared for career advancement and can successfully transition into new professional roles (Cardador, Hill, & Lopez-Alvarez, 2022). During this stage, engineers often shift their focus to acquiring the managerial and leadership competencies needed for career progression. The increasing complexity of the engineering field, driven by technological advancements and evolving industry demands, requires engineers to be versatile, balancing technical expertise with strong business acumen (Brunhaver, Korte, Barley & Sheppard, 2017; Bucciarelli & Kuhn, 2018). Companies value engineers who not only excel in technical problem-solving but who can also lead teams, manage projects, and understand the broader impacts of their work on both business and society (Cardador et al., 2022).

To develop these capabilities, many engineers pursue advanced qualifications, such as Master's degrees in Engineering Management or MBAs, to gain the necessary leadership and business skills. These formal learning programs are specifically designed to build on the foundational technical knowledge acquired during the GDP phase, expanding engineers' roles within organisations and enhancing their qualifications for leadership positions (Craps et al., 2021; Miao, 2018). While formal education and training are essential, the importance of coaching and

mentoring in the post-GDP phase cannot be overstated. Early-career engineers often report a lack of structured mentoring and development opportunities, particularly for "soft skills" such as communication, teamwork, and leadership (Posada, 2017; Wong, Cross & Mueller, 2018). This gap in professional development can hinder engineers' ability to navigate complex work environments and limit their career growth.

Therefore, organisations must not only prioritise technical training but also ensure that engineers are equipped with the mentorship and support required for comprehensive development. Structured mentoring programs provide invaluable guidance and help engineers integrate soft skills into their professional toolkit, thus facilitating their progression into leadership roles (Posada, 2017). Ultimately, for engineers to continue thriving after completing GDPs, a well-rounded approach to career development is essential. This includes providing a combination of technical, managerial, and interpersonal skill-building opportunities through formal learning, mentorship, and on-the-job experience (Clarke & Scurry, 2020). By investing in comprehensive development programmes, organisations can cultivate a workforce capable of meeting the demands of an ever-evolving engineering landscape, ultimately leading to greater career success and long-term organisational contributions (Gallup, 2019).

3.7.3 Mentoring

For early-career engineers who have participated in GDPs, mentoring serves as a valuable source of guidance as they transition into permanent roles within their organisations. Traditionally, mentoring is defined as a long-term developmental relationship between an experienced mentor and a less experienced mentee, in which the mentor provides support in career progression, professional networking, and skills development (Mullen & Klimaitis, 2021). Within the context of GDPs, mentoring plays a significant role in complementing structured training by helping engineers navigate workplace dynamics, technical challenges, and career growth opportunities. Graduate Development Programmes expose early-career engineers to different departments, projects, and responsibilities, preparing them for diverse career paths. However, as they move beyond the structured nature of these programmes, they often face new challenges that require continuous learning and adaptation. Mentoring provides a crucial support system during this transition, offering engineers insights from experienced professionals, helping them refine their career strategies, and broadening their professional networks (Grek, 2017).

There are two primary models of mentoring that influence the experiences of early-career engineers: the functionalist model and the relational model (Burns, 2020). In the functionalist model, the mentor provides structured, goal-oriented guidance, ensuring that the mentee acquires specific technical and professional competencies aligned with organisational objectives. This model is particularly relevant for GDP graduates who need to quickly develop role-specific expertise as they transition into permanent positions (Burns, 2020). Conversely, the relational model of mentoring emphasises mutual trust, collaboration, and holistic professional development. Engineers who engage in relational mentoring benefit from a more personalised approach that fosters not only technical proficiency but also leadership, critical thinking, and decision-making skills (Burns, 2020). This model is particularly valuable for engineers seeking long-term career growth, as it nurtures adaptability and innovation; key attributes for success in dynamic engineering environments (Burns, 2020).

Beyond traditional one-on-one mentoring, the concept of distributed mentoring has gained traction as an effective approach for early-career engineers (Jensen, 2017). Rather than relying on a single mentor, engineers who have completed GDPs benefit from engaging with multiple mentors across different disciplines, departments, and levels of seniority. This exposure enhances their professional development by broadening their perspectives, providing access to diverse career paths, and strengthening their ability to navigate complex workplace challenges (Burns, 2020). For early-career engineers, mentoring offers significant career advantages, including accelerated career progression, improved job satisfaction, and increased self-confidence (Eby & Robertson, 2020). Engineers with strong mentoring relationships are more likely to receive promotions, secure leadership opportunities, and develop critical professional skills that set them apart in competitive work environments. Mentoring also enhances their ability to handle workplace pressures, navigate technical complexities, and integrate into their organisational cultures more effectively.

From the mentor's perspective, guiding early-career engineers is equally beneficial. Serving as a mentor strengthens leadership and coaching skills, refines communication abilities, and fosters a sense of fulfilment through contributing to the growth of future engineering professionals (Ivey & Dupré, 2022). Many mentors find that engaging with early-career engineers offers fresh insights

and new approaches to problem-solving, creating a reciprocal learning process that benefits both parties (Ivey & Dupré, 2022). Ultimately, mentoring provides early-career engineers with valuable support as they transition from GDPs into more established roles. Organisations that embed mentoring within their talent development strategies foster a culture of continuous learning, collaboration, and professional growth (Okolie et al., 2020). By providing engineers with access to strong mentoring networks, organisations enhance employee retention, job satisfaction, and long-term workforce development. When effectively implemented, mentoring serves as a powerful tool for career acceleration, knowledge transfer, and the advancement of both individuals and the engineering profession as a whole (Okolie et al., 2020).

3.7.4 Coaching

Coaching is a critical mechanism for supporting the professional growth of early-career engineers. While GDPs provide foundational exposure to different functions, work environments, and organisational expectations, the post-GDP phase presents new challenges that require engineers to navigate increased responsibilities, organisational complexities, and evolving career trajectories (Jones, Woods & Guillaume, 2016). At this stage, coaching serves as a structured developmental tool, helping engineers refine their professional competencies, strengthen leadership capabilities, and align their skills with long-term career aspirations (Passmore & Sinclair, 2021). One of the primary benefits of coaching for post-GDP engineers is its role in enhancing self-efficacy and career adaptability. As these engineers move beyond structured development programmes into more autonomous roles, they often face heightened expectations related to decision-making, problem-solving, and stakeholder engagement (McCarthy & Milner, 2020).

Coaching interventions provide a personalised framework for engineers to reflect on their experiences, develop adaptive strategies, and build confidence in their professional capabilities (Hagen & Gavrilova Aguilar, 2021). This is particularly relevant in engineering-intensive industries, where rapid technological advancements and shifting market demands require engineers to continuously upskill and reposition themselves within their organisations (Bozer & Jones, 2018). The transition from a structured GDP to an independent professional role also necessitates the development of leadership and managerial competencies. Many engineers encounter difficulties in shifting from purely technical roles to positions that require people management, cross-functional collaboration, and strategic thinking (Ladyshewsky, 2017).

Coaching provides targeted support in these areas by helping engineers refine their interpersonal skills, enhance communication effectiveness, and cultivate leadership mindsets (Ellinger et al., 2011). Additionally, engineers who receive coaching post-GDP are better equipped to handle workplace challenges such as navigating complex team dynamics, managing high-pressure projects, and aligning their contributions with broader organisational goals (Blackman, Moscardo & Gray, 2016).

From an organisational perspective, coaching plays a key role in retaining engineering talent and fostering long-term career engagement. Many engineers struggle with career stagnation or role ambiguity after completing a GDP, as the structured learning and rotational opportunities provided during the programme give way to more fixed, performance-driven expectations (Gifford, 2019). Coaching helps mitigate these challenges by offering engineers a structured yet flexible means of career planning and skills development. By providing a platform for engineers to clarify their career goals, explore new opportunities, and address workplace concerns, coaching contributes to higher job satisfaction, motivation, and retention (Grant, 2017). Organisations that invest in coaching for post-GDP engineers also benefit from enhanced workforce engagement, as engineers who receive continuous developmental support are more likely to contribute to innovation, efficiency, and long-term business success (Garvey, Stokes & Megginson, 2017). Despite its advantages, the effectiveness of coaching for early career engineers is influenced by several factors, including the availability of experienced coaches, the integration of coaching within organisational talent strategies, and the alignment of coaching goals with individual career aspirations (Theeboom, Beersma & Van Vianen, 2014).

3.8 The Effect of Post-GDP Learning Experiences on SCCT components

Post-GDP learning experiences play a pivotal role in shaping the components of SCCT, which include career self-efficacy, outcome expectations, and career goals. These components collectively guide an individual's career development, influencing decisions, career paths, and long-term professional growth. Early career engineers, having completed GDPs, enter a phase where they must apply and adapt the knowledge and skills gained during their structured learning experiences to real-world professional contexts. The learning opportunities they encounter during

this phase significantly impact how they perceive their abilities (self-efficacy), expect to succeed in various roles (outcome expectations), and define their career trajectories (career goals).

3.8.1 Self-Efficacy

Career self-efficacy, as conceptualised within SCCT, refers to an individual's belief in their capacity to execute behaviours necessary to achieve specific career outcomes (Lent, Brown, & Hackett, 1994). This belief system plays a crucial role in career decision-making, persistence in the face of obstacles, and overall professional development (Bandura, 1997). Post-GDP learning experiences, such as mentoring, coaching, and exposure to challenging work assignments, significantly contribute to the development of self-efficacy among early career engineers by reinforcing their ability to perform successfully in professional settings (Mendez et al., 2017). One of the key mechanisms through which post-GDP learning experiences enhance self-efficacy is mastery experiences, which are recognised as the most influential source of self-efficacy development (Bandura, 1986). When engineers successfully complete complex projects, lead initiatives, or solve critical problems, they gain confidence in their ability to handle future challenges. Research suggests that hands-on involvement in multidisciplinary projects and leadership responsibilities fosters a stronger sense of self-efficacy by demonstrating the effectiveness of their skills in real-world contexts (Baker & McDonald, 2018). For instance, engineers who transition from structured GDP rotations into independent roles where they must manage stakeholders, budgets, and project timelines may initially experience uncertainty. However, with continuous exposure and incremental successes, their belief in their capabilities strengthens, making them more likely to pursue ambitious career goals (Lent & Brown, 2013).

Another critical factor influencing self-efficacy is social persuasion, which involves encouragement and feedback from peers, supervisors, and mentors. Positive reinforcement, such as recognition for successful contributions, enhances engineers' confidence in their abilities and motivates them to take on increasingly complex responsibilities (Hackett & Lent, 2017). Conversely, constructive feedback helps them refine their skills, recognise growth areas, and develop resilience, a crucial attribute for career advancement in highly technical and competitive fields (Hackett & Lent, 2017). Research indicates that mentoring relationships play a particularly vital role in shaping engineers' self-efficacy, as mentors provide guidance, encouragement, and

industry-specific insights that reinforce the belief in one's ability to succeed (Ghosh, 2017). Engineers who engage in structured mentoring programs report higher confidence levels and a greater willingness to take on leadership roles (Koufteros, Edwin Cheng, & Lai, 2020). Furthermore, observational learning experiences (i.e. observing and modelling the behaviour of successful engineers) also contribute to self-efficacy development. When early-career engineers witness senior professionals effectively managing projects, negotiating challenges, and advancing in their careers, they internalise these behaviours and develop the confidence to emulate them (Power, Tanner, Egan, Mooney Simmie & Buckley, 2025). Exposure to role models within the workplace provides tangible examples of career progression and enhances motivation, particularly for engineers from underrepresented backgrounds (Power et al., 2025).

Engineers who experience excessive stress, performance anxiety, or imposter syndrome may struggle with self-doubt, which can undermine their belief in their professional capabilities (Bandura, 1997). However, organisations that foster psychologically safe environments, where employees feel supported and encouraged to take risks without fear of harsh repercussions, enable engineers to develop greater self-efficacy (Edmondson, 1999). Coaching interventions, stress management programs, and professional development workshops can help mitigate negative emotional responses and enhance confidence in problem-solving and leadership abilities (Roussin, Larraz, Jamieson and Maestre, 2018). Essentially, the development of self-efficacy in post-GDP engineers has a profound impact on their long-term career trajectories. Engineers with high career self-efficacy are more likely to persist in challenging roles, seek out leadership opportunities, and proactively manage their career progression (Hackett & Lent, 2017). By integrating structured learning experiences, social support, and opportunities for reflective practice, organisations can cultivate a workforce that is not only technically competent but also resilient, adaptable, and prepared for future leadership positions (Bozkurt, 2021).

3.8.2 Outcome Expectations

Outcome expectations, as defined by SCCT, refer to an individual's beliefs about the potential consequences of engaging in specific career-related behaviours. These expectations encompass anticipated rewards such as career advancement, job satisfaction, financial stability, and professional recognition (Lent, Brown, & Hackett, 1994). Early-career engineers' outcome expectations are shaped by both direct experiences in the workplace and observations of their peers

and mentors, which help them form realistic perceptions of career progression within their industry. Post-GDP learning experiences significantly influence these expectations by providing engineers with insights into the tangible and intangible benefits of various career paths. Through exposure to challenging projects, leadership opportunities, and mentorship, engineers develop a clearer understanding of the competencies and behaviours that lead to professional success (Lent & Brown, 2013). Positive reinforcement, such as successful project completion, recognition from senior colleagues, or promotions, reinforces the expectation that persistence and skill development will lead to desirable career outcomes (Bell & Rosowsky, 2021).

Conversely, experiences of stagnation, limited career mobility, or lack of mentorship may cause engineers to reassess their goals and expectations, sometimes leading to career shifts or adjustments in ambition (Bell & Rosowsky, 2021). Additionally, outcome expectations are shaped by the alignment between personal values and workplace experiences. Engineers who find purpose in their work, whether through innovation, sustainability, or problem-solving, are more likely to develop positive outcome expectations related to job satisfaction and long-term engagement in the field (Duffy et al., 2016). For example, an engineer working on renewable energy projects may come to expect career growth in sustainability-driven roles, while another engaged in high-impact infrastructure development may anticipate career success through leadership in large-scale engineering firms.

The role of organisational culture and industry trends also plays a crucial role in shaping these expectations. Engineers in industries with well-defined career ladders and structured development programmes may develop strong expectations of upward mobility, while those in more volatile sectors may anticipate less stability but greater opportunities for innovation and entrepreneurship (Massimino & Turner, 2018). Furthermore, as engineers gain experience in their post-GDP phase, they may become more aware of extrinsic motivators such as financial incentives, international career prospects, or leadership roles, which can further refine their expectations of success (Lent et al., 2019). Moreover, career outcome expectations influence engineers' career decision-making and goal-setting behaviours (Lent, Ireland, Penn, Morris & Sappington, 2017). Research suggests that individuals with clear and positive expectations are more likely to proactively seek career development opportunities, engage in continuous learning, and take calculated risks that enhance

their long-term career prospects (Lent, Brown, & Hackett, 2000). By contrast, unclear or negative expectations can lead to career indecision, disengagement, or premature career shifts (Lent, Brown, & Hackett, 2000).

3.8.3 Goal Setting

Career goals in SCCT are the desired future outcomes that individuals strive to achieve, shaped by their self-efficacy and outcome expectations (Lent et al., 1994). For post-GDP engineers, the transition from structured development programmes to independent roles marks a critical phase in career goal development. Early in their careers, engineers' goals may be shaped by the parameters and expectations set within the GDP (Winberg, Bramhall, Greenfield, Johnson, Rowlett, Lewis & Wolff, 2020). However, as they accumulate experience and engage in further learning beyond the GDP, their goals evolve, becoming more nuanced and aligned with their deeper understanding of personal strengths, industry trends, and organisational needs (Winberg et al., 2020).

Post-GDP learning experiences, such as leadership roles, high-impact projects, and involvement in strategic decision-making, play an essential role in shaping engineers' career goals. These experiences not only foster a clearer understanding of their professional aspirations but also guide engineers in refining and adjusting their goals to be more realistic and achievable (Blom, Steyn & Bond-Barnard, 2023). Through exposure to diverse challenges and broader organisational responsibilities, engineers may shift their focus from technical expertise to include leadership and management goals. For instance, engineers who initially enter the workforce with a goal to achieve technical mastery may later develop aspirations to manage teams or influence strategic direction as they gain experience in organisational settings (Nguyen et al., 2020).

In addition to hands-on experiences, mentorship and coaching relationships, which often extend beyond the GDP phase, provide vital support in goal development. These relationships serve as a guiding force in aligning engineers' personal career goals with the broader objectives of the organisation and the evolving dynamics of the industry (Nunan, Ebrahim & Stander, 2023). Mentors and coaches offer advice, share knowledge, and provide feedback on career trajectories, helping engineers identify critical milestones and refine their aspirations. Through this guidance, engineers are empowered to set long-term goals that not only reflect their personal ambitions but

also consider organisational needs, industry trends, and professional development opportunities (Nunan et al., 2023).

This alignment between personal and professional goals enhances engagement, increases commitment to career progression, and ultimately supports the engineers' long-term success (Gibson & Goldstein, 2019). Moreover, goal-setting in the post-GDP phase is often a dynamic process. Engineers continuously evaluate and adjust their career objectives based on ongoing experiences, feedback, and personal reflection. As a result, their goals may shift in response to new opportunities or challenges, demonstrating the flexible nature of career goal development during this stage (Coetzee & Mbiko, 2023). This flexibility is particularly important in a fast-paced industry like engineering, where innovation, market demands, and organisational structures can rapidly evolve (Coetzee & Mbiko, 2023).

3.9 Integrating SCCT with Post-GDP Learning Experiences

The integration of SCCT with post-GDP learning experiences provides a valuable framework for understanding how early-career engineers navigate the transition from structured development programmes to independent roles. SCCT emphasises the interplay between self-efficacy, outcome expectations, and career goals as key factors influencing career decisions and progression (Lent et al., 1994). Post-GDP, engineers encounter a variety of learning experiences, such as mentorship, challenging projects, and exposure to leadership responsibilities, that significantly shape these SCCT components. These interactions are not isolated but form a dynamic feedback loop, where success in one area positively influences others (Mendez et al., 2017). As engineers gain experience in their roles, their self-efficacy becomes increasingly solidified. Successfully managing complex projects or receiving positive reinforcement from supervisors boosts engineers' confidence, thus enhancing their self-efficacy. In turn, a higher sense of self-efficacy leads to more ambitious career goals, as engineers believe they can achieve greater professional milestones (Ngonda, Shaw & Kloot, 2022). For instance, engineers who initially set goals focused on technical mastery may shift toward leadership aspirations as they gain confidence in their ability to manage people and strategic projects (Nguyen et al., 2020).

Simultaneously, engineers' outcome expectations evolve as they encounter both positive and negative experiences in the workplace. Engineers who achieve success in high-impact projects or

are recognised for their contributions tend to develop strong expectations of career advancement and satisfaction (Klenk, Bjorklund, Gilmartin & Sheppard, 2018). Conversely, challenges such as unanticipated setbacks or limited upward mobility can lead engineers to adjust their career goals or expectations, potentially prompting a reassessment of their professional trajectory (Hackett & Lent, 2017). These shifts highlight the flexible nature of career goal setting, as engineers recalibrate their aspirations based on ongoing feedback and experiences. Organisational structures play a pivotal role in shaping these dynamic processes. Organisations that encourage continuous learning, provide opportunities for skill development, and offer exposure to leadership roles foster a supportive environment for engineers to build their self-efficacy and refine their career goals (Ye, Liu & Tan, 2022).

Through initiatives like leadership training, cross-functional projects, and regular feedback sessions, organisations create a feedback loop that reinforces positive career development outcomes. These structures ensure that engineers can continuously challenge their expectations and align their personal career objectives with the broader goals of the organisation, ultimately leading to higher career satisfaction, performance, and retention (Lent & Brown, 2013). By integrating SCCT with post-GDP learning experiences, it becomes clear that career progression for early-career engineers is not a linear process. Rather, it is a continuous cycle of self-reflection, goal adjustment, and feedback that is influenced by both individual experiences and organisational support. This dynamic interplay of factors highlights the importance of maintaining supportive environments that nurture engineers' professional development and align their career goals with organisational objectives, thereby facilitating long-term career success and growth (Gupta, Yeter, & Khoo, 2023).

3.10 Personal Characteristics

The career trajectories of early-career engineers in South Africa are influenced not only by structural and institutional factors but also by individual personal characteristics. Attributes such as race, gender, economic background, language proficiency, and age shape the professional experiences of engineers in the post-GDP phase, affecting their access to career opportunities, workplace inclusion, and long-term advancement. While technical competence is essential in

engineering careers, personal characteristics often intersect with broader systemic issues, influencing career mobility, professional networks, and leadership potential.

3.10.1 Race

Race remains a fundamental determinant in shaping the career paths of early-career engineers in South Africa, particularly in the post-GDP phase. South Africa's unique history of racial segregation, institutionalised through the apartheid system, continues to influence not only the structures of workplaces but also the lived experiences of individuals within them (Carey, 2018). For African, Indian, and Coloured engineers, the vestiges of apartheid persist as significant barriers, both overt and subtle, that influence their professional opportunities, career trajectories, and personal aspirations. Despite possessing the same technical qualifications as their White counterparts, these engineers often face systemic challenges that limit their access to career advancement and leadership roles (Samuel, Magwagwa & Mazingi, 2020). According to the Department of Employment and Labour (2024), the workforce in South Africa remains starkly divided along racial lines, with White employees continuing to dominate top management positions. The apartheid system ensured that opportunities for career progression were available predominantly to White South Africans, while Black[1] South Africans, particularly, were confined to menial labour roles, denied access to higher education, and subjected to restrictive laws that prevented upward mobility (Shaw & Kloot, 2024).

Post-apartheid, while legal segregation has ended, racial inequality remains entrenched in the fabric of South African society, particularly in the workplace, where structural and institutional barriers continue to disproportionately affect Black, Indian, and Coloured engineers (Bergh & Hoobler, 2018). These barriers often manifest in a lack of access to influential networks and mentors, making it harder for individuals from these backgrounds to navigate career paths that require not just technical expertise but also social capital and professional visibility (Bergh & Hoobler, 2018). This situation is compounded by the continued dominance of White South Africans in senior technical and managerial positions (Department of Employment and Labour, 2024). The underrepresentation of engineers from historically marginalised racial groups in

[1] In South Africa, "Black" refers to individuals of African descent, while "Coloured" refers to people of mixed-race ancestry, "Indian" to people of South Asian descent, and "White" to people of European descent. These categories were legally defined under apartheid and remain in use for demographic and employment equity purposes.

leadership roles has created a vicious cycle: the lack of racial diversity at the top perpetuates the lack of role models and mentors for younger, aspiring engineers, thereby hindering their chances of advancing within organisations (Department of Employment and Labour, 2024). The absence of diverse representation in decision-making roles means that the career aspirations of engineers from historically disadvantaged backgrounds often remain unfulfilled, as they are excluded from the circles that can provide critical career development opportunities, sponsorship, and access to high-profile projects that are essential for upward mobility (Bosch, 2019).

Racial biases - both explicit and implicit - continue to permeate workplace interactions in post-apartheid South Africa. The racial hierarchies established during apartheid have not been fully dismantled, and despite the passage of time, lingering assumptions about racial superiority still affect workplace dynamics. White South Africans, particularly in leadership roles, may still hold prejudiced views about the abilities of engineers from marginalised racial backgrounds, resulting in unequal treatment and missed opportunities for career advancement (Steyn, 2024). These biases can manifest in subtle forms, such as fewer developmental opportunities being extended to Black, Indian, and Coloured engineers or a reluctance to assign them to high-profile projects (Steyn, 2024). Furthermore, the internalisation of these racial dynamics by individuals, including those from marginalised racial backgrounds, can affect their self-efficacy and career goal-setting. Engineers who face repeated barriers may internalise notions of inferiority or failure, further hindering their aspirations and ability to assert themselves within professional settings (Magubane, 2019).

In addition to these structural barriers, the lack of mentorship and networking opportunities remains a significant challenge for post-GDP engineers from underrepresented racial groups. Mentorship and sponsorship, which are often key to career progression, are critical in helping engineers navigate organisational structures and gain access to high-impact projects and leadership roles (Aigbavboa, Oke, & Mutshaeni, 2016). However, engineers from marginalised racial backgrounds may find it difficult to secure mentors, especially when those in senior roles tend to be predominantly White. This dearth of mentorship can limit the opportunities available to young engineers to advance their careers, as they lack the guidance and support needed to effectively navigate workplace dynamics and organisational politics (Bosch, 2019). Race remains a critical

factor in the professional development of early-career engineers in South Africa. The intersection of personal characteristics and systemic forces continues to shape their experiences and career trajectories (Pillay, 2022). Racial inequalities, though formally addressed through legislation, continue to manifest in subtle and overt ways, influencing career advancement opportunities for engineers from marginalised racial backgrounds. Addressing these systemic issues will require not only policy reforms but also cultural changes within organisations to ensure that all engineers, regardless of their racial background, have equal opportunities to succeed and advance in their careers (Pillay, 2022).

3.10.2 Gender

Gender inequality remains a significant and persistent challenge within South Africa's engineering sector, especially for early-career female engineers post-GDP. Despite a notable increase in the participation of women in engineering education and the workforce, the profession continues to grapple with gender-based barriers that impede career advancement, particularly in senior technical and leadership positions (Barkhuizen, Masakane & van der Sluis, 2022). Gender bias, both implicit and explicit, continues to shape the workplace dynamics and opportunities available to women in engineering. The impact of these biases is compounded by male-dominated organisational cultures that prevail in many engineering firms, which further exacerbate the challenges that women face in achieving career progression (Ames, Coplen, & Malloy, 2019; Beigi, Wang & Arthur, 2017).

Research has shown that women in engineering are often excluded from high-profile projects and are underrepresented in leadership roles, which limits their access to the experiences necessary for career growth (Steyn & Nene, 2020). These structural barriers result in a situation where women often encounter difficulties in gaining mentorship and sponsorship, essential elements for career advancement. The lack of representation in leadership roles also perpetuates a cycle in which younger engineers struggle to find role models or mentors who can guide them through their career development (Gipson et al., 2017). As a result, women engineers are often relegated to supporting roles, with limited opportunities to demonstrate their technical abilities and leadership potential, which can hinder their long-term career goals (Hunt, 2016; Engineers Rising, 2018).

Additionally, gender pay gaps and biased promotion practices remain critical obstacles for women's career progression. Studies consistently reveal that women in engineering are often paid less than their male counterparts for the same work and face higher barriers to promotion, despite similar qualifications and experience (ECSA, 2020). These inequities are rooted in deeply entrenched systemic biases that perceive male engineers as more competent and capable of leadership than their female counterparts, irrespective of their actual performance or capabilities. Such biases perpetuate the "glass ceiling," a metaphorical barrier that hinders women's ascension to senior leadership and technical positions, thus limiting their career progression (Baker & Cangemi, 2016; Komalasari et al., 2017).

Moreover, the interplay between family caregiving responsibilities and career development disproportionately affects women engineers. The challenge of balancing work and caregiving duties often results in women engineers experiencing slower career trajectories, especially when organisational policies fail to accommodate flexible work arrangements or provide adequate support for work-life balance (Beigi et al., 2017). These external barriers are compounded by organisational cultures that do not fully support gender equality, where women are expected to perform at the same level as their male counterparts while simultaneously managing familial responsibilities (Makarem & Wang, 2020). The lack of supportive workplace policies, such as flexible working hours or parental leave, particularly in male-dominated industries like engineering, continues to affect the career growth of women and exacerbates gender inequalities in the workplace (Chung & Van der Lippe, 2020).

The Commission for Employment Equity (2022) highlights that Black women remain significantly underrepresented in senior leadership roles in South Africa, despite making up a substantial portion of the workforce. These challenges are compounded by systemic barriers that are rooted in historical patterns of inequality, which continue to affect Black women disproportionately. These barriers are often perpetuated by cultural and organisational resistance to change, as well as ongoing bias in decision-making processes such as promotions and hiring (April & Govender, 2022). Black women engineers face a dual burden: they must navigate both gendered and racial biases that hinder their career progression and limit their access to the resources and opportunities needed for advancement (Motsei, 2015). Despite these challenges, it is essential to note that

women's career progression in engineering is not entirely determined by external barriers. Women who gain access to mentorship, coaching, and supportive networks are better positioned to navigate these obstacles and achieve career advancement (Yates & Skinner, 2021). Mentorship plays a pivotal role in helping women engineers gain the necessary skills, confidence, and exposure to high-impact projects that enhance their career prospects (Ames et al., 2019). However, the systemic inequalities that exist within many organisations continue to limit the effectiveness of these programmes, as they often fail to address the structural barriers that women face (Ames et al., 2019).

3.10.3 Economic status/Background

The economic status and background of early career engineers play a critical role in shaping their post-GDP career trajectories in South Africa. The country's deeply entrenched socioeconomic disparities, rooted in historical inequalities, continue to influence access to professional opportunities and career advancement (Smith, 2018). Engineers from economically disadvantaged backgrounds often face structural barriers that extend beyond the workplace, affecting their ability to leverage critical career resources such as professional networks, financial capital, and developmental opportunities. These disparities, while somewhat mitigated by affirmative action policies and corporate transformation initiatives, remain a significant factor in determining long-term career success (Smith, 2018).

A key dimension of economic background influencing career trajectories is access to higher education and professional development opportunities. While GDPs serve as a bridge between academia and industry, enabling structured skill development, engineers from lower-income households often enter these programs with limited exposure to industry networks, extracurricular learning, and leadership opportunities (De Schepper, Clycq & Kyndt, 2023). Many may have relied on government bursaries, scholarships, or student loans to finance their studies, often necessitating part-time employment that competes with academic and professional development activities (Letseka & Pitsoe, 2018). Consequently, their ability to participate in unpaid internships, networking events, and research collaborations - activities that often give wealthier graduates an early career advantage - is significantly constrained (Letseka & Pitsoe, 2018).

Beyond tertiary education, economic background shapes an engineer's ability to engage in continuous professional development (CPD) and credentialing post-GDP. Membership in professional bodies such as the Engineering Council of South Africa (ECSA) is a crucial step in career progression, offering legitimacy, industry recognition, and networking opportunities (Motala et al., 2023). However, the associated costs of registration, annual fees, and certification exams pose financial hurdles for engineers from disadvantaged backgrounds, potentially delaying their professional accreditation and limiting their competitiveness in the job market (Motala et al., 2023). By contrast, engineers from wealthier families often have the financial flexibility to invest in Continuing Professional Development (CPD) courses, attend industry conferences, and pursue advanced degrees; all of which enhance career mobility (Motala et al., 2023).

Social capital also plays a crucial role in career advancement, often intersecting with economic status. Engineers from well-connected families may benefit from informal mentoring, industry referrals, and strong alumni networks that facilitate early career opportunities. These advantages often translate into quicker promotions, access to high-impact projects, and greater visibility within organisations (Ngcwangu, 2025). Conversely, engineers from economically disadvantaged backgrounds frequently lack access to these networks, making career progression more challenging. Without internal sponsorship or senior advocates within organisations, they may struggle to secure leadership roles or transition into specialised fields that offer long-term career growth (Ngcwangu, 2025).

Financial responsibilities further shape the career decisions of early-career engineers from lower-income backgrounds. Many must navigate financial pressures such as student debt repayment, supporting extended family members, and securing financial stability before prioritising strategic career moves. As a result, they may opt for immediate job security in stable but lower-paying positions rather than pursuing riskier, long-term opportunities such as postgraduate studies, international assignments, or leadership-track roles (Bhorat, Cassim & Tseng, 2016). This trade-off, while pragmatic, can limit their exposure to career-enhancing experiences, slowing their overall progression in the profession (Bhorat, Cassim & Tseng, 2016).

Despite these challenges, targeted organisational interventions can play a pivotal role in reducing socioeconomic disparities in career advancement. Structured mentorship programmes, financial support for professional development, and initiatives aimed at increasing access to high-impact projects can help level the playing field (Rogan & Reynolds, 2019). Organisations that actively promote inclusive career development pathways (such as offering financial assistance for professional registration, prioritising diverse hiring practices, and implementing sponsorship programs) contribute to long-term transformation within the sector (Rogan & Reynolds, 2019).

3.10.4 Language

Language plays a critical role in shaping the professional experiences of early career engineers in South Africa, particularly in the post-GDP phase. As English is the dominant language in professional and technical settings, engineers who are not native English speakers may encounter significant challenges in navigating corporate environments where proficiency in English is expected for communication, technical documentation, client interactions, presentations, and networking (Chikumbu, 2019). Given the linguistic diversity of South Africa, where multiple indigenous languages are spoken alongside English, language barriers can contribute to disparities in career advancement (Louw, 2022). For engineers from non-English-speaking backgrounds, linguistic proficiency can impact confidence, participation in professional discussions, and even perceptions of competence. Studies have shown that language-related challenges may lead to exclusion from critical career-enhancing opportunities, such as leadership roles, high-profile projects, and key decision-making processes (Prah, 2018; Louw, 2022).

Engineers who struggle with professional English may face additional hurdles in writing reports, engaging in technical discourse, or effectively communicating ideas in meetings, which can inadvertently affect their career progression (Eggleston & Rabb, 2018). However, multilingualism can also serve as an asset in South Africa's diverse workplaces. Engineers who are fluent in multiple languages, particularly indigenous languages, may have a strategic advantage in industries where engaging with a broad range of stakeholders - including employees, clients, suppliers, and government officials - requires linguistic adaptability (Zano, Sibanda, van Tonder & Dudu, 2022). In sectors such as infrastructure development, manufacturing, and consulting, multilingual engineers can bridge communication gaps, enhance collaboration across teams, and foster stronger professional relationships (Makalela, 2018). Organisations that recognise and

leverage linguistic diversity can create more inclusive workplaces by promoting multilingual communication and providing language support where necessary (Makalela, 2018).

Language proficiency also intersects with workplace culture and perceptions of professionalism. In South Africa, where historical inequalities have shaped access to education and language instruction, engineers from underprivileged backgrounds may face implicit biases regarding their language skills, particularly if their accents or speech patterns deviate from dominant corporate norms (Madiba, 2019). These biases can contribute to exclusionary practices, where engineers from non-English-speaking backgrounds are overlooked for leadership positions or key client-facing roles (Madiba, 2019). To address these challenges, organisations should implement targeted language development initiatives, such as professional English training, communication workshops, and mentorship programmes that provide support for engineers from linguistically diverse backgrounds. Additionally, embracing linguistic inclusivity; through multilingual communication policies and the recognition of indigenous languages in workplace interactions; can help create a more equitable and diverse engineering profession in South Africa (Akintayo, Eden, Ayeni & Onyebuchi, 2024).

3.10.5 Age

Age plays a significant role in shaping the career trajectories of early-career engineers post-GDP in South Africa. While GDPs serve as structured pathways to integrate engineering graduates into professional environments, the age at which engineers enter these programmes and subsequently transition into full-time roles can influence their career development, workplace experiences, and long-term progression (Marais, Barnard & Mensele, 2017). Younger engineers, particularly those in their early to mid-twenties, often face the challenge of being perceived as inexperienced despite possessing advanced technical knowledge acquired through formal education and GDPs. In industries where technical expertise, leadership, and problem-solving abilities are closely associated with years of experience, younger engineers may struggle to establish credibility among senior colleagues and managers (Groenewald & De Lange, 2018). This credibility gap can result in limited opportunities for early career engineers to take on high-impact projects, lead teams, or contribute meaningfully to strategic decision-making (Groenewald & De Lange, 2018).

Additionally, younger engineers may find it difficult to assert themselves in hierarchical workplace cultures where seniority is highly valued (Rogan & Reynolds, 2019). In South African engineering firms, where mentorship structures are often informal and built on long-standing professional networks, younger engineers may not always have direct access to decision-makers or high-ranking technical leaders, further delaying their career progression. This is particularly evident in industries with a strong traditional engineering culture, where practical experience is regarded as the primary marker of competence (Rogan & Reynolds, 2019). The presence of generational differences in the workforce also affects mentorship and professional relationships. While GDPs typically provide formal mentorship structures, the generational divide between early career engineers and older, more experienced professionals can create challenges in knowledge transfer (Ramadi et al., 2016). Senior engineers, often shaped by different educational systems and workplace expectations, may emphasise long-standing industry norms, while younger engineers bring fresh perspectives influenced by digital transformation, sustainability concerns, and globalised engineering practices (Ramadi et al., 2016). However, this intergenerational interaction can be mutually beneficial. Younger engineers benefit from the institutional knowledge, technical expertise, and leadership insights of senior colleagues, while organisations stand to gain from the innovative approaches and digital fluency of younger professionals (Motala et al., 2023). Companies that foster structured mentorship programmes, encouraging reciprocal learning rather than one-directional knowledge transfer, can leverage age diversity as a competitive advantage (Motala et al., 2023).

Despite early career challenges, younger engineers may experience accelerated career growth if they demonstrate strong technical capabilities, adaptability, and leadership potential. Engineers who actively seek professional development, pursue industry certifications, and engage in continuous learning often gain recognition within their organisations regardless of their age (Hawse & Wood, 2018). Furthermore, industries experiencing rapid technological advancements may provide younger engineers with unique opportunities to take on leadership roles in emerging fields such as artificial intelligence, automation, and renewable energy, where traditional experience hierarchies are less rigid (Hawse & Wood, 2018). Age-related career barriers can also be mitigated by organisations that emphasise merit-based promotion rather than tenure-based progression. Companies that adopt performance-driven talent management strategies, provide

leadership training, and create inclusive decision-making structures enable younger engineers to contribute meaningfully and progress based on their competencies rather than their years of experience (Ngcwangu, 2025).

3.11 Organisational Influences

Organisational influences, particularly organisational culture and mentoring relationships, significantly impact the career progression of early career engineers. Organisational culture shapes the work environment, guiding how employees interact and advance within the company, often affecting access to career opportunities and mentorship. In male-dominated fields like engineering, entrenched cultural norms and biases can create barriers, particularly for women and marginalised groups. Mentoring relationships, critical for career development, are also shaped by these organisational dynamics, with race, gender, and power influencing access to valuable guidance and networks.

3.11.1 Organisational culture

The culture of an organisation; the collective values, norms, beliefs, and behaviours; greatly influences how work is conducted, how employees interact, and how individuals progress in their careers (Massimino & Turner, 2018). For early career engineers, the organisational culture not only impacts their day-to-day experiences but also determines the opportunities available for career advancement, mentorship, and professional growth (Massimino & Turner, 2018). Organisational culture extends beyond formal policies and regulations to include informal practices, unwritten rules, and everyday behaviour that guide how individuals are managed and promoted within an organisation (Massimino & Turner, 2018). While formal structures such as affirmative action or diversity programs are implemented to support the advancement of underrepresented groups, these can be undermined by entrenched cultural norms, biases, and stereotypes (Lips-Wiersma et al., 2016). For example, women in male-dominated fields like engineering may face resistance in the workplace due to cultural norms that regard them as less capable than their male counterparts. These informal practices, which often remain unchallenged, can become significant barriers to career progression, limiting access to high-profile projects, leadership roles, or mentoring opportunities that are crucial for career development.

Research highlights that organisational culture is a key driver in shaping recruitment, promotion, and development practices (Chatman & O'Reilly, 2016). In cultures where systemic biases are prevalent, the implementation of diversity and inclusion policies may be ineffective. For instance, male-dominated organisations may fail to adequately address the barriers women face, such as unequal access to leadership positions or professional networks, which often results in stalled professional growth (Ames, Coplen & Malloy, 2019; McKinsey & Company, 2019). Organisational culture can either reinforce gender disparities or work toward dismantling them. A workplace culture that actively fosters inclusivity, embraces diverse perspectives, and promotes equality can create an environment where women and other marginalised groups feel supported and empowered to progress in their careers (McKinsey & Company, 2019).

One of the critical challenges within organisational cultures is the persistence of stereotypes and biases, which often develop in educational settings and are perpetuated in workplace practices (Tabassum & Nayak, 2021). In many engineering organisations, gender and racial biases are not only ingrained in recruitment and promotion practices but also reflected in everyday interactions and decision-making (April & Govender, 2022). For organisations to foster true transformation, senior leaders must model inclusive practices and take proactive steps to challenge prejudices that hinder diversity. This requires a commitment to systematic change, including reevaluating hiring processes, providing professional development opportunities, and creating organisational cultures that prioritise inclusivity and diversity at every level (April & Govender, 2022).

For women, in particular, organisational culture has a profound effect on their career progression. Studies show that mentorship, sponsorship, and exposure to leadership opportunities are essential to breaking down the barriers that women face in male-dominated industries like engineering (Gipson et al., 2017; Stacho, Stachová & Raišienė, 2019). Initiatives such as targeted development programmes, flexible career models, and creating support networks for women within the organisation are critical to helping them navigate their career paths successfully (Stachová & Raišienė, 2019). For instance, organisations that provide women with access to leadership training and mentorship programmes significantly enhance their opportunities for career advancement (Afande, 2015; Salleh et al., 2023). By promoting female role models and fostering a culture that

supports women-to-women networking, companies can help mitigate some of the challenges women face in achieving senior positions (Faniko et al., 2017).

The importance of organisational culture in shaping career outcomes extends beyond gender. Racial biases, stereotypes, and exclusionary practices within organisational cultures also play a significant role in impeding the career progression of engineers from historically marginalised racial backgrounds (Salleh et al., 2023). In South Africa, for example, Black, Indian, and Coloured engineers continue to face systemic barriers that limit their access to leadership roles and career growth, despite having the necessary qualifications. These barriers are often compounded by a lack of representation in senior technical and managerial positions, as well as limited networking and mentorship opportunities (Bosch, 2019). To truly address these issues, organisations must challenge their internal cultures, create more inclusive practices, and ensure that the voices of underrepresented groups are heard and valued within decision-making processes (Bosch, 2019).

Organisations that are committed to fostering a truly inclusive culture recognise the need to provide equal access to professional networks, leadership training, and development opportunities. This means not only focusing on legislative compliance but also taking tangible steps to change ingrained organisational practices and attitudes (Tadesse & Debela, 2024). By prioritising diversity, equity, and inclusion, organisations can create environments where early career engineers - regardless of gender or race - have the support and resources they need to succeed and progress in their careers. In doing so, they will not only help individual engineers thrive but also enhance their overall organisational performance, innovation, and competitiveness by leveraging the diverse talents and perspectives of their workforce (Okatta et al., 2024).

3.11.2 Mentoring (dis)similarities

In South Africa, the intersection of race and gender adds significant complexity to mentoring relationships, particularly for Black professionals and women. These dynamics are shaped by the country's unique history, where race and gender-based disparities continue to affect workplace interactions and career progression (Ncube, 2018). For early career engineers, particularly those who have participated in GDPs, the mentoring process often reflects these underlying societal and organisational inequities. One of the major barriers faced by Black professionals and women in South Africa is tokenism, stereotyping, and limited access to informal networks that are crucial for

career advancement (Freeman & Kochan, 2019). The history of apartheid and the continued legacy of racial segregation have led to systemic disadvantages for Black South Africans in the workplace, including fewer opportunities to access meaningful mentoring relationships (Bosch, 2019). Cross-racial mentoring relationships, in particular, are often hindered by mistrust and a perceived risk on the part of White mentors, who may be reluctant to engage with non-White mentees. This reluctance stems from historical power dynamics and the ongoing racial tensions in South African organisations, where White individuals may view mentoring Black mentees as fraught with challenges or uncertainties (Freeman & Kochan, 2019). This creates an additional layer of complexity for Black engineers seeking mentorship, as they are more likely to face barriers in accessing valuable networks and career guidance.

In contrast to the challenges faced by Black professionals, women in South African engineering often experience a different set of (dis)similarities in mentoring relationships. South Africa's engineering sector, like many others, remains predominantly male-dominated, and women, particularly Black women, are underrepresented in leadership roles. As a result, women tend to experience mentoring dynamics that emphasise power-sharing, collaboration, and mutual respect, particularly when mentored by other women (Goerisch et al., 2019). Female mentors in South Africa are more likely to provide their mentees with career preparation and research opportunities that directly enhance their professional growth, which is a distinct approach compared to the more hierarchical mentoring styles of male mentors (Moghe, Baumgart, Shaffer, & Carlson, 2021).
However, these benefits are not without their challenges. Women in South Africa face systemic barriers to accessing mentoring opportunities due to their lower representation in senior roles and limited positional power (Read, Fisher & Juran, 2020). Black women, in particular, struggle to access leadership positions and mentoring relationships, which further hampers their career development. In many cases, women are placed in cross-gender mentoring relationships, which can carry added challenges due to gender stereotypes and biases (Kogovšek & Ograjenšek, 2019). These stereotypes, deeply ingrained in South African workplaces, often undermine women's professional growth and limit their access to high-quality mentoring. For example, gender biases that suggest women are less suited for leadership or managerial positions can hinder their ability to receive developmental support (Kogovšek & Ograjenšek, 2019). This is particularly relevant in

male-dominated industries such as engineering, where women may be less likely to be mentored by senior leaders or given the same opportunities for career advancement (Garvey et al., 2021).

Furthermore, traditional mentoring models in South Africa have historically reflected the experiences and values of White male professionals, reinforcing power imbalances and perpetuating exclusionary practices within organisations (Garvey et al., 2021). These models often embody paternalistic dynamics that restrict open communication, especially for women and Black professionals in engineering fields (Goerisch et al., 2019). However, studies indicate that women in mentoring roles are more likely to foster inclusive and collaborative environments, where mutual respect and interdependence are prioritised over hierarchy (Goerisch et al., 2019). These more inclusive mentoring approaches can be particularly beneficial for Black women and other marginalised groups, as they encourage a more supportive and less competitive atmosphere (Goerisch et al., 2019). Despite these positive trends, the systemic barriers to mentoring in South Africa cannot be ignored. The country's socio-political history continues to influence how mentorship is experienced by underrepresented groups, particularly in the context of race and gender (Bal et al., 2022). These disparities highlight the need for organisations to address the ingrained biases in their mentoring practices and create more inclusive, cross-cultural mentoring relationships that provide equitable opportunities for career progression (Bal et al., 2022).

3.12 The effect of Personal Characteristics on Organisational influences

The effect of personal characteristics, such as race, gender, economic status, language and age on organisational influences is complex and multifaceted. These characteristics significantly shape how individuals interact with organisational structures, policies, and cultures, which can either facilitate or hinder their career progression (Botha & Coetzee, 2017). In many cases, traditional organisational systems fail to accommodate or consider the diverse personal characteristics of their employees, especially in male-dominated and structurally rigid fields like engineering. Understanding the impact of these factors is crucial in explaining how personal characteristics influence not only individual career paths but also shape organisational outcomes (Secules, Strong & Fletcher, 2021).

Gender is one of the most visible and impactful personal characteristics in shaping how individuals experience organisational systems. Traditional career models, especially in male-dominated industries such as engineering, often assume linear, vertical career progression with an emphasis on full-time, rigid work schedules. These models frequently fail to recognise the specific challenges women face, particularly when balancing professional responsibilities with family or caregiving duties (Broadbridge, 2015; Herman, 2015). In these organisational structures, women often encounter systemic barriers, such as limited access to leadership roles, exclusion from informal networks, and a lack of work-life balance, which can severely hinder career progression (Rapuano, 2020).

Moreover, the intersectionality of gender and race complicates these barriers further. Black women, in particular, experience compounded challenges due to both gendered and racial stereotypes, which influence their treatment and opportunities within the workplace. These employees may find it harder to access mentorship, face implicit biases, and be excluded from critical conversations or decision-making processes (Buse, Bilimoria & Perelli, 2013). In engineering, where women are underrepresented, this lack of support and mentorship can lead to higher attrition rates, creating a cycle where there are fewer female role models and leaders (Hunt, 2016; Engineers Rising, 2018). Race is a critical personal characteristic that shapes individuals' interactions with organisational structures. In South Africa, the legacy of apartheid continues to impact organisational dynamics, where race remains a significant determinant of career advancement and professional opportunities (Steyn, 2021). Black employees often encounter systemic barriers such as exclusion from professional networks, limited access to leadership opportunities, and the effects of racialised workplace cultures that may include microaggressions or overt discrimination (Steyn, 2021). These barriers disproportionately affect Black professionals, making it harder for them to achieve career success compared to their white counterparts (Hunt, 2016).

Additionally, in organisations with a lack of racial diversity in leadership positions, Black employees may face challenges in identifying role models or mentors who can provide guidance and support (Murrell, Blake-Beard & Porter, 2021). This lack of representation in senior roles further compounds the difficulty Black employees face in progressing within the organisation, as

it limits access to opportunities and perpetuates existing inequalities (Murrell, Blake-Beard & Porter, 2021). Age is also a significant personal characteristic that interacts with organisational structures. Younger employees may be seen as lacking experience, which can hinder their career advancement, especially in organisations where seniority is highly valued (Kobayashi & Kondo, 2019). In contrast, older employees may encounter age-related biases, including perceptions of being technologically outdated or less adaptable, which can negatively impact their opportunities for career progression (Malek, Hassan, & Sabil, 2019). These age-related barriers not only affect professional growth but also influence how employees are integrated into organisational cultures and decision-making processes, limiting their contributions and growth opportunities (Malek et al., 2019).

Economic status and access to resources also intersect with organisational influences. Employees from economically disadvantaged backgrounds may not have the same opportunities to access professional networks, higher education, or career development resources, which can impede their ability to compete on an equal footing with wealthier colleagues (Hunt, 2016). This disparity in access to resources can perpetuate a cycle of inequality, as those from wealthier backgrounds have more opportunities for additional qualifications, networking, and professional development. Without addressing these inequities, organisations risk reinforcing existing socio-economic divides, which can hinder diversity and limit the potential of economically disadvantaged employees (Hunt, 2016).

Language is an often overlooked but important personal characteristic that affects how employees interact with organisational structures, especially in diverse, multicultural environments. In South Africa, where multiple languages are spoken, employees who do not speak the dominant language(s) in the workplace (e.g., English or Afrikaans) may face challenges in communication, networking, and accessing key information (Mkhize, 2017). These language barriers can lead to misunderstandings, exclusion from critical conversations, and a sense of marginalisation within the organisation (Mkhize, 2017). Organisations that fail to consider language diversity may inadvertently create an environment in which employees feel disconnected or excluded, limiting their potential for career advancement (Rezai, Lindsay, Ahmed & Vijayakumar, 2023).

3.13 The effect of Organisational influences on Self-efficacy

Self-efficacy plays a critical role in career development, particularly in technical and highly structured professions such as engineering. For early-career engineers transitioning from GDPs to independent professional roles, organisational influences can either enhance or diminish their self-efficacy (Reddy et al., 2016). These influences stem from workplace culture, leadership practices, professional development opportunities, and the nature of work assignments. In the South African engineering sector, where skills development and retention remain ongoing challenges, fostering high self-efficacy among early-career engineers is vital for ensuring long-term career success and workforce sustainability (Reddy et al., 2016).

A supportive organisational culture is instrumental in shaping self-efficacy. Environments that encourage autonomy, constructive feedback, and knowledge sharing contribute to an individual's confidence in their abilities (Lent et al., 2019). However, in many South African organisations, particularly those operating in historically male-dominated engineering fields, workplace cultures may still reflect implicit biases that influence the self-efficacy of underrepresented groups, particularly women and previously disadvantaged professionals (Solomons, 2024). Engineers who experience exclusion from informal networks, limited mentorship opportunities, or microaggressions may internalise doubts about their competence, leading to reduced confidence in their professional capabilities (April & Govender, 2022). Conversely, inclusive cultures that actively promote diversity and equitable opportunities can strengthen self-efficacy by reinforcing engineers' sense of belonging and professional identity (April & Govender, 2022).

Leadership practices within organisations also significantly impact self-efficacy. Transformational leadership, which emphasises mentorship, employee empowerment, and visionary guidance, has been shown to enhance self-efficacy by providing engineers with a sense of direction and purpose (Lu, & Li, 2021). In contrast, autocratic leadership styles that focus on rigid hierarchical control may undermine self-efficacy by limiting decision-making opportunities and reinforcing dependency on authority figures (Lu, & Li, 2021). In South Africa, where engineering leadership structures often reflect historical patterns of exclusivity, progressive leadership approaches that prioritise mentorship and professional development are necessary to build self-efficacy among

early-career engineers, particularly those from underrepresented backgrounds (Kruger & Ramphal, 2016).

Work assignments also shape self-efficacy by providing engineers with opportunities to apply theoretical knowledge in practical settings. When engineers are entrusted with challenging projects and given opportunities to take ownership of technical and managerial responsibilities, they develop a stronger belief in their ability to navigate complex engineering problems (Ngonda, Shaw & Kloot, 2022). However, if early-career engineers are consistently assigned low-impact tasks with minimal decision-making authority, they may struggle to develop the confidence required for career progression (Ngonda et al., 2022). Furthermore, disparities in work allocation; often influenced by implicit biases; can result in differential skill development trajectories, with some engineers receiving more exposure to high-stakes projects than others (Eaton et al., 2020). Addressing these discrepancies through transparent work assignment policies and equitable access to career-enhancing opportunities is essential for fostering high self-efficacy across the workforce (Eaton et al., 2020).

Professional development initiatives, including structured training programmes, mentorship, and leadership development schemes, further contribute to self-efficacy by equipping engineers with the competencies needed for career advancement (Brunhaver et al., 2017). Engineers who perceive their organisations as actively investing in their growth are more likely to develop strong self-efficacy, as they attribute their successes to skill acquisition rather than external factors beyond their control (Lent & Brown, 2013). In South Africa, where skills shortages in engineering persist, continuous professional development is particularly crucial in ensuring that engineers feel competent and confident in their evolving roles (Reddy et al., 2016). Companies that neglect such initiatives risk creating environments in which engineers feel undervalued and ill-equipped to meet industry demands, ultimately diminishing self-efficacy and increasing attrition rates (Reddy et al., 2016).

3.14 The effect of Organisational influences on Outcome Expectations

Organisational influences exert a critical impact on the outcome expectations of employees, particularly among early career engineers transitioning from GDPs to autonomous professional

roles. While personal attributes and individual agency are central to shaping these expectations, they are profoundly mediated by organisational structures, cultures, policies, and practices (Lent et al., 2000; Lips-Wiersma et al., 2016). Within this context, the degree to which an organisation actively supports, recognises, and facilitates career progression significantly determines how early career engineers perceive their potential for advancement (Ogbonnaya & Bevan, 2021). The interplay between organisational culture, leadership, employee support mechanisms, and broader systemic variables, such as race and gender, shapes not only engineers' immediate professional experiences but also their long-term expectations of career success (Bosch, 2019; Tabassum & Nayak, 2021)

Organisational culture is arguably one of the most influential determinants of outcome expectations. Cultures characterised by transparency, meritocracy, and inclusivity foster an environment in which early career engineers feel confident that their efforts will yield meaningful outcomes (Jha, 2021; Ogbonnaya & Bevan, 2021). When progression and recognition are perceived to be based on competence rather than seniority, favouritism, or other extrinsic factors, engineers are more inclined to invest effort, pursue innovation, and envision upward mobility. In cultures that encourage creativity and calculated risk-taking, early career engineers often develop a heightened sense of personal efficacy and professional optimism, even in the absence of extensive experience (Ames, Coplen & Malloy, 2019). Conversely, rigid or hierarchical cultures can diminish individual agency, constraining engineers' belief in their capacity to shape their own career trajectories. Open communication, constructive feedback, and collaborative problem-solving further strengthen engineers' capacity to navigate complex organisational landscapes, reinforcing positive outcome expectations (Ames et al., 2019).

Organisational climate; the shared perceptions of leadership quality, workplace morale, and support systems; has been shown to significantly influence engineers' career outcomes. A supportive organisational climate, characterised by positive leadership, strong interpersonal relationships, and autonomy, enhances job satisfaction, motivation, and work engagement among engineers (Gonzales, 2021; Amah, 2018). These factors contribute to improved performance and career progression by fostering a conducive environment for professional growth. Conversely, a negative organisational climate can impede engineers' development and job satisfaction, highlighting the importance of cultivating a positive work environment to support career

advancement. Transformational leadership, in particular, plays a pivotal role in enhancing outcome expectations by inspiring engineers to embrace challenges, take initiative, and believe in their professional potential (Ames et al., 2019). Leaders who provide mentorship, articulate clear developmental goals, and recognise employee contributions instil a sense of purpose and direction, especially critical for engineers at the early stages of their careers (Bosch, 2019; Kaleem & Masood, 2020). Participative leadership, wherein employees are included in strategic decision-making, further fosters a sense of ownership over one's career path, contributing to elevated satisfaction and confidence (Tadesse & Debela, 2024).

Structured organisational initiatives, such as career development programmes, technical and soft skills training, and mentorship schemes, are indispensable in shaping the career expectations of early career engineers. Following GDPs, these individuals often rely on organisational structures to scaffold their professional growth. Programmes that provide continuous learning opportunities and social support foster not only the acquisition of technical competence but also the social capital necessary for navigating organisational complexity (Lips-Wiersma et al., 2016). Mentorship, in particular, has been shown to significantly elevate outcome expectations by offering guidance, experiential insights, and access to strategic networks (April & Govender, 2022). Furthermore, the presence of transparent career progression frameworks enables early career engineers to link performance with reward and advancement, thereby strengthening belief in their capacity to succeed (Afande, 2015).

However, the mere presence of development initiatives does not guarantee enhanced outcome expectations. Organisational context remains a critical mediator. In environments with robust internal talent pipelines and a culture of promoting from within, early career engineers are more likely to view their futures with optimism. In contrast, in organisations where advancement is opaque or where external hiring is disproportionately favoured for leadership roles, engineers may experience disillusionment, curtailing their career aspirations (Tabassum & Nayak, 2021).

Informal organisational networks also shape outcome expectations, particularly in the post-GDP phase when formal guidance often diminishes. These networks, comprising peer relationships, mentorship bonds, and unspoken norms of inclusion, can facilitate access to high-impact projects, leadership opportunities, and visibility among senior stakeholders (McKinsey & Company, 2019).

Engineers embedded within inclusive networks often experience enhanced career confidence and are more likely to anticipate upward mobility. However, informal networks can simultaneously act as gatekeepers, especially when access is mediated by socio-cultural factors such as race, gender, or institutional history. Engineers from underrepresented backgrounds frequently encounter exclusion from these informal circles, thus facing restricted access to career-enabling resources and diminished outcome expectations (Bosch, 2019).

This intersectional dimension, wherein race, gender, and other identity markers intersect with organisational dynamics, warrants critical attention. The engineering profession, traditionally dominated by white, male norms, continues to present barriers for women and racially marginalised groups (Tabassum & Nayak, 2021). These barriers may include exclusion from informal networks, lack of visible role models, or discriminatory assumptions about competence and leadership potential, all of which depress career expectations, even when qualifications and performance are equivalent (Tabassum & Nayak, 2021). Addressing these inequities requires systemic organisational transformation. Companies that adopt inclusive leadership practices, foster diverse mentorship opportunities, and institutionalise equity-driven policies are better positioned to enhance the outcome expectations of all employees. Crucially, such interventions not only foster fairness but also enable early career engineers from diverse backgrounds to build the confidence and self-efficacy necessary for career advancement (Ames et al., 2019; McKinsey & Company, 2019).

3.15 The effect of Organisational influences on post-GDP learning

The post-GDP phase of early career engineers is significantly shaped by organisational influences, which either facilitate or constrain continued professional development. As engineers transition out of GDPs, their learning experiences are increasingly determined by the nature of their work assignments, the quality and relevance of ongoing training, and the availability of mentoring and coaching support. These organisational mechanisms collectively influence how engineers build upon their foundational competencies, navigate complex workplace environments, and prepare for future leadership roles.

Work assignments play a pivotal role in the professional growth of post-GDP engineers by providing practical platforms for applying technical knowledge and developing leadership potential. In many organisations, early-career engineers are strategically allocated to projects across diverse operational areas; including engineering, finance, and IT; to cultivate broad-based competencies (Prospect, 2021; Schreuder & Coetzee, 2016). These structured rotations are not merely developmental tools but are also perceived by engineers as avenues for upward mobility and organisational visibility (Crowley-Henry et al., 2019). Assignments that align personal aspirations with strategic organisational priorities tend to yield more meaningful career progression, enhancing both job satisfaction and retention (Nguyen et al., 2020; Neneh, 2020; DeLoach, 2020).

Moreover, exposure to high-level strategic initiatives and leadership forums enriches the learning experience beyond technical domains. Participation in decision-making processes, performance reviews, and strategic forums provides engineers with insights into corporate governance and organisational dynamics, while also fostering the soft skills necessary for leadership (Posada, 2017; Wong et al., 2018). These assignments are often embedded within feedback-rich environments, supported by individual development plans (PDPs) that help engineers track their progress and align with organisational expectations (Saul, Binza & Moeti, 2023). Such structured yet adaptive approaches ensure that engineers continue to develop holistically, evolving into agile professionals capable of navigating increasingly complex roles (Saul et al., 2023).

Post-GDP engineers operate in environments that demand continuous upskilling, particularly in managerial, strategic, and interpersonal domains. Ongoing training initiatives; including workshops, seminars, and advanced qualifications; are instrumental in supporting this evolution (Clarke & Scurry, 2020; Cardador, Hill, & Lopez-Alvarez, 2022). As the engineering profession becomes more interdisciplinary, organisations place increased value on engineers who combine technical excellence with leadership potential and business acumen (Brunhaver et al., 2017; Bucciarelli & Kuhn, 2018). In response, many engineers pursue formal qualifications such as MBAs or Engineering Management degrees to remain competitive and advance professionally (Craps et al., 2021; Miao, 2018).

However, despite these structured training opportunities, the post-GDP phase often reveals significant gaps; particularly in the development of soft skills and in the availability of structured mentoring support (Posada, 2017; Wong et al., 2018). Organisations that actively address these gaps through integrated learning strategies foster more adaptive, confident, and leadership-ready professionals. By combining technical training with interpersonal skill development, organisations ensure that early-career engineers are well-prepared to take on broader responsibilities and leadership challenges (Gallup, 2019). Mentoring continues to serve as a critical developmental infrastructure in the post-GDP phase. Beyond the structured support offered during GDPs, mentoring helps engineers navigate the more ambiguous and autonomous phases of early career development. Effective mentoring provides career guidance, enhances networking opportunities, and supports professional identity formation (Mullen & Klimaitis, 2021; Grek, 2017). The functionalist model of mentoring addresses role-specific expertise, while the relational model emphasises personal growth, trust, and the cultivation of leadership potential (Burns, 2020).

In practice, a hybrid approach; often in the form of distributed mentoring; is emerging as a valuable model for post-GDP engineers (Jensen, 2017). By interacting with multiple mentors across disciplines and hierarchies, engineers gain exposure to a wider array of experiences, accelerating their adaptability and expanding their career pathways. Mentoring not only benefits the mentee but also fosters a reciprocal learning process for mentors, reinforcing leadership and coaching capabilities (Wong et al., 2018). For organisations, embedding mentoring within broader talent development strategies enhances retention, strengthens organisational culture, and promotes long-term succession planning (Okolie et al., 2020). While mentoring supports broad developmental goals, coaching offers a more individualised, performance-driven mechanism to support post-GDP engineers. As engineers assume more autonomous roles and face increased complexity, coaching provides structured opportunities to build self-efficacy, navigate organisational challenges, and clarify career trajectories (Jones, Woods & Guillaume, 2016; Passmore & Sinclair, 2021). Coaching interventions support engineers in managing leadership transitions, enhancing communication skills, and cultivating strategic thinking capabilities; critical areas often neglected in technical training (McCarthy & Milner, 2020; Ellinger et al., 2011).

Organisations that invest in coaching are better positioned to retain engineering talent and prevent career stagnation, a common issue after the conclusion of structured development programmes

(Gifford, 2019; Grant, 2017). By aligning coaching with both individual aspirations and organisational objectives, companies foster a high-engagement environment that drives innovation and performance (Garvey, Stokes & Megginson, 2017). Nevertheless, coaching effectiveness depends on the availability of experienced coaches, alignment with organisational talent strategies, and the degree to which coaching outcomes are integrated into performance management systems (Theeboom, Beersma & Van Vianen, 2014).

3.16 External disruptions

The career development of early-career engineers in South Africa does not occur in isolation but is shaped by broader socio-economic, political, and global events. External disruptions, such as the COVID-19 pandemic, ongoing economic instability, and evolving government policies, have significantly influenced the opportunities available to these professionals, particularly in the post-GDP phase. These disruptions have altered labour market dynamics, delayed transitions into permanent roles, and shifted employer expectations, thereby complicating the progression from structured graduate development programmes into sustainable, long-term engineering careers.

3.16.1 Covid-19

The COVID-19 pandemic, instigated by the SARS-CoV-2 virus, emerged in late 2019 and quickly escalated into a global health crisis, producing far-reaching disruptions across economic, social, and labour market systems. In March 2020, the World Health Organisation (WHO) declared COVID-19 a pandemic, prompting governments worldwide to implement lockdowns, travel restrictions, and remote work policies (WHO, 2020). These necessary public health measures resulted in profound, lasting structural changes across industries, including the engineering sector, where GDPs are pivotal for facilitating the transition of early-career professionals into fully developed roles within the workforce. According to the International Labour Organisation (ILO), global working hours declined by 4.5% in early 2020, impacting over 305 million jobs, with youth, including early-career professionals, being disproportionately affected by heightened unemployment risks (ILO, 2020). Engineering, a field traditionally rooted in hands-on experience, mentorship, and experiential learning, faced significant challenges. The disruption of GDPs, which typically involve structured rotations, skill-building activities, and immersion within the workplace, severely curtailed opportunities for skill acquisition, networking, and career progression (Bansal, Abruzzese, Hewawasam, Hasebe, Hamada, Hoodbhoy & Isasi, 2022).

In this context, COVID-19 can be framed as a career shock; an unexpected, high-intensity event that necessitates a reassessment of career trajectories and professional goals (Akkermans, Seibert, & Mol, 2018). The pandemic precipitated a fundamental disruption to the career progression of early-career engineers, with many GDPs being either delayed, adapted to remote work formats, or cancelled altogether, thereby exacerbating career uncertainty. As engineering job opportunities contracted, numerous graduates were compelled to seek employment outside their field of study, risking skill deterioration and misalignment with long-term career aspirations (Tomlinson, Reedy, & Burg, 2022). In addition to these economic consequences, the pandemic catalysed heightened psychological stress and career anxiety among early-career professionals. Career shocks have been shown to induce psychological distress, particularly among individuals navigating critical career transitions (Taylor, 2017). A Kaiser Family Foundation (KFF) survey highlighted that nearly half of respondents reported increased mental health challenges during the pandemic (KFF, 2020), with prolonged uncertainty around GDPs, employment stability, and professional development opportunities further exacerbating this anxiety (Mahmud, Talukder, & Rahman, 2021).

Setbacks in the early stages of one's career can often result in prolonged earnings stagnation, diminished upward mobility, and delayed professional milestones (Kalleberg & Von Wachter, 2017). While mid-career professionals experienced salary reductions and job insecurity, early-career engineers were especially vulnerable to delays in establishing themselves within the industry, impeding their transition to fully-fledged professional roles (Hite & McDonald, 2020). However, career adaptability; the ability to proactively navigate labour market shifts; emerged as a critical factor in fostering resilience (Rudolph & Zacher, 2020). Many early-career engineers proactively engaged in online learning platforms, pursued technical upskilling, and leveraged virtual networking opportunities in a bid to maintain employability (Hite & McDonald, 2020). At the organisational level, there was an accelerated push towards digital transformation, creating new avenues for engineers skilled in automation, artificial intelligence, and remote collaboration technologies (The Economist, 2020).

The pandemic highlighted the importance of workforce agility, continuous skill development, and strategic career management for early-career engineers. The disruption of structured, in-person

work experiences and delayed career entry may have long-term ramifications for professional identity formation and career trajectory (ILO, 2020). Given the potential long-term effects of early-career instability, targeted interventions - such as mentorship programmes, industry-academic partnerships, and digitally oriented skill-building initiatives - are critical to mitigating these career disruptions (Matsouka & Mihail, 2016). The pandemic highlighted the centrality of adaptability and proactive career management, not only for individual career resilience but also for broader workforce sustainability. For early-career engineers to successfully integrate into the post-pandemic labour market, a concerted effort is required from policymakers, educational institutions, and industry leaders to collaborate on sustainable workforce development strategies (Tomlinson et al., 2022). Investing in robust GDPs, promoting virtual mentorship, and enhancing digital engineering competencies will be integral to shaping a resilient and adaptable engineering workforce for the future.

3.16.2 Economic instability

Economic instability in South Africa has had profound and enduring consequences for the career development of early-career engineers. These effects are shaped by a combination of long-standing structural issues, including high unemployment, economic stagnation, and a shifting labour market, as well as more recent disruptions brought about by events such as the COVID-19 pandemic. Together, these factors have created a challenging environment for young professionals entering the engineering workforce, complicating their efforts to establish stable careers, develop essential skills, and transition from academic training to professional roles (Ranchhod, 2020).

One of the most significant impacts of South Africa's economic instability on early-career engineers has been the disruption of career progression (Wilding, 2023). For many young professionals, securing stable, permanent employment in their field has proven increasingly difficult. Economic downturns have led to widespread contraction in key industries such as manufacturing, construction, and the energy industries that traditionally offer robust opportunities for engineering graduates. This has resulted in job market uncertainty, hiring freezes, and reduced investment in talent development (Van den Berge et al., 2018).

Early-career engineers, who often enter the workforce with limited professional experience, have faced difficulties in obtaining the on-the-job training and mentorship necessary for career advancement (Bansal et al., 2022). Moreover, many engineers have been forced to accept positions

that do not align with their qualifications or career aspirations, which further hinders their professional growth and exacerbates skill mismatches (Tomlinson, Reedy, & Burg, 2022). The broader economic context of persistently high unemployment, which stood at 33.2% in the second quarter of 2025 (Stats SA, 2025), continues to influence engineers' professional opportunities and career trajectories. It has created a highly competitive labour market where young engineers must compete not only with their peers but also with experienced professionals for limited job openings. This has led to increased frustration and disillusionment, as many early-career engineers face prolonged periods of underemployment or unemployment, with little prospect for advancement. The loss of income security and reduced opportunities for career progression have long-term implications, affecting engineers' lifetime earning potential and their ability to move up the career ladder (Miller, Glick, & Cardinal, 2005).

South Africa's economic recovery from the COVID-19 pandemic has been slow, hindered by multiple structural constraints, including infrastructure bottlenecks and low productivity. While the country's GDP has recovered to pre-pandemic levels, growth has remained sluggish, with a modest increase of 0.6% in 2024, down from 0.7% in 2023 (Stats SA, 2025). The labour market remains challenging, with the official unemployment rate rising to 33.5% in the second quarter of 2024, the highest since Q2 2022 (Stats SA, 2024). Among youth aged 15–24, the unemployment rate was alarmingly high at 63.9%, highlighting the disproportionate impact of the economic downturn on young workers. These challenges have made it increasingly difficult for early-career engineers to enter the workforce and establish themselves professionally.

In 2019, it was reported that South Africa had a skills mismatch of more than 50% and ranked lowest in labour productivity compared to 30 other countries (Isaac, 2021). According to the Global Competitiveness Index for 2017–2018, South Africa ranked 61st out of 137 countries in terms of its ability to develop, attract, and retain talent (WEF, 2018). These figures highlight the significant barriers faced by early-career engineers in developing the necessary skills to thrive in the workforce. The country's sluggish economic growth, averaging around 1% annually, has been exacerbated by factors such as policy uncertainty, corruption, inadequate infrastructure, and energy supply constraints, all of which have hampered private sector investment (World Bank, 2024). South Africa's complex labour market regulations, including minimum wage legislation,

collective bargaining, and strict entry and exit policies, aim to protect workers' rights but also present significant barriers to employment. While these measures promote social justice, they can be challenging for young workers, particularly in the face of rapid technological advancements and automation, which are transforming the nature of work (WEF, 2018). These factors compound the difficulty young professionals, including engineers, face in finding stable, long-term career opportunities.

In addition to domestic challenges, South Africa's economy is also influenced by global economic shifts, including the recent resurgence of trade protectionism. The escalation of tariffs by the United States, particularly in its trade disputes with China and other countries, has disrupted global trade flows and increased uncertainty in international markets (Investec, 2025). These developments have had ripple effects on emerging economies like South Africa, which are heavily reliant on global trade and foreign investment. As key export markets become more volatile and global supply chains are strained, sectors such as manufacturing, mining, and automotive; where many engineers are employed; face reduced demand and investment hesitation (Engineering, 2025). These global dynamics further constrain job creation and skills development opportunities for early-career engineers, as companies adopt cautious hiring and investment strategies in response to international economic instability (Reuters, 2025).

3.16.3 Government policies

Despite the challenges, the South African government has taken steps to address workplace disparities through various policies aimed at fostering diversity and inclusion. Notably, affirmative action and Black Economic Empowerment (BEE) policies have been introduced to improve the representation of Black South Africans in various sectors, including engineering (McWalter & Ritchken, 2022). Although these policies have contributed to some improvements, their practical implementation has often been inconsistent, leaving many engineers still facing racial discrimination and bias within the workplace (Mokoena, 2020). This gap between policy goals and real-world outcomes highlights the complexity of overcoming the lingering effects of apartheid, even in the post-apartheid era (McWalter & Ritchken, 2022).

Key pieces of transformative legislation, such as the Skills Development Act (1998), the National Skills Development Plan 2030 (NSDP), the Employment Equity Act (1998), and the Broad-Based

Black Economic Empowerment Act (2013), have a significant impact on the career development of early career engineers, particularly those who have completed GDPs. These policies aim to address skills gaps, promote inclusivity, and ensure equitable representation in the workforce, directly influencing engineers' career trajectories after completing their GDPs. However, despite their significance, the post-GDP phase remains fraught with challenges (Khunoethe & Reddy, 2023).

The Skills Development Act (1998) and the NSDP aim to bridge the skills gap in critical sectors, including engineering, by promoting education, training, and career development (Khunoethe & Reddy, 2023). Post-GDP, engineers are expected to transition from structured development environments to more independent roles within the sector (Mpangeva & De Braine, 2024). These policies continue to influence their career development by emphasising the need for ongoing skills enhancement, access to mentorship, and opportunities for advancement. However, despite their intent, these policies often fall short due to structural barriers, such as gender, race, and geographic disparities, which hinder the progression of underrepresented groups, particularly those from disadvantaged backgrounds (Mputa, 2016).

The Employment Equity Act (EEA) plays a pivotal role in shaping the post-GDP career progression of engineers by addressing systemic workplace inequalities. The EEA promotes diversity, eliminates unfair discrimination, and ensures equal treatment, directly impacting the career paths of engineers (Ndweni & Ozumba, 2021). However, despite mandates for affirmative action and diversity in the workplace, engineers from Black, female, and rural backgrounds often experience slower career progression due to implicit biases, exclusion from mentorship opportunities, and limited access to leadership roles (Mayer, Oosthuizen and Tonelli, 2019). While the Act offers a legal framework for advancement, its effectiveness depends largely on organisations' commitment to addressing deeply ingrained cultural biases and ensuring that all employees have equal access to career development opportunities (Mayer et al., 2019).

The Broad-Based Black Economic Empowerment Act (B-BBEE) (2013) is another critical piece of legislation that impacts the career development of engineers post-GDP. B-BBEE encourages greater participation of Black South Africans in the economy, supporting the inclusion and

advancement of Black professionals, particularly in engineering. While the Act has opened doors for increased representation, the pace of transformation in South Africa's corporate sector remains slow (Myeni & Singh, 2024). For engineers from disadvantaged backgrounds, barriers such as limited access to leadership opportunities, mentorship, and professional networks continue to hinder upward mobility. Despite facilitating entry into the workforce, B-BBEE's ability to promote sustained career growth for Black engineers remains uneven, highlighting the need for further interventions (Myeni & Singh, 2024).

While policies such as the Employment Equity Act and B-BBEE aim to foster gender equity, women engineers still face considerable challenges in the workplace. Despite the policy focus on gender diversity, women often encounter systemic gender biases, restricted access to high-profile projects, and a male-dominated organisational culture (Barkhuizen, Masakane & van der Sluis, 2022). These factors significantly hinder their career progression, particularly in fields like engineering, where they remain underrepresented. While gender equity policies have made strides, more is needed to ensure that women engineers have equal access to mentorship, leadership training, and career advancement opportunities. Additionally, many women face the added challenge of balancing work with family caregiving duties, which, in the absence of flexible work arrangements, further limits their ability to succeed in their careers (Ngobeni et al., 2024).

3.17 The effect of External disruptions on Outcome expectations

External disruptions play a significant role in shaping the career development trajectories of early-career engineers, particularly during the post-GDP phase; a period that is already marked by uncertainty, ambiguity, and a lack of structured support (Robinson, Cimporescu & Thompson, 2021). In South Africa, these disruptions are not only episodic, such as the COVID-19 pandemic, but also systemic, tied to long-standing economic, political, and social challenges. These external shocks and structural instabilities influence how early-career engineers interpret their professional environment and, subsequently, what they perceive as possible or likely outcomes in their careers (Tregenna et al., 2021).

One of the most significant recent disruptions has been the COVID-19 pandemic, which caused widespread delays in projects, hiring freezes, and the reallocation of national resources away from

infrastructure investment toward health and crisis relief (De Groot & Lemanski, 2021). For early-career engineers exiting GDPs during or immediately after the pandemic, this meant entering a labour market that was simultaneously oversupplied and under-demanding. Many engineers, particularly those from historically disadvantaged backgrounds, experienced misalignment between their career aspirations and the available opportunities (Papier, 2020). Some recalibrated their outcome expectations in light of these constraints, leading to reduced optimism about rapid upward mobility or professional registration. Others were diverted into roles outside of core engineering fields, which can have long-term implications for skill development and professional identity (Botha, 2021).

South Africa's economic context has further compounded these effects. Persistent issues such as load shedding, declining investment in state-owned enterprises (SOEs), and the erosion of technical capacity within the public sector have limited both the volume and quality of engineering opportunities in the country (Kahn, 2022; Creamer, 2023). As infrastructure budgets are cut or delayed, many engineers; particularly early-career professionals; find themselves in positions of precarity. These macroeconomic pressures influence how engineers assess the returns on their efforts, qualifications, and professional development (Ocampo, 2019). The traditional belief that engineering guarantees upward social mobility is being increasingly challenged, especially among Black engineers who often carry broader familial expectations (Mnguni, 2019; Van Broekhuizen, 2016).

In addition to economic challenges, policy-related disruptions have also influenced outcome expectations. Government policy aimed at transformation and localisation; while necessary to address historical inequities; can inadvertently create instability when implementation is inconsistent or misaligned with sectoral realities (Lie, 2024). Engineers may encounter environments where employment equity targets drive appointment decisions without corresponding mentorship or capacity-building initiatives, resulting in performance anxiety and professional stagnation (Amadi-Echendu & Phillips, 2020). Furthermore, abrupt shifts in procurement regulations, leadership changes, or institutional failures within the state apparatus often cause project disruptions that directly affect career progression, especially in early stages (Mantashe, 2023).

Social media platforms have introduced a comparative lens to career development, often intensifying the psychological impact of unmet expectations. Witnessing peers' seemingly accelerated trajectories, especially those who have relocated abroad or moved into more supportive work environments, can create a sense of relative deprivation among local engineers. In this context, external disruptions not only alter material access to opportunities but also contribute to lowered self-assessments of future success (Savickas, 2013). Ultimately, external disruptions; whether macroeconomic, socio-political, or global in nature; affect not only access to opportunities but also the perceived reliability of effort-reward relationships in professional development (Hadzi-Vaskov, Pienknagura & Ricci, 2023).

For early-career engineers in the post-GDP phase, the absence of programmatic support leaves them especially vulnerable to these external shocks. Many experience disorientation, disappointment, or even career pivoting, particularly when expected outcomes such as professional registration, promotion, or progression into strategic roles remain elusive due to structural barriers beyond their control (de Bruin, 2023). Addressing these issues requires a more holistic approach that acknowledges not just internal motivation or capacity, but also the deeply embedded structural and environmental forces shaping the South African engineering profession (de Bruin, 2023).

3.18 The Conceptual Framework Emanating from the Literature Review

The conceptual framework presented in Figure 3.1 builds on SCCT and synthesises literature to illustrate the interrelationships among personal characteristics, organisational influences, and external factors in shaping the career progression of early-career engineers in the post-GDP phase. Personal characteristics, such as race, gender, age, language, and socioeconomic background; interact with organisational influences like culture, leadership, and mentoring structures to shape individuals' access to and experiences of post-GDP learning opportunities. These learning experiences, including training, coaching, and work-based assignments, serve as key developmental inputs that influence self-efficacy and career outcome expectations. External contextual factors, such as the COVID-19 pandemic and economic instability, simultaneously shape individuals' perceptions of opportunities and constraints, further influencing their expectations of success and career possibilities. The framework posits that self-efficacy and

outcome expectations are mutually reinforcing and together shape the nature and clarity of career goal setting. Clear and structured goals, in turn, drive targeted career actions; such as pursuing promotions, shifting roles, or seeking leadership responsibilities; which ultimately result in varied forms of career progression. Thus, the framework emphasises the interconnectedness of individual and contextual factors and the mechanisms through which they influence early-career engineers' developmental trajectories beyond the GDP phase.

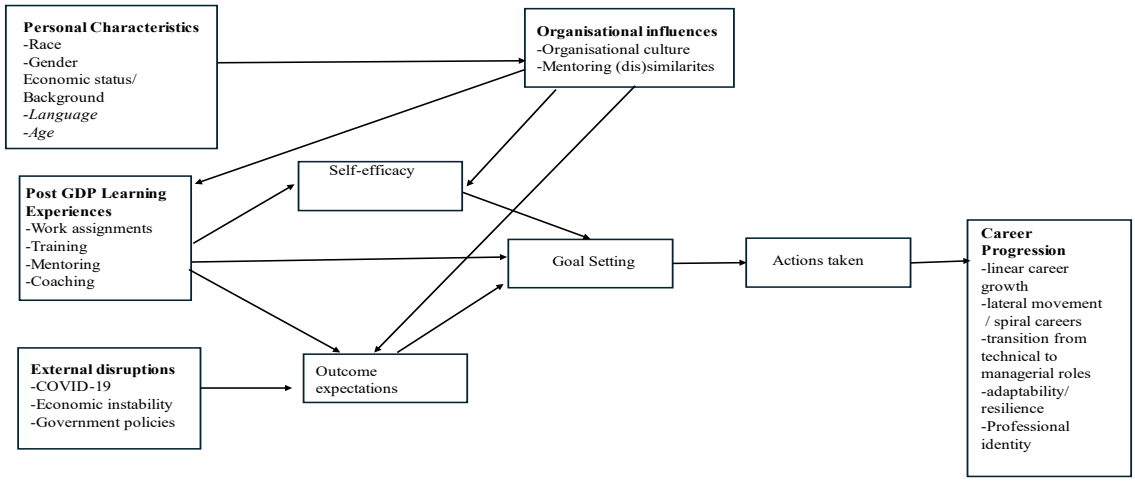


Figure 3.1 A Social Cognitive Career Theory based framework for post-GDP early career engineer who experienced COVID-19

3.19 Study-Specific Conceptual Framework

Although the study-specific framework closely aligns with the overarching conceptual framework; both of which are informed by existing literature and grounded in SCCT; it has been refined to directly address the specific goals of this research and the propositions arising from its central research questions. This framework explores how early-career engineers who have completed GDPs navigate their career progression in the post-GDP phase, with particular attention to their lived experiences during the COVID-19 pandemic, goal-setting behaviours, and access to support mechanisms. Informed by the literature, the framework incorporates personal characteristics such as race, gender, age, economic background, and language, recognising their influence on how individuals engage with and are affected by their organisational contexts. It also considers organisational influences, including leadership practices, organisational culture, and access to developmental opportunities, as critical contextual factors shaping career progression. The framework reconceptualises support as targeted post-GDP learning experiences; particularly mentoring and coaching; rather than broad organisational support, emphasising their role in

promoting career clarity and outcome expectations. External disruptions such as the COVID-19 pandemic, economic uncertainty, and shifting policy environments further compel engineers to reassess their aspirations, engage in structured goal-setting, and take proactive steps in managing their careers. Ultimately, the study-specific framework highlights the dynamic interplay between individual agency and organisational context, accounting for diverse progression pathways including vertical advancement, lateral career moves, and transitions into leadership roles.

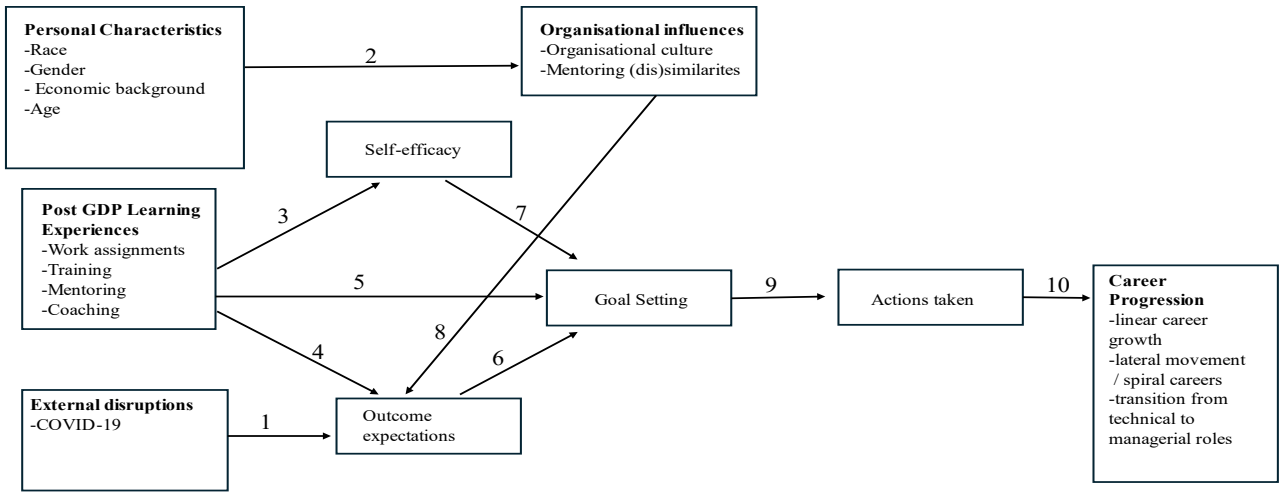


Figure 3.2 A Study-specific Social Cognitive Career Theory based framework for post-GDP early career engineers who experienced COVID-19

Building on the SCCT and the unique realities of the South African post-GDP context, this study proposes a set of interconnected propositions that aim to explain the career development trajectories of early-career engineers beyond graduate development programmes. These propositions reflect the influence of contextual factors, personal beliefs, and behavioural strategies on how early-career engineers formulate expectations, develop confidence, and take purposeful action in their careers.

Proposition 1: Contextual Disruptions Shape Career Outcome Expectations

External contextual factors; such as the COVID-19 significantly alter early-career engineers' expectations regarding career outcomes.

Proposition 2: Personal Characteristics Shape Organisational Influences

Personal characteristics, such as race, gender, economic status and age, shape how individuals interact with organisational influences, which in turn can facilitate or hinder their career progression.

Proposition 3: Post-GDP Learning Experiences Enhance Self-Efficacy

Post-GDP learning experiences, such as challenging projects, mentorship, formal training and learning opportunities, and feedback and coaching, enhance self-efficacy by improving skill development, boosting professional confidence, and fostering adaptability in the workplace.

Proposition 4: Post-GDP Learning Experiences Influence Career Outcome Expectations

Post-GDP learning experiences help shape more positive career outcome expectations, leading individuals to anticipate greater success in their professional endeavours.

Proposition 5: Post-GDP learning experiences significantly influence goal setting among early-career professionals

Learning experiences individuals are exposed to after completing GDPs; such as on-the-job training, mentoring, continued professional development, exposure to challenging assignments, and feedback; play a critical role in shaping their career goals.

Proposition 6: Career Outcome Expectations Drive Goal Setting

Early-career engineers with positive career expectations are more likely to set systematic and structured goals for professional growth. In contrast, those who feel uncertain or pessimistic about their career prospects may be less proactive in goal setting, highlighting the need to reassess their approach to career planning.

Proposition 7: Self-Efficacy Underpins Ambitious Goal Setting

Engineers with higher self-efficacy are more likely to set ambitious and well-structured goals, driven by their confidence in their ability to succeed.

Proposition 8: Organisational Influences Significantly Affect Individuals' Outcome Expectations

Organisational influences such as its culture, leadership practices, support systems, policies, mentoring opportunities, and performance management processes; play a critical role in shaping what individuals believe they will gain from their work and career efforts (i.e., their ***outcome expectations***).

Proposition 9: Structured Goal Setting Influences Targeted and Proactive Career Actions

Structured goal setting serves as a foundational step that shapes targeted career actions, such as

pursuing promotions, seeking leadership roles, and acquiring advanced skills, all of which are aligned with long-term professional aspirations and upskilling efforts.

Proposition 10: Career Actions Facilitate Diverse Career Progression Pathways

Active engagement in concrete career actions; including pursuing promotions, seeking leadership roles, and acquiring advanced skills; is posited to be positively associated with varied manifestations of career progression, encompassing linear advancement, lateral moves, and transitions into managerial roles.

3.20 Chapter summary

This chapter has critically reviewed the theoretical and empirical literature relevant to understanding the post-Graduate Development Programme (GDP) career development experiences of early-career engineers in South Africa. Anchored within the Social Cognitive Career Theory (SCCT) framework, the chapter explored how self-efficacy, outcome expectations, learning experiences, contextual influences, goal setting, and career actions intersect to shape diverse career trajectories in the early years following structured organisational support. A key finding from the literature is that the post-GDP period is both under-theorised and inconsistently addressed, despite being a pivotal phase in professional identity formation and long-term career trajectory. This phase marks a transition from structured developmental support to independent navigation of often complex, unpredictable, and unequal career terrains. For early-career engineers; particularly those from historically marginalised groups; this transition is mediated by personal, interpersonal, and systemic factors that profoundly shape how careers unfold beyond initial professional integration.

The chapter highlights that self-efficacy, while central to SCCT, does not operate in a vacuum. Instead, it is continually shaped and reshaped by learning experiences, exposure to challenges, opportunities for skill application, and feedback from mentors and supervisors. These experiences contribute to how individuals perceive their competence and, in turn, how they envision their professional future. Importantly, the literature suggests that positive learning environments; characterised by coaching, mentoring, and skill-enhancing opportunities; are critical in sustaining self-belief and promoting ambitious goal-setting post-GDP.

In addition to self-efficacy, outcome expectations emerged as a salient and vulnerable construct in the post-GDP context. External disruptions; such as economic instability, unemployment, structural inequality, and the lingering effects of COVID-19; have recalibrated how early-career engineers imagine what is attainable. In many cases, structural barriers and unpredictable labour market conditions have diluted optimism, restricted long-term planning, and triggered career stagnation or lateral movement rather than upward progression. This challenges traditional models of linear career progression and highlights the need for adaptive and context-sensitive conceptual frameworks.

The review also identified how structured goal setting, when underpinned by strong self-efficacy and shaped by realistic outcome expectations, can lead to more proactive and targeted career behaviours. Engineers who perceive themselves as capable and who expect favourable outcomes are more likely to engage in deliberate actions such as seeking promotions, pursuing additional qualifications, or targeting leadership roles. Conversely, negative outcome expectations, often rooted in external socio-economic and institutional barriers; can hinder agency and reduce engagement with growth opportunities. However, while SCCT provides a useful framework for exploring these dynamics, the literature reveals significant limitations. There is a noticeable dearth of empirical studies that specifically interrogate the post-GDP experiences of early-career engineers, particularly in the South African context, where race, inequality, and transformation agendas remain powerful forces in shaping career trajectories. Furthermore, much of the existing literature is silent on how macro-level forces, such as national policy shifts, economic instability, and systemic discrimination, intersect with individual-level constructs like self-efficacy and career agency.

In addressing these gaps, this study positions itself at the intersection of individual development and structural influence. The propositions emerging from the literature review are designed not only to explore how early-career engineers navigate the post-GDP terrain but also to illuminate the contextual pressures, learning dynamics, and personal beliefs that underpin their decision-making and career strategies. By doing so, the study contributes to a more holistic, empirically grounded, and socially responsive understanding of early career development in engineering; one that accounts for complexity, acknowledges systemic barriers, and affirms the agency of individuals operating within constrained environments.

Ultimately, this chapter has laid the conceptual and critical foundation for the study's analytical framework. It calls for a reimagining of early-career support and professional development strategies that extend beyond the GDP phase, particularly in contexts marked by historical inequities and persistent socio-economic challenges. In doing so, it advances the argument that the long-term success of graduate development initiatives cannot be evaluated solely by short-term integration metrics but must consider how engineers are prepared to navigate the uncertainties, opportunities, and structural dynamics that define their post-GDP professional lives.

CHAPTER 4: RESEARCH METHODOLOGY

4.1Introduction

Chapter 3 culminated in the development of the conceptual framework and ten research propositions, which articulate the hypothesised relationships between SCCT constructs and the career progression pathways of early-career engineers. This chapter outlines the systematic framework and procedures employed to empirically test these propositions and address the overall research aim. It provides a clear rationale for adopting a qualitative approach within an interpretivist paradigm, utilising a multiple case study design to capture participants' lived experiences. The chapter further details the selection of 25 participants, the use of semi-structured interviews for data collection, and the deductive thematic analysis rigorously anchored in the SCCT propositions.

Serving as a comprehensive guide to the study's research methodology, this chapter delineates the philosophical underpinnings, methodological choices, and analytical strategies that informed the investigation into engineering graduates' career progression following participation in Graduate Development Programmes (GDPs). Methodological rigour underpins the validity, reliability, and ethical integrity of the study, facilitating a meaningful exploration of the research objectives (Yin, 2018; Abe & Chikoko, 2020). The qualitative design, situated within an interpretivist paradigm, enabled the collection of rich, complex narratives through in-depth semi-structured interviews. The multiple case study design further enhanced the research by providing detailed insights into individual experiences while identifying broader patterns across diverse contexts (Yin, 2018).

The chapter systematically presents the research paradigm, methodology, design, and data collection methods, emphasising their alignment with the study's objectives. Sampling strategies are described to ensure the inclusion of a representative and diverse participant group, addressing practical and ethical considerations associated with recruitment. The thematic analysis approach is outlined, demonstrating a systematic and credible method for interpreting qualitative data.

Ethical considerations, central to the study's integrity, are highlighted, detailing measures taken to protect participants' privacy, confidentiality, and anonymity.

By adopting a structured and methodologically rigorous approach, the chapter establishes a strong foundation for the study, ensuring robust and meaningful insights into the dynamics of career progression among engineering graduates within the context of Graduate Development Programmes. The following sections provide a detailed account of each research component, underpinning the study's validity, reliability, and theoretical contributions.

4.2Research Methodology

Research methodology refers to the systematic framework employed to address a research problem. It plays a pivotal role in defining and refining research questions, formulating hypotheses, and guiding the collection, organisation, and evaluation of data. Through this process, methodology facilitates the development of conclusions about the research phenomenon and tests their alignment with the initial hypothesis. As such, research methodology contributes to the construction of new theoretical perspectives or enhances the existing body of knowledge (Tobi & Kampen, 2018). Methodology encompasses the concepts, techniques, and tools utilised by researchers to gather, analyse, and interpret data (Patel & Patel, 2019). Common methodologies include the analysis of historical records and documents, participant and non-participant observation, mass observation, mail questionnaires, personal and focused interviews, group interviews, case studies, small group studies of random behaviour, and techniques such as play and role analysis (Patel & Patel, 2019). These methods collectively provide researchers with the means to systematically investigate and gain insights into their chosen phenomena.

4.3 Research Paradigm and Methodology

Researchers' beliefs and perspectives significantly influence how they engage with their environment and approach the research process (Davies & Fisher, 2018). As a result, research methodologies often vary, reflecting these individual worldviews. Despite this variability, research is guided by established principles and frameworks collectively referred to as research paradigms. A research paradigm provides the philosophical and theoretical foundation that underpins a study, shaping how phenomena are understood and knowledge is constructed (Kamal, 2019). Kamal (2019:1435) defines a research paradigm as "the theoretical or philosophical ground for the

research work; it is viewed as a research philosophy." This study employs a qualitative research approach to explore graduates' experiences of career progression following their participation in graduate development programmes. Qualitative research is characterised by its focus on systematically collecting, organising, and interpreting textual data derived from conversations and observations (Ngozwana, 2018; Mohajan, 2018).

One of the key strengths of qualitative research lies in its interactive nature, which allows participants to express their experiences and opinions in detail. This interactive engagement enables the researcher to address the research questions more comprehensively by capturing the depth and complexity of participants' perspectives (Weil, 2017). The qualitative methodology adopted in this study aligns with the interpretivist paradigm, which acknowledges the existence of multiple truths and realities. This paradigm emphasises a holistic understanding of individuals and their environments as interrelated components of the research context (Weil, 2017). By grounding this research within the interpretivist paradigm, the study is well-equipped to explore the detailed social and human experiences of graduates, providing rich insights into their career progression and the broader impacts of graduate development programmes.

4.4 Research design

A research design serves as a comprehensive blueprint that guides the systematic collection, analysis, and interpretation of data, ensuring a structured approach to addressing research questions while minimising variance (Bloomfield & Fisher, 2019). It encompasses key elements such as identifying the research problem, selecting appropriate methodologies, gathering data, analysing findings, and presenting results (Asenahabi, 2019). For this study, a multiple case study design was adopted to investigate the experiences of early-career engineers who participated in GDPs across various industries. This design is well-suited for exploring real-life contexts, facilitating an in-depth examination of both unique differences and shared patterns across cases, thereby fostering a deeper understanding of the phenomenon (Yin, 2018). By focusing on multiple cases, this design enables the identification of recurring themes, the refinement of theoretical constructs, and the testing of theories across diverse contexts. Such an approach enhances the transferability of findings and strengthens the study's theoretical contributions (Yin, 2018). Furthermore, the multiple case study design ensures the robustness and credibility of the research

by employing multiple data sources, providing a detailed understanding of individual cases while simultaneously supporting cross-case comparisons and theory development (Yin, 2018).

In this study, the multiple case study design enables a comprehensive examination of career progression dynamics among early-career engineers. It explores the impact of various contextual factors, including industry, organisational culture, and individual demographics, such as race, gender, and age group. This approach sheds light on both common themes and contextual variations, offering meaningful insights into how GDPs influence career trajectories and professional development, thus contributing to both theory and practice. The study employs a qualitative research approach to capture participants' perspectives as the primary source of data.

4.5 Population

In research, a population refers to a defined group of individuals or entities that share common characteristics and are relevant to addressing the research problem (Majid, 2018). Given the typically large size of populations, it is often impractical to study every member, necessitating the use of sampling techniques to ensure feasibility while maintaining validity and reliability (Asiamah et al., 2017). This study focused on an accessible population**,** which represents a subset of the broader target population that is practically reachable and suitable for addressing the research objectives (Asiamah et al., 2017). The accessible population serves as the primary source from which the research sample is drawn and to which conclusions can be applied (Majid, 2018; Asiamah et al., 2017).

For this research, the accessible population consisted of early-career engineers across South Africa who had participated in Graduate Development Programmes (GDPs) and were willing to take part in the study. By including participants from diverse regions and contexts within South Africa, this approach ensured a comprehensive exploration of career progression experiences and the role of GDPs in professional development. This population was particularly relevant for addressing the research objectives, as it captured the perspectives of individuals navigating early career challenges within a dynamic and evolving professional landscape.

4.6 Sampling Design and Procedure

4.6.1 Sampling frame

A sampling frame refers to a systematically organised collection of source materials from which a research sample is drawn. It typically includes identifiable elements such as names, contact details, or other relevant attributes that define the target population in operational terms, facilitating the selection of participants (Kölln, Ongena, & Aarts, 2019). The primary purpose of a sampling frame in this study was to provide a structured basis for selecting participants who could offer rich, relevant insights into the research phenomenon, enhancing the credibility and trustworthiness of the findings within the specific context under investigation. (Kölln et al., 2019). For this study, the sampling frame consisted of early-career engineers across South Africa who participated in GDPs during the COVID-19 pandemic. LinkedIn was utilised to identify potential participants. Ethical approval for this study was granted by the Rhodes University Human Research Ethics Committee (RU-HREC), approval number 2024-8034-9039, covering the overall research design, including participant recruitment, data collection, and analysis.

While the approval letter did not explicitly mention LinkedIn as a recruitment mechanism, its use was interpreted as consistent with the scope of the approved methodology. Recruitment via LinkedIn adhered to the inclusion criteria and aligned with the ethical principles underpinning the study. Importantly, Rhodes University's ethics framework requires protocol amendments only for substantive methodological changes. The use of LinkedIn was not considered such a departure, but rather a pragmatic adaptation to access the defined participant population, early-career engineers who had participated in GDPs during the COVID-19 pandemic. The approach maintained the core ethical commitments of voluntary participation, informed consent, confidentiality, and minimisation of risk, remaining congruent with the intent and scope of RU-HREC approval. This approach aligns with contemporary scholarship, which cautions against treating social media recruitment as "exceptional," instead advocating that it be evaluated against standard ethical principles of beneficence, respect for persons, and justice (Gelinas et al., 2017).

Recruitment relied solely on publicly available professional information, such as job titles and professional roles that users voluntarily disclose for networking and career visibility. LinkedIn's orientation as a professional platform differentiates it from personal social networking spaces,

where expectations of privacy are typically higher (Fiesler & Proferes, 2018). In line with best practice, the researcher maintained transparency by approaching potential participants under their real identity, sending connection requests personally, and proceeding only once consent was explicitly provided. Email addresses displayed on profiles were not automatically utilised; instead, participants were asked for permission to be contacted, after which formal informed consent procedures were initiated. This phased, opt-in process respected autonomy, safeguarded against undue intrusion, and exemplified ethical diligence. Such strategies are endorsed in the literature as mechanisms to navigate the ethical sensitivities of social media recruitment, particularly where public and private boundaries are blurred (Hokke et al., 2020).

Compliance with South Africa's Protection of Personal Information Act (POPIA) was a central consideration. Because the Engineering Council of South Africa (ECSA) could not release contact details of registered engineers under POPIA, LinkedIn presented an ethically permissible alternative. While professional data on LinkedIn is publicly disclosed, public availability does not equate to unrestricted research use (Fiesler & Proferes, 2018). Risk was minimised by limiting recruitment to professional identifiers (e.g., "engineering trainee" or "graduate in training") and adopting a multi-stage consent procedure. All in-depth communication and consent processes were conducted in secure, private channels (email correspondence and signed consent forms), in line with recommendations that participants be directed to secure study-specific environments for consent and data collection (Darko et al., 2022). Participants were assured of anonymity, confidentiality, and voluntariness throughout, thereby meeting both POPIA requirements and internationally accepted ethical standards for human subjects research.

4.6.2 Research sample

A research sample refers to a subset of a larger population that is selected to provide insights into the characteristics or parameters of the entire group (Boddy, 2016). In studies involving people, a sample comprises individuals chosen to participate in the research, with the selection process aiming to ensure that the sample accurately represents the broader population (Boddy, 2016). Sampling methods were employed to identify participants who could provide rich, relevant insights into the phenomenon under investigation, ensuring the collection of in-depth data that reflects the diversity of experiences within the defined participant population. In this study, the principle of data saturation guided the determination of the sample size, with 25 participants being

interviewed. Data saturation refers to the point at which no new themes, insights, or significant variations emerge from additional data collection (Mwita, 2022). No willing participants were rejected, and recruitment continued until successive interviews yielded recurring patterns, indicating sufficient depth and breadth of data to address the research questions. To mitigate potential recall bias inherent in retrospective interviews, participants were asked to anchor their reflections to specific timeframes, events, and developmental milestones within and after their GDPs, thereby enhancing the accuracy of their accounts. Furthermore, the interview protocol was refined to distinguish mentoring from coaching; mentoring being positioned as long-term, developmental guidance, and coaching as short-term, performance-focused support; to ensure conceptual clarity in both data collection and subsequent analysis.

The decision to use a sample of 25 participants was justified by the observed saturation of data during the collection process. As interviews progressed, it became evident that additional participants were not yielding novel information or insights, indicating that the data had reached a point of completeness. This sample size allowed the study to capture a range of perspectives across diverse industries, demographics, and contexts, ensuring that the findings were credible, nuanced, and reflective of the experiences of early-career engineers who participated in Graduate Development Programmes.By adhering to the principle of data saturation, this study enhances the validity and reliability of its qualitative findings, demonstrating a thorough exploration of the research topic.

4.6.2.1 Sampling procedure

Sampling methods can be broadly categorised into probability sampling and non-probability sampling. In probability sampling, every individual in the target population has an equal or known chance of being selected as a participant, which enhances the likelihood of obtaining a sample that accurately represents the entire population (Cornesse et al., 2020). In contrast, non-probability sampling occurs when individuals have an unequal or unknown chance of selection. This method is often chosen for its practicality, cost-effectiveness, and convenience, particularly in studies with resource or accessibility constraints (Cornesse et al., 2020). Given the practical limitations of time, budget, and accessibility, this study employed non-probability sampling to select participants.

5.6.2.1 Sampling Techniques

Two non-probability sampling techniques were used: purposive sampling and snowball sampling.

4.6.2.1.1 Purposive Sampling

Purposive sampling involves the deliberate selection of participants who meet predefined criteria relevant to the study's objectives (Sharma, 2017). This method ensures that the sample consists of individuals who can provide rich, context-specific insights aligned with the research focus. In this study, purposive sampling was used to identify early-career engineers who had participated in Graduate Development Programmes (GDPs) during the COVID-19 pandemic. Initial access to potential participants was facilitated by the Engineering Council of South Africa (ECSA), which provided a letter of support signed by its Chief Executive Officer endorsing the research (see Appendix B for the ECSA support letter). However, to comply with the Protection of Personal Information Act (POPIA), ECSA was unable to share the contact details of registered engineers. Consequently, the researcher identified potential participants through publicly available professional profiles on LinkedIn, clearly demonstrating ECSA's support for the study to establish credibility. This approach ensured that all participants met the inclusion criteria while enabling the collection of rich, relevant insights into diverse career trajectories.

4.6.2.1.2 Snowball Sampling

Snowball sampling involves leveraging initial participants to identify additional respondents who meet the study's inclusion criteria (Anieting & Mosugu, 2017). This method is particularly useful for reaching individuals who may not be accessible through conventional channels. In this study, participants who had been recruited via LinkedIn and confirmed their willingness to participate were invited to recommend colleagues or acquaintances who had also participated in GDPs. To comply with the Protection of Personal Information Act (POPIA), participants were asked to first inform their colleagues about the study and to obtain their consent before sharing any contact information. Only after the referred individuals expressed interest and provided permission were they contacted by the researcher. This phased, opt-in process ensured that personal data were not shared without consent, maintaining confidentiality and ethical integrity throughout the recruitment process.This technique expanded the pool of respondents while maintaining relevance to the research objectives. By combining purposive and snowball sampling, this study was able to

ensure that the sample included participants who provided diverse, meaningful insights while addressing the practical and ethical challenges associated with data collection.

4.7 Trustworthiness of the study

In qualitative research, trustworthiness is essential for ensuring that findings authentically reflect participants' experiences. Building on the foundational framework by Lincoln and Guba (1985), recent scholars have reinforced the relevance of credibility, transferability, dependability, and confirmability as criteria for ensuring rigour in qualitative inquiry (Nowell, Norris, White & Moules, 2017; Forero, Nahidi, De Costa, Mohsin, Fitzgerald, Gibson, McCarthy & Aboagye-Sarfo, 2018). These principles were applied throughout this study to strengthen the integrity of insights into the post-GDP career trajectories of early career engineers.

4.7.1 Credibility

Credibility refers to confidence in the accuracy and authenticity of the data and interpretations (Forero et al., 2018). In this study, credibility was enhanced through prolonged engagement with participants during semi-structured interviews, which enabled the researcher to develop rapport and elicit detailed, context-rich narratives. Member checking was used to validate interpretations; participants were invited to review and confirm the accuracy of their interview transcripts and clarify ambiguities. This process ensured that the data genuinely reflected participants' lived experiences of navigating career development after completing a GDP.

4.7.2 Transferability

Transferability concerns the extent to which findings can be applied beyond the immediate study context (Nowell et al., 2017). Although qualitative research does not aim for statistical generalisability, transferability was supported through thick description**.** Detailed contextual information was provided on the participants' professional settings, demographic backgrounds, and the institutional characteristics of their respective GDPs. By offering detailed accounts of how early-career engineers experience career support, goal-setting, and self-efficacy in the aftermath of the COVID-19 pandemic, the study offers insights that may be applicable to similar post-GDP populations in engineering and related sectors.

4.7.3 Dependability

Dependability relates to the consistency and reliability of the research process over time (Forero et al., 2018). To establish dependability, a clear and transparent documentation trail was maintained. This included records of interview protocols, coding procedures, and analytical decisions. The use of a consistent interview guide; developed from relevant theoretical frameworks and literature on career development; ensured uniformity in data collection while allowing space for participant-driven exploration. Revisions to the coding framework were tracked through iterative cycles of thematic analysis, supporting methodological coherence.

4.7.4 Reflexibility

Reflexivity involves the researcher's ongoing critical reflection on how their positionality, assumptions, and values influence the research process (Dodgson, 2019). Given the researcher's prior experience in the field of human capital and graduate development, a reflexive journal was kept throughout the study to identify potential biases and maintain analytical neutrality. This journal captured reflections on interview dynamics, emerging interpretations, and shifts in understanding. Reflexivity was also practised during data analysis to ensure that the findings remained grounded in participants' lived experiences rather than the researcher's expectations.

4.7.5 Confirmability

Confirmability ensures that the findings are shaped by participants' responses rather than researcher bias (Nowell et al., 2017). This was achieved through reflexive journaling, where the researcher recorded personal reflections, decisions, and potential biases during data collection and analysis. The thematic analysis process was grounded in direct quotations and verified against raw data to ensure that interpretations were firmly rooted in participants' accounts. The use of qualitative analysis software further enabled traceability between coded data and emerging themes, reinforcing the objectivity of the findings.

By addressing these four dimensions of trustworthiness, the study offers a rigorous, context-sensitive exploration of the career development experiences of early-career engineers following their participation in Graduate Development Programmes.

4.8 Data collection

4.8.1 Primary data

To generate rich qualitative data, semi-structured interviews were employed as the primary method of data collection (see Appendix E for the full Interview Guide). The Interview Guide was developed through a systematic, theory-driven process to ensure rigour and reliability, being explicitly anchored in the Social Cognitive Career Theory (SCCT) and the study's conceptual framework. Questions were deductively derived from the ten research propositions and structured to address the study's four objectives, covering topics such as the role of Graduate Development Programmes (GDPs) on goal setting, the impact of COVID-19 on self-efficacy, and the influence of organisational supports and barriers. This design ensured construct validity and alignment between theoretical constructs, research propositions, and the data collection instrument. The semi-structured format facilitated consistency across participants while providing the flexibility to probe individual experiences in depth, enabling the collection of contextually rich data. Participants were recruited via email, which provided a comprehensive overview of the study's purpose, scope, and ethical considerations, and informed consent was obtained prior to participation (see Appendices C and D). Interviews were scheduled to accommodate participants' full-time work commitments, with fourteen conducted virtually via Microsoft Teams and eleven conducted in person, thereby enhancing accessibility and ensuring secure, interactive data collection. Virtual interviews were audio-recorded and transcribed verbatim, while detailed notes and selective transcriptions were used for in-person sessions in line with participant consent. The core constructs of the Interview Guide directly informed the development of the coding manual (Appendix F), supporting systematic thematic analysis and ensuring that the collected data were rigorously aligned with the theoretical framework and research objectives. These procedures collectively uphold the qualitative trustworthiness criteria of credibility, dependability, and confirmability, as recommended in recent methodological literature (Spiers et al., 2018). This approach ensured methodological rigour while capturing rich insights into early-career engineers' post-GDP career trajectories and professional development experiences.

4.8.2 Secondary data

The study was informed by an extensive review of scholarly literature of early career development in engineering, which is discussed in Chapter 2.

4.9 Data Analysis

Data analysis for this study was guided by a deductive thematic approach, underpinned by the theoretical framework of Social Cognitive Career Theory (SCCT). Thematic analysis served as the principal method for identifying salient patterns, recurring concepts, and theoretically significant insights across the interview data. As a widely recognised method for qualitative analysis, thematic analysis enables the systematic identification, analysis, and reporting of patterns or themes within data (Castleberry & Nolen, 2018), facilitating rich, detailed, and nuanced accounts of participants' experiences (Terry et al., 2017). Its flexibility allows for the capture of both explicit and implicit patterns across diverse datasets, making it particularly suitable for exploring complex phenomena such as the post-GDP career experiences of early-career engineers.

The data were analysed using a deductive thematic approach, guided by the research propositions developed for this study. The analytic process began with a familiarisation phase, during which transcripts were read multiple times to ensure accuracy and contextual grounding. Familiarisation was conducted with reference to the guiding propositions derived from Social Cognitive Career Theory, rather than through open-ended exploration.

Initial codes were generated deductively from these propositions, focusing on constructs such as self-efficacy, outcome expectations, and contextual influences. Related codes were then grouped to form categories, which were iteratively refined and synthesised into overarching themes. Throughout this process, annotative memos captured how participants' accounts aligned with, extended, or challenged the theoretical propositions.

This approach ensured that the analysis remained closely aligned with the study's research objectives and theoretical framework, while maintaining methodological rigour and transparency.

To ensure a systematic and transparent coding process, Notebook LM, an AI-powered research tool developed by Google, was employed. This platform facilitated the manual tagging and organisation of relevant text segments, supported the retrieval of coded data, and provided an auditable trail of analytical decisions. Notebook LM also assisted in verifying the sufficiency of the dataset for evaluating the study's research propositions. Coding was fully deductive, aligned

with the predefined SCCT constructs, including self-efficacy, outcome expectations, personal goals, and contextual influences (Bingham & Witkowsky, 2021). These constructs shaped both the development of the interview guide and the analytical strategy.

Although a formal question matrix was not used during data collection, a post hoc analytical matrix was constructed during analysis to ensure coherence between participant narratives, theoretical categories, and the study's propositions.

This study further integrated pattern matching into the deductive thematic approach, following the seven-step procedure outlined by Pearse (2019). Pattern matching involved comparing the empirical data against the theoretically derived propositions, allowing the researcher to assess whether the observed phenomena confirmed, refined, or challenged the anticipated relationships. The research commenced with a comprehensive literature review, which informed a conceptual framework depicting key constructs and their interrelationships. From this framework, research propositions were derived, serving as qualitative statements articulating expected relationships between constructs and guiding both data collection and analysis.

A coding manual **(**see Appendix F for the coding manual) was developed prior to data collection. Each key concept from the propositions was assigned a code and expanded to include a label, definition, operational description, and qualifiers or exclusions. This structured approach ensured consistency and rigour in coding.

During analysis, the coding manual guided the identification of theoretically derived codes within the data. Themes were then developed by matching observed data patterns to the pre-defined propositions, with a record maintained to indicate whether the data were supporting, contradictory, or nuanced in relation to each proposition. This audit trail enhanced transparency and analytical rigour.

Findings are presented by first addressing each proposition in relation to its corresponding theoretical construct, illustrating confirmation or refutation with participant narratives and quotations. An integrated discussion then considers how the constructs interact, highlighting areas of convergence, tension, or contradiction, and concludes by indicating which propositions and theories best explain the observed phenomena. Supplementary materials; including the codebook,

coding memorandum, question matrix, and hits-and-misses table; are provided to enhance dependability and transparency.

4.10 Ethical considerations

Ethics can be understood as the principles and norms that guide behaviour, delineating acceptable from unacceptable conduct. Ethical considerations play a pivotal role in research by safeguarding against practices such as fabrication, falsification, or misrepresentation of data, thereby promoting the integrity and accuracy of research findings. Moreover, ethical adherence fosters trust, accountability, mutual respect, and fairness between researchers and participants (Ketefian, 2015). This study rigorously adhered to ethical principles by prioritising the privacy and confidentiality of research participants and ensuring the integrity of the collected data. Participants were explicitly informed that their involvement in the study was entirely voluntary, and assurances were provided regarding the maintenance of their anonymity and confidentiality throughout the research process. Additionally, ethical approval for the study was granted through the issuance of an ethics clearance certificate by Rhodes University (see Appendix A for the ethical clearance certificate) further highlighting the commitment to upholding ethical standards in the research.

4.11 Summary of Chapter

This chapter outlined the methodological framework employed to investigate the career progression experiences of engineering graduates following their participation in Graduate Development Programmes (GDPs). By adopting a qualitative approach grounded in the interpretivist paradigm, the study aimed to capture the diverse and multifaceted perspectives of early-career engineers. The use of a multiple case study design provided a structured yet flexible approach, enabling an in-depth exploration of individual experiences while identifying broader patterns across contexts. Key methodological components, including the sampling design, data collection methods, and analytical strategies, were carefully aligned with the study's objectives to ensure the validity, reliability, and ethical integrity of the research. The use of semi-structured interviews facilitated the collection of detailed and context-specific data, while the thematic analysis approach allowed for a systematic and rigorous examination of the findings. Sampling strategies, including purposive and snowball sampling, were employed to recruit a diverse and representative participant group, ensuring that the study addressed the research questions comprehensively.

Ethical considerations were integral to every stage of the research process, reflecting a commitment to maintaining participants' privacy, confidentiality, and autonomy. These measures not only safeguarded the integrity of the study but also fostered trust and transparency between the researcher and participants. Through its robust methodological design, this chapter established a solid foundation for the exploration of the impact of GDPs on career progression. The approach detailed herein ensures that the findings presented in subsequent chapters are credible, meaningful, and contribute to both theoretical understanding and practical applications in the field of graduate career development. The next chapter presents the findings and analysis derived from this methodologically rigorous study.

CHAPTER 5: Findings and Discussions

5.1 Introduction

Building on the methodological blueprint established in Chapter 4; including the sampling procedures and the deductive thematic analysis approach; this chapter presents the empirical findings derived from in-depth interviews with 25 early-career engineers. The data are organised and discussed around the ten research propositions that emerged from the conceptual framework developed in Chapter 3. Through extensive use of participant voices and narrative accounts, this chapter examines the alignment of empirical evidence with the predicted relationships, illustrating how factors such as post-GDP learning experiences, organisational influences, and contextual disruptions shape self-efficacy, outcome expectations, and career actions.

The journey from engineering graduate to early-career professional is far from linear, shaped by a dynamic interplay of personal resolve, organisational support, societal expectations, and broader contextual disruptions. This chapter brings this complexity to life by presenting ten data-driven propositions that illuminate how early-career engineers in South Africa navigate their post-Graduate Development Programme (GDP) trajectories. These propositions unpack the interactions between external environments, individual attributes, post-GDP learning experiences, and workplace cultures, each influencing how engineers perceive their careers, set goals, and activate the self-belief required to pursue them. While some propositions are supported by clear patterns in participant experiences, others reveal contradictions and tensions that challenge conventional narratives of career development, highlighting a mosaic of experiences shaped by both agency and constraint.

The study is driven by a central aim: to explore the lived realities of career progression among engineering graduates who have completed structured GDPs. In a sector marked by rapid technological change and persistent inequalities, understanding how these young professionals transition into substantive roles is both timely and critical. Five research objectives guided the inquiry:

1. Conduct a systematic review of the SCCT theoretical framework to identify research gaps addressed in this study.
2. Explore the career progression experiences of graduates since completing their GDPs, including the impact of COVID-19 and associated lockdowns.
3. Identify the role of self-efficacy, goal-setting, and social support in helping graduates develop new skills and competencies required as early-career engineers.
4. Examine the level of support graduates have received in their careers post-GDP.
5. Formulate recommendations to enhance support for early-career engineers following GDP participation.

These objectives are directly informed by the conceptual framework developed in Chapter 2 (Figure 2.2), which builds on Social Cognitive Career Theory (SCCT) to illustrate the interplay of contextual, personal, and organisational variables shaping career outcomes. Objective 1 is addressed through the integration of external disruptions, most notably COVID-19, which impacted both outcome expectations and actual career trajectories. Objective 2 is represented through relationships among post-GDP learning experiences, organisational influences, self-efficacy, and goal-setting, illustrating how early-career engineers navigate skill development and agency within complex environments. Objective 3 is addressed by examining the influence of mentoring, coaching, and training; both as post-GDP experiences and organisational supports; on self-efficacy and career-related decisions. Insights from these three objectives inform the fifth objective, which focuses on proposing targeted recommendations to support early-career engineers in the post-GDP phase.

This chapter is structured around the key themes generated through thematic analysis. Each theme is discussed in dialogue with relevant literature and interpreted through the lens of SCCT. Direct participant quotations are used throughout to ground the analysis in lived experience, offering a deeper, more authentic understanding of how early-career engineers craft their professional pathways amid opportunity, constraint, and change.

5.2 Overview of Participants

A total of 25 participants from diverse industries, including mining, energy, rail infrastructure, fast-moving consumer goods (FMCG), petrochemicals, consulting, and telecommunications,

participated in the study. This variety of sectors reflects the diverse contexts in which GDPs operate, providing insights into how industry-specific challenges influence professional development. Some graduates advanced to senior positions and management roles after completing their GDPs, demonstrating the impact of programme-based professional development on career trajectories. All participants identified as South African citizens, contributing to the local context of career development in the country. All participants had at least a Bachelor's degree in engineering-related fields, including civil engineering, chemical engineering, and mechanical engineering. Many participants pursued additional professional qualifications during or after their GDPs, such as certifications in project management, leadership training, and technical specialisations. These additional qualifications not only enhanced their professional profiles but also positioned them as competitive candidates in their respective industries.

Participants frequently noted that their academic training provided a strong theoretical foundation but did not fully prepare them for the real-world demands of engineering roles. This gap between theoretical knowledge and practical application highlights the importance of GDPs in bridging the divide by offering hands-on experiences and mentorship. Graduate Development Programmes offered participants exposure to rotational assignments across departments, enabling them to gain broad experience and develop technical versatility. However, the COVID-19 pandemic disrupted this structure for many, leading to adjustments in the learning process, such as virtual project management and remote mentorship. The pandemic significantly influenced participants' professional experiences, limiting site access, reducing hands-on learning opportunities, and increasing reliance on digital collaboration tools. Participants experienced varying levels of mentorship, from highly supportive mentors to inconsistent engagement. Gender dynamics played a notable role, with some female participants navigating challenges in male-dominated workspaces. Below is a table that reflects the demographic information of participants.

The participant overview highlights the diverse backgrounds, roles, and experiences of the early-career engineers who took part in this study. The demographic diversity; spanning race, gender, age, degree type, engineering discipline, industry sector, and GDP status; provides a rich context for understanding how Graduate Development Programmes (GDPs) influence professional development. Most participants identified as Black African, with smaller groups identifying as

Coloured, Indian, or White. The gender representation was relatively balanced between male and female participants. In terms of age, most were between 26 and 30 years old, with others in the 20-25 and 30-35 age ranges.

Table 5.1: Demographic Information

Category	Sub-category	Count
Race	Black / African	19
	Coloured	3
	Indian	2
	White	1
	Not Specified	2
Gender	Male	12
	Female	13
Age Group	20-25	5
	26-30	13
	30-35	7
Degree Type	BEng / BSc Eng	16
	BTech / Hons / MEng	9
Discipline	Mechanical Engineering	7
	Electrical Engineering	4
	Chemical Engineering	5
	Industrial Engineering	4
	Civil Engineering	2
	Electronic Engineering	3
Current Sector	Manufacturing	6
	Energy	2
	Petrochemical	3
	Mining & Minerals	7
	Telecommunications	2
	Research & Consulting	3
	FMCG	2
GDP Status	Completed	22
	Exited the programme before full completion	3

Participants held a mix of qualifications, including BEng and BSc Engineering degrees, as well as BTech, Honours, and Master's degrees. The disciplines represented included Mechanical, Electrical, Chemical, Industrial, Electronic, and Civil Engineering. They were employed across a

variety of sectors, such as Manufacturing, Mining and Minerals, Energy, Petrochemical, Research and Consulting, Telecommunications, and FMCG.

Regarding GDP completion status, the majority of participants had successfully completed their programmes, while a smaller group had only partially completed them due to organisational restructuring, contract terminations, or early transitions into permanent roles. This distinction is important, as participants' reflections on their career development often differed based on the extent of their exposure to structured GDP activities.

Taken together, this breadth of experience offers valuable insights into how GDPs support the development of technical expertise, leadership capabilities, and professional identity. However, participants' journeys were shaped not only by their GDP experiences, but also by the level of mentorship they received, the organisational culture, and external challenges, such as the COVID-19 pandemic.

The next section presents the key themes that emerged from the interview data, identified through a rigorous process of thematic analysis. By aligning these themes with the study's research propositions, this section critically examines and validates the conceptual framework, offering deeper insight into how the lived experiences of early-career engineers either confirm, challenge, or extend existing constructs.

5.3 Thematic and Propositional Findings and Discussion

The findings from the interviews are presented below, organised into key themes that emerged from the thematic analysis. Each theme represents a significant pattern in the lived experiences of early-career engineers who have completed GDPs. To ensure analytic depth and rigour, each theme is discussed in relation to relevant literature and theoretical constructs, particularly focusing on SCCT constructs. Verbatim quotes from participants are included to illustrate and substantiate the thematic interpretations, while ensuring anonymity and ethical integrity. The discussion highlights both commonalities and variations in participants' experiences, enabling a detailed understanding of how contextual, organisational, and individual factors influence career trajectories in the early stages of engineering careers.

5.3.1 Contextual Disruptions Shape Career Outcome Expectations

The first proposition was that external contextual factors, such as the COVID-19 pandemic, significantly alter early-career engineers' expectations regarding career outcomes. Literature would suggest that the pandemic acted as a career shock (Akkermans, Seibert, & Mol, 2018), disrupting established trajectories and compelling many participants to reassess their aspirations, timelines, and opportunities. External disruptions, particularly the economic and labour market effects of COVID-19, significantly shaped how participants perceived their career prospects. Engineer B expressed anxiety over the South African job market, referencing pay cuts, shorter work weeks, and restrictive hiring practices: "It brought a lot of anxiety; now we are wanting to even go abroad." Engineer J recounted working "for free for like six months" due to oversupply in her company, eventually questioning whether she still "fit into the categories" of employability post-COVID. Similarly, Engineer N adjusted his expectations after realising that "most of the technical things will be outsourced to consultants," prompting a shift in career goals. These accounts confirm that early-career engineers' expectations are shaped not only by their internal capacities but by larger socio-economic forces that disrupt anticipated career pathways.

Engineer A, shared that "COVID-19 did affect her outlook on career opportunities." Sponsored by a major energy firm during her studies, she received an "unfortunate email" in her final year informing her that, due to restructuring and retrenchments, her placement was withdrawn. This abrupt shift forced her to seek alternative options and fostered anxiety about employment: "Most of the companies did a restructuring, and being a graduate fresh from varsity, you're the least to be considered." Her experience reflects the vulnerability of new graduates amid labour market contractions, a phenomenon widely reported during the pandemic (ILO, 2020; WHO, 2020).

Engineer B similarly noted the need to "relook at your career expirations", describing a saturated chemical engineering market that had driven some peers to consider emigration: "We are now wanting to even go abroad. South Africa, with regards to our career, doesn't seem sustainable." He also cited increased digital interaction during the pandemic as influencing his interest in technology. This aligns with research identifying the pandemic as a catalyst for career adaptability, digital upskilling, and geographic mobility among early-career professionals (Rudolph & Zacher, 2020; Hite & McDonald, 2020).

Several participants highlighted how COVID-19 not only disrupted immediate plans but recalibrated both short-term and long-term goals. Engineer C described how the pandemic "made her more flexible in her approach," prompting her to prioritise digital literacy and adaptability in the short term and stability and work-life balance over the long term. Engineer D explained that remote work, an outcome of the pandemic, reshaped his priorities: "My career strategy now includes more flexible work options, which was not a priority before COVID-19." Engineer I, reflecting on remote learning, also expressed a preference for future roles with flexibility: "It definitely changed my outlook on how I want my future life to look like." These shifts support studies identifying remote work and digital fluency as emerging priorities in post-pandemic career thinking (Papier, 2020; The Economist, 2020).

Participants also described the emotional and psychological toll of the pandemic on their sense of security and direction. Engineer E, for instance, developed an openness to career change: "A small desire in me to want to shift careers, I'm way more open now," even considering management roles. Engineer F feared that new graduates would not be absorbed into mining firms, which were transitioning to mechanisation. As a response, he began reskilling in business acumen. Engineer G shared concerns about retrenchments, describing "an altered expectation regarding career security caused by economic instability." Similarly, Engineer H expressed anxiety about his progression: "Retrenchments were occurring even among experienced staff." These anxieties mirror findings from Tomlinson et al. (2022), who describe South Africa's persistent youth unemployment and instability as compounding the effects of the pandemic for new entrants to the workforce.

Others described extreme forms of insecurity. Engineer J recalled working for no pay: "Everything was a struggle because the company had retrenched a lot of people," highlighting how diminished hiring capacity and shrinking budgets eroded expectations around job entry. These examples echo literature on pandemic-induced labour market contraction, where graduates were often compelled to accept roles misaligned with their qualifications, or remained unemployed, risking skill deterioration (Akkermans et al., 2018; Rudolph & Zacher, 2020). However, not all participants experienced the pandemic as a transformative disruption. A few reported minimal to no impact on

their career outlooks. Engineer K stated that COVID-19 did "not at all" influence his expectations, as his focus remained on his studies. Engineer L, who had planned to stay in academia, viewed her pathway as "the least influenced", explaining that her research-oriented context insulated her from employment-related anxieties. Engineers M and N echoed similar sentiments, with Engineer N stating that the pandemic "didn't affect her goals at all." Engineer O also maintained optimism despite challenges, noting that she "still had that hope that things would get better" and continued securing interviews. These differences highlight the heterogeneous effects of contextual disruptions, shaped by sector, career stage, and personal mindset.

The degree of disruption appears to be influenced by several interrelated factors:

Sectoral exposure: Engineers in directly impacted industries (e.g., mining, petrochemicals, energy) reported more profound disruptions. Engineer B, for example, pointed to the closure of major refineries as a source of career instability: "Companies are now deciding to close down, South Africa doesn't seem sustainable." Engineer E similarly observed that "the industry itself is becoming smaller and smaller." In contrast, Engineer L, employed in the research sector, noted: "My employer was research-based. I could always keep studying," suggesting a buffered experience.

Career stage: Those still studying (e.g., Engineer K) or in secure institutional settings were less directly exposed to job market volatility, while final-year students and GDP participants like Engineer A were more acutely affected, particularly when employers withdrew graduate offers due to restructuring.

Organisational culture and support: Supportive environments played a protective role. Engineer S described a company that "provided robust remote support," which helped sustain motivation. Conversely, Engineer I reflected that the absence of structured support during her GDP had lasting effects on her early career trajectory. She described the experience as being 'thrown in the deep end', and "you figure it out for yourself," noting that the lack of formal mentorship was "very demotivating and very depressing at one point." In the post-GDP phase, this initial lack of guidance made it more challenging for her to navigate career decisions confidently, highlighting how insufficient developmental support can hinder self-efficacy and delay goal clarity beyond the programme itself.

Individual mindset and resilience: Proactive participants, such as Engineer F, adapted by reskilling, while Engineer O attributed her optimism to religious faith. In contrast, Engineer A confessed that the environment forced her into "survival mode," stating: "I lost my vision."

These findings align with theoretical and empirical literature. Akkermans et al. (2018) conceptualise COVID-19 as a career shock that requires individuals to reassess and redirect their career goals. Hite & McDonald (2020) and the ILO (2020) describe a surge in online learning, digital upskilling, and career adaptability, all of which were reflected in the experiences of Engineers B, C, F, and D. The Economist (2020) and Papier (2020) note that the pandemic accelerated digital transformation, which created new opportunities in automation and remote collaboration; mirrored in the shifting aspirations of participants such as Engineers B, D, and I.

Taken together, the evidence confirms that COVID-19 functioned as a significant contextual and psychological disruptor, altering career outcome expectations through both structural constraints and personal recalibrations. The findings highlight Social Cognitive Career Theory's (Lent, Brown & Hackett, 1994) emphasis on the interaction between contextual influences, self-efficacy, and outcome expectations, particularly in environments marked by uncertainty. For early-career engineers in South Africa, navigating post-GDP transitions amid pandemic-related instability required not only adaptability and resilience but also access to organisational support and industry pathways that were often unevenly distributed.

5.3.2 Personal Characteristics Shape Organisational Influence

The second proposition was that personal characteristics, such as race, gender, economic status and age, shape how individuals interact with organisational influences, which in turn can facilitate or hinder their career progression.

The data reveals that many participants experienced career-related barriers or enablers rooted in their personal identities. Engineer I, a female engineer, described the challenges of working in a highly masculinised environment: "It is a very, very male-dominated industry currently. I'm like the only female engineer on site, so sometimes in meetings you're the only female there, and everybody is very opinionated. Even when you talk, they sometimes don't listen to you." Her experience echoes Barkhuizen, Masakane & van der Sluis (2022), who highlight the enduring

gender biases within engineering workplaces in South Africa. Despite increasing diversity mandates, male-dominated cultures continue to marginalise women, making it difficult to secure visibility and influence in team settings.

Similarly, Engineer B explicitly linked improved organisational experience to racial representation in leadership: “When the manager, who was a Black guy, came through, I felt my life became easier, he provided a lot of guidance with regards to my career.” He also described ongoing “racial tension” within his company. These reflections support Carey’s (2018) and Samuel, Magwagwa & Mazingi’s (2020) findings that race remains a fundamental determinant of access to mentorship and advancement, particularly for African, Indian, and Coloured engineers. Smith (2018) further notes that the dominance of white employees in top leadership roles limits access to influential networks, exacerbating career disparities.

Engineer C identified a combination of race and age as sources of exclusion, citing organisational resistance to empowering young Black professionals, “Older employees felt threatened by younger Black engineers, they were not willing to provide opportunities.” Such perceptions are supported by Onyebuchi (2024), who argues that young professionals, particularly from historically marginalised backgrounds, are often perceived as lacking credibility, limiting their access to high-impact projects.

Structural contradictions rooted in gendered, racialised, and economic contexts shaped how participants interacted with organisational influences during and after the GDP. Engineer I described the added difficulty of being “the only female engineer on site” and initially navigating her role without structured support. These narratives illustrate how identity-based exclusion and marginalisation undermined the developmental intentions of the GDP and constrained participants' ability to benefit from organisational resources. This supports the proposition that personal characteristics strongly shape individuals’ engagement with organisational environments, as noted by Barkhuizen, Masakane & van der Sluis (2022).

Socioeconomic background also emerged as a significant factor. Engineer A explained that her drive was shaped by her roots in a “small town”: “I always remember where I come from.” This

background cultivated ambition and resilience, helping her overcome structural barriers. Engineer C echoed similar motivations. These findings are consistent with Onyebuchi (2024), who argues that socioeconomic status shapes an individual's drive, self-efficacy, and ability to persevere in the face of organisational inertia.

However, while identity-based challenges were prevalent, other participants emphasised individual agency and proactivity as key drivers of career advancement, sometimes independent of personal characteristics. Engineer F attributed his success to: "my proactivity and the goals that I had set for myself." Similarly, Engineer O asserted: "You determine the rate at which you want to grow, it is person-based. How proactive you are." These views resonate with the Social Cognitive Career Theory (Lent, Brown & Hackett, 1994), which recognises the interplay between personal agency, environmental affordances, and outcome expectations. Nonetheless, the data suggest that proactivity alone is insufficient when systemic or cultural barriers exist.

The complex interplay between identity, agency, and organisational culture was particularly evident in narratives that combined multiple themes. Engineer A, a female Black respondent, further elaborated on the discriminatory environment she faced, noting explicit "segregation" within her company. This highlights how race and gender translated into active structural barriers, leading to a profound negative impact on her "self-esteem and career concept", making her feel her "qualification means nothing". This highlights how identity-driven experiences, such as exclusion and being perceived as a "threat," shape organisational resistance and create systemic barriers to progression. Engineer B, too, spoke of working in an environment "mostly infested by men," where her "voice was basically silenced." In contrast, Engineer P, a white female, did not report identity-based impediments, instead focusing on personal adaptability. This contrast highlights the protective effect of whiteness in certain organisational contexts (Samuel et al., 2020).

Beyond identity, the broader sectoral and organisational landscape influenced how engineers navigated their careers. For instance, participants in industries directly impacted by economic disruption (such as manufacturing, mining, and petrochemicals) expressed heightened insecurity. Engineer B referenced the closure of refineries, stating that: "the future in South Africa is

unsustainable." Engineer J described significant economic hardship, recalling that she worked "for free for like six months" because her company had retained too many staff. Conversely, Engineer L, working in a research-oriented institution, reported a more supportive environment "that caters more towards learning than production." Likewise, Engineer M highlighted that his sector adapted well to remote work, making operations "simpler and easier to do."

Participants repeatedly linked organisational culture, particularly support or its absence, to career development. Where structures were enabling, progression was more likely. For example, Engineer S reported that their company "provided robust remote support," and Engineer X cited "great support from our HR and leadership teams." In contrast, toxic cultures actively obstructed advancement. Engineer T, working in a research institution, explained that progression was restricted by criteria "geared towards scientists," disadvantaging engineers. These findings further illustrate that sector-specific policies and institutional logics can structurally marginalise certain professional identities.

Taken together, these narratives affirm the central proposition that personal characteristics shape how early-career engineers interact with organisational influences. The extent of this influence is shaped by three interrelated dimensions: industry dynamics, institutional cultures, and individual agency. For example, participants navigating male-dominated and resource-constrained sectors reported limited support for development, reflecting how industry-specific norms affect progression. Similarly, institutional cultures, especially within legacy organisations, were often perceived as resistant to change, reinforcing implicit and explicit biases. These biases, particularly around race and gender, were described as embedded in recruitment, promotion, and mentoring practices, aligning with existing literature on workplace inequality in South African engineering contexts (Barkhuizen et al., 2022; Carey, 2018; Samuel et al., 2020; Smith, 2018). Moreover, individual agency, expressed through resilience, strategic career moves, or withdrawal, emerged as a critical factor in negotiating these challenges. Thus, while race, gender, economic status, and age remain key axes of inequality (Onyebuchi, 2024), their impact is influenced by the broader industry and institutional context, and the agency that early-career engineers can exercise within it. The varied accounts also support SCCT's proposition that both contextual supports and barriers interact with personal characteristics and self-efficacy to shape career development (Lent et al.,

1994). For some, proactive behaviour and supportive environments are aligned to promote success. For others, deeply entrenched organisational cultures and systemic inequality undermined even the most resilient efforts.

The data suggests that for the early career engineers interviewed, career development is often shaped by the intersection of personal identity and organisational practices. Participants described how experiences of exclusion, stereotyping, or lack of recognition influenced their sense of opportunity and belonging. These identity-driven encounters, though varied, point to patterns that warrant deeper exploration. While the findings are not generalisable, they offer a context-rich account of how race, gender, and other identity markers may influence career progression in specific organisational and industry settings. A structurally detailed interpretation, grounded in both empirical evidence and theoretical insight, enables a more differentiated understanding of the post-GDP experiences of these early-career engineers.

5.3.3 Post-GDP Learning Experiences Enhance Self-Efficacy

The third proposition was that post-GDP learning experiences (including challenging projects, mentorship, formal training and learning opportunities, feedback and coaching) enhance self-efficacy by improving skill development, boosting professional confidence, and fostering adaptability in the workplace.

Drawing from SCCT, self-efficacy refers to individuals' beliefs in their ability to execute tasks successfully (Lent, Brown, & Hackett, 1994; Lent & Brown, 1996), which in turn influences motivation, adaptability, and career persistence (Bandura, 1994). According to the SCCT framework, Graduate Development Programmes (GDPs) and subsequent workplace experiences enhance self-efficacy by facilitating skill development, expanding access to developmental feedback, and fostering exposure to diverse learning contexts (Schreuder & Coetzee, 2016; Clarke & Scurry, 2020; Cardador, Hill, & Lopez-Alvarez, 2022; Brunhaver, Korte, Barley & Sheppard, 2017; Bucciarelli & Kuhn, 2018; Oruç, 2022).

While this study focuses on the post-GDP phase, participants frequently referenced their Graduate Development Programme experiences as foundational to their early professional growth. These reflections were not ends in themselves but rather points of comparison that shaped how they

navigated the transition beyond structured development. For instance, Engineer G described the GDP as a turning point: “The GDP exposed me to the practicality of things. You start gaining engineering knowledge because now you know very well, you can apply it.” However, in the post-GDP phase, he noted a sharp decline in formal support and structured learning, which required greater self-direction. Similarly, Engineer Q regarded the GDP as “pivotal” in bridging the theory-practice divide, but found that post-GDP, continued development depended largely on proactive engagement with line managers and project leads. Engineer R echoed this sentiment, describing the GDP as “instrumental” in preparing for real-world expectations, but acknowledged that sustaining growth post-GDP required navigating less structured and more politically nuanced organisational environments. These reflections reinforce findings by Brunhaver et al. (2017) and Cardador et al. (2022) on the importance of workplace immersion, while also highlighting a key challenge: translating structured early-career support into sustained post-GDP development.

Mentorship emerged as a critical factor in the development of self-efficacy. Engineer S described his mentor as having “played a pivotal role in building my confidence by providing constructive feedback and guiding me through challenging scenarios.” Engineer O noted that mentorship gave her “a guided, clear path” and helped her “realise her potential.” Such findings align with SCCT literature, which emphasises the role of social persuasion and vicarious learning in shaping self-efficacy beliefs (Lent et al., 2000; Bandura, 1994). Engineer M emphasised the relational aspect of his development, stating that the GDP “groomed me. I got experts to teach me, to guide me, and to mentor me.” These experiences reflect Oruç’s (2022) assertion that structured learning and relational support contribute significantly to early-career confidence.

Formal training, certifications, and feedback also played a role in bolstering perceived competence. Engineer U completed professional certifications, which “enhanced his skills and confidence,” while Engineer B reflected on plant operations training that “helped me better understand how the plant operates.” These findings mirror Schreuder & Coetzee’s (2016) assertion that access to structured development within GDPs strengthens technical capacity and self-belief. For Engineer Q, career confidence was further solidified through recognition. His project earned acknowledgement from senior management, demonstrating the reinforcing impact of performance accomplishments, a critical component of self-efficacy development (Bandura, 1994). Similarly,

Engineer G remarked that: “if you work hard, one person who just recognises you can give you a chance,” highlighting the role of external validation in sustaining motivation.

While some participants benefited from strong support systems, others developed self-efficacy through resilience in the absence of structured support. Engineer A, despite lacking a dedicated mentor, described her ability to “learn by yourself” and develop “resilience,” which she believed would benefit her long-term development. Likewise, Engineer H attributed his career progression in part to “my self-resilience.” These experiences align with Bandura’s (1994) assertion that individuals with high self-efficacy often interpret setbacks as opportunities for learning and growth.

Nevertheless, the quality and impact of post-GDP experiences varied significantly depending on the organisational context and the support available. Engineer A reported that her confidence and sense of identity were undermined in her post-GDP environment: “My self-esteem went down, my self-concept went down… the company didn’t know how to handle me. I had a mentor, but he didn’t know what to do. He just kept shutting me down.” Her account illustrates how intersecting factors, such as race, gender, and the lack of meaningful support, can constrain development and erode professional confidence. These challenges echo broader findings on the marginalisation of underrepresented engineers in unstructured work environments (Barkhuizen et al., 2022; Samuel et al., 2020).

Other participants described organisational and structural challenges that impeded their developmental trajectories. Engineer F highlighted the need for “the right people, support, and sponsors,” noting the demoralising effect of “naysayers.” Engineer T described limited career progression opportunities in his research institution due to promotion criteria that were “geared towards scientists,” reflecting structural rigidity. Economic and sectoral disruptions also constrained growth. Engineer K’s inability to complete vacation work during COVID-19 was perceived as “a bit of a disadvantage” in interviews, illustrating how early experiential gaps can affect long-term credibility. Engineer B experienced instability due to pay cuts and reduced work weeks, while Engineer E reported reduced project availability following retrenchments, both highlighting how economic constraints limit developmental opportunities, including access to

mentorship. These findings are consistent with SCCT literature, which posits that career development is not only a function of individual effort but is significantly shaped by environmental affordances and barriers (Lent et al., 1994; Lent et al., 2000). Positive developmental environments that provide constructive feedback, mentorship, structured learning, and visibility within the organisation contribute to enhanced self-efficacy (Clarke & Scurry, 2020; Oruç, 2022; Schreuder & Coetzee, 2016). Conversely, poorly structured programs, lack of mentorship, and organisational exclusion undermine confidence and professional identity formation.

In summary, the data affirms that post-GDP learning experiences play a critical role in enhancing self-efficacy among early-career engineers. Whether through structured training, mentorship, recognition, or self-driven resilience, these experiences shape not only technical competence but also perceived professional agency. The variation in outcomes reflects the interplay between personal initiative and organisational context, consistent with SCCT's emphasis on reciprocal determinism between person, environment, and behaviours. For early-career engineers, particularly in complex socio-economic environments such as South Africa's, supportive and inclusive developmental structures are essential for sustaining confidence, career adaptability, and long-term progression.

5.3.4 Post-GDP Learning Experiences Influence Career Outcome Expectations

The fourth proposition was that post-GDP learning experiences help shape more positive career outcome expectations, leading individuals to anticipate greater success in their professional endeavours.

For several participants, GDPs offered crucial exposure to the workplace, enabling a better understanding of personal strengths, industry demands, and future pathways. Engineer G reflected that the programme made him "very clear of what I want" in his career, revealing "where my strengths are" and contributing to a "clear direction." Similarly, Engineer D described the GDP as having "set a solid foundation," enabling him to envision "realistic pathways for growth" and to "plan his career trajectory." Engineer C shared that the program provided "realistic insights into how much effort and skill development is needed to progress" and afforded her a "clearer view of her path forward."

While mentorship and structured exposure during the GDP were frequently described as catalysts for early career clarity, participants' reflections also highlighted how these foundational experiences shaped their post-GDP trajectories. In line with SCCT's emphasis on learning experiences as shaping outcome expectations (Lent, Brown, & Hackett, 1994; Lent & Brown, 2013; Bell & Rosowsky, 2021), Engineer O explained that the GDP provided a "guided clear path" which enabled her to recognise her potential and set clearer post-programme goals. However, she also noted that once this structure fell away, sustaining that momentum required self-navigation and proactive alignment with mentors or sponsors. Similarly, Engineer L credited the programme with exposing her to "a whole new world of careers and possible projects," which influenced her decision to explore diverse opportunities after the programme ended. These post-GDP shifts illustrate how early exposure influences subsequent career decision-making, consistent with Trevelyan (2019) and Oruç (2022), who argue that the true value of GDPs lies not only in immediate skill acquisition but in equipping engineers for long-term leadership development and career exploration across technical and non-technical domains.

While the GDP served as an initial platform for career exploration, several participants described how the exposure gained during the programme informed their post-GDP career decisions. Engineer M, for example, discovered an interest in renewable energy through a rotation and noted that he "fell in love with" the field, prompting him to seek post-GDP opportunities specifically within the green energy sector. Similarly, Engineer B reflected on how real-world exposure during the GDP encouraged many graduates to "relook" their paths and "pivot to something else," including roles that better aligned with their evolving interests. These post-GDP redirections reflect the outcome expectation component of SCCT, whereby learning experiences reshape how individuals perceive career possibilities and influence their motivation to pursue new or non-linear pathways (Lent et al., 1994; Lent & Brown, 2013). In this way, the GDP catalysed post-programme career reappraisal that participants actively acted upon beyond the structured environment.

Although many participants credited the GDP with boosting their confidence and career clarity, their reflections also revealed how this early self-efficacy influenced their behaviour in the post-GDP phase. For instance, Engineer Q described how project exposure and mentoring during the GDP "boosted my self-efficacy," which enabled him to actively pursue a project management role

shortly after the programme ended. Similarly, Engineer C's clear post-GDP goals helped her remain motivated despite encountering less structured support, suggesting that early clarity can sustain professional momentum. Engineer M referred to the GDP as a "starter" that shaped his understanding of possible career directions, which he later pursued independently. These examples reflect Bandura's (1997) conceptualisation of self-efficacy, not only as shaped by early learning experiences, but as a driver of post-programme career action. In this way, the findings illustrate how self-efficacy developed during structured phases may translate into agency and career persistence in the less structured, and often more uncertain, post-GDP environment.

Even though participants recognised the value of GDPs, the data also illustrates that the positive impact is not guaranteed. Several participants who experienced poorly structured programmes or limited mentorship reported that these shortcomings affected their post-GDP progression. Engineer I described her GDP as a "throw you in the deep end" experience, with no formally assigned mentor, which she found "very demotivating and very depressing at one point." She later struggled to position herself confidently in the post-GDP phase, citing persistent uncertainty about expectations and organisational direction. Similarly, Engineer O noted that the unstructured nature of her programme led to a prolonged period of self-navigation beyond the GDP. These accounts suggest that insufficient support during the structured phase may result in uneven readiness for the autonomy required in the post-GDP phase. This finding supports SCCT's emphasis on the importance of enabling environments and guided mastery experiences in fostering self-efficacy and outcome expectations (Lent et al., 1994).

Participants also discussed the need for external support and sponsorship beyond personal agency. Engineer F stated: "You need the right people to support you - sponsors - because you get a lot of naysayers." Engineer A similarly highlighted the resilience she developed due to having to "learn by yourself" in the absence of mentorship. These reflections highlight that learning alone is insufficient without access to enabling structures and relational support systems.

Taken together, these findings strongly support the SCCT proposition that post-GDP learning experiences - particularly those involving challenging assignments, mentorship, and feedback - significantly shape career outcome expectations (Lent et al., 1994; Lent & Brown, 2013; Bell & Rosowsky, 2021). Participants such as Engineers G, D, C, and O reflected enhanced clarity and

motivation, while Engineers L, B, and M described the discovery of new professional avenues, confirming the developmental and directional impact of GDPs (Trevelyan, 2019; Oruç, 2022). In parallel, self-efficacy gains reported by Engineers Q, J, and G align with SCCT's emphasis on experiential learning as a mechanism through which individuals come to believe in their capacity to succeed (Bandura, 1997).

Ultimately, while post-GDP learning experiences play a critical role in shaping positive career outlooks, their impact is shaped by organisational structure, workplace culture, identity-related dynamics, and broader economic conditions. When early career engineers are placed in supportive, inclusive, and well-structured post-GDP environments, they are more likely to develop self-efficacy, sustain motivation, and engage in purposeful career planning (Bell & Rosowsky, 2021). Conversely, in the absence of mentorship, recognition, or equitable opportunities, post-GDP experiences can reinforce existing inequalities and hinder developmental trajectories. These findings highlight the importance of contextually responsive and inclusive post-GDP environments that extend beyond technical training to address the psychosocial and structural factors that influence long-term career progression (Bell & Rosowsky, 2021).

5.3.5 Post-GDP learning experiences significantly influence goal setting among early career professionals

The fifth proposition was that learning experiences individuals are exposed to after completing GDPs (such as on-the-job training, mentoring, continued professional development, exposure to challenging assignments, and feedback) play a critical role in shaping their career goals. Drawing on Social Cognitive Career Theory (SCCT), goal setting is conceptualised as a dynamic process influenced by learning experiences, self-efficacy, and outcome expectations (Lent, Brown & Hackett, 1994).

Many participants described the direct influence of structured learning and relational support on their ability to set meaningful and achievable career goals. Engineer U, for instance, attributed her ability to set "realistic and achievable career goals" to the GDP's "mentorship, training, and resources." Similarly, Engineer J, despite lacking a formal mentor, noted that "people would offer guidance in order to achieve these goals," which helped shape her career strategies. These accounts align closely with Nunan, Ebrahim & Stander's (2023) finding that mentoring supports goal

formation by helping early-career engineers identify milestones, navigate ambiguity, and refine their aspirations.

Formal mentorship was repeatedly cited as providing a structured and guided career orientation. Engineer O remarked that mentorship "really helped the process" and "provided guidance to know what you want." In contrast, Engineer I, who lacked a mentor during her GDP, developed a desire to become one in the future; her aspiration emerged directly from her negative experience. Similarly, Engineer H recounted a pivotal experience in project management that "opened his eyes" and prompted him to explore both managerial and technical trajectories, demonstrating how experiential learning influences goal diversification and goal clarity.

Several participants described how exposures after their initial training broadened their career interests and prompted new directions. Engineer M pursued renewable energy following his early career experiences, a field he grew passionate about and actively developed skills in. Engineer B reflected on how later industry engagements encouraged reconsidering career options and making strategic pivots. Engineer L expanded her expertise into programming and machine learning through ongoing projects, uncovering new career possibilities. Engineer E observed peers moving into project and engineering management roles, which motivated her to explore leadership paths, highlighting the role of vicarious learning in shaping evolving career goals (Lent & Brown, 2013; Bell & Rosowsky, 2021).

Feedback mechanisms were also noted as powerful influences. Engineer U recalled that "feedback received during the GDP impacted her ability to adjust or realign her career goals." Engineer Q also spoke of the role of mentoring and performance recognition in building confidence and prompting the decision to take on greater responsibility. These observations are consistent with Posada (2017), Wong et al. (2018), and Bell and Rosowsky (2021), who argue that feedback loops play a central role in identifying developmental gaps and reinforcing the belief that skill acquisition can lead to meaningful outcomes.

Clarity and direction were often developed through experiences encountered after the formal training phase. Engineer G reported gaining a strong sense of what he wanted in his career through

subsequent roles, which helped him develop a clear professional direction. Engineer D described how ongoing work experiences provided a solid foundation, enabling him to see realistic growth pathways and plan his career trajectory effectively. Engineer M reflected that continuous exposure to varied projects gave him perspectives on where he could go and what he could achieve. Engineer C noted that real-world challenges helped her gain realistic insights into the effort and skill development required to progress, giving her a clearer view of her path forward. Engineer N highlighted how later experiences helped him identify his professional niche. These accounts align with SCCT's emphasis on learning experiences shaping career goal formulation by enhancing self-knowledge, situational awareness, and motivation (Lent et al., 1994; Lent & Brown, 2013).

In addition to structured support, several participants described self-driven goal setting, emphasising personal agency. Engineer F argued that "if you want to progress in a career, it's all about you," attributing his success to "my proactivity and the goals that I had set for myself." Engineer O echoed this view, framing her career journey as a "self-determination process" where one decides "the rate at which you want to grow, what skills you want to pick up." Engineer A, in the absence of mentorship, "learned to find out things on her own," developing "resilience" that supported her evolving career intentions. Engineer N noted that his goal to work in renewable energy was pre-existing but strengthened through exposure, while Engineer L joined the programme already focused on pursuing postgraduate qualifications, selecting her company accordingly. These reflections illustrate that goal formation is shaped by both contextual opportunities, and individual predispositions, aligning with SCCT's conceptualisation of personal inputs and learning experiences as co-influencers of goal construction (Lent et al., 1994).

However, not all participants experienced post-GDP learning environments as conducive to goal development. Several cited organisational and structural barriers that disrupted or delayed their career intentions. Engineer J experienced inconsistency in mentorship, which hindered her development, "those assigned to support her were 'too busy' and 'not focusing on me specifically.". This lack of focused support indicates an environment not conducive to her structured goal development. Engineer I, initially placed in a male-dominated environment without a formal mentor, reassessed her goals due to "mental and physical exhaustion." Similarly, Engineer T reported a mismatch between engineering roles and academic promotion criteria, delaying his

advancement goals. Engineer J experienced inconsistency in mentorship, as those assigned to support her were “too busy” and “not focusing on me specifically.” Engineer O described her programme as “no active programme” and reiterated the theme of “self-determination.”

Broader industry instability and economic uncertainty not only reshaped participants’ career goals but also influenced how they engaged with and interpreted their post-GDP learning experiences. Engineer B, confronted with pay cuts and reduced work weeks, sought out learning opportunities aligned with international business roles, reflecting a strategic adaptation to economic realities. Engineer J’s experience of working “for free” heightened her awareness of employability challenges, prompting her to focus on skill development to remain competitive. Engineer E, affected by retrenchments, approached her learning with increased urgency, seeking to diversify her competencies amid job insecurity. Engineer N’s realisation that technical work was being outsourced led him to prioritise learning that supported broader leadership capabilities. Engineer K recalibrated his learning goals from professional registration toward becoming a technical leader, recognising the need to develop skills valued in a shifting industry. Engineer H’s early exit from his programme stemmed from the perception that it did not provide the technical skills necessary to navigate this unstable environment, motivating him to seek more skill-intensive learning pathways. These accounts illustrate how external economic and industry factors shape the nature and impact of post-GDP learning experiences, ultimately influencing career outcome expectations.

These findings align strongly with the SCCT literature, which posits that career goals are shaped by the interaction of learning experiences, self-efficacy beliefs, and outcome expectations (Lent et al., 1994; Lent & Brown, 2013). Formal mentorship, exposure to multiple career pathways, and feedback mechanisms create developmental contexts that influence how early-career engineers define, pursue, or adjust their goals (Nunan et al., 2023). Engineers such as U, J, O, and I demonstrated how mentoring shaped their goal awareness and future intent. Participants like M, B, L, and E exemplified how exposure to alternative roles and industry needs encouraged career diversification, while Q, G, and D illustrated how feedback and structured learning enabled confident, future-oriented goal setting. These findings affirm that post-GDP experiences play a

pivotal role in shaping career goal formulation, a key construct within SCCT (Bell & Rosowsky, 2021).

In essence, the data confirms that post-GDP learning experiences significantly influence goal formation and adjustment among early-career engineers. Whether through mentorship, performance feedback, experiential learning, or self-determined resilience, these experiences serve as critical inflexion points in career development. However, structural inequities and industry volatility can inhibit the positive influence of these experiences. The findings highlight the importance of equitable, structured, and responsive developmental ecosystems in supporting the long-term goal orientation of early-career professionals in the engineering sector.

5.3.6 Career Outcome Expectations Drive Goal Setting

The sixth proposition was that early-career engineers with positive career outcome expectations are more likely to set structured and purposeful goals. In contrast, those with uncertain or negative expectations may be less proactive in their planning, which may necessitate reassessing their career strategies. The findings affirm that career-related expectations, particularly those formed in the early post-GDP phase, can strongly shape goal-directed behaviour. These expectations are often influenced by exposure to developmental opportunities, mentorship, and perceived organisational support.

The findings indicate that positive outcome expectations, often shaped through early post-GDP workplace experiences such as exposure to real projects, workplace challenges, and mentorship, act as a catalyst for purposeful goal setting among early-career engineers. For example, Engineer G described how engaging in real projects helped him clarify what he wanted from his career and boosted his confidence in his strengths, shaping his expectations for future growth. Similarly, Engineer D noted that mentorship and exposure provided "realistic pathways for growth," which influenced his planning of career steps ahead. These accounts align with the SCCT proposition that individuals' expectations about their career outcomes significantly influence their motivation, goal-directed behaviour, and persistence (Lent, Brown & Hackett, 2000; Klassen & Klassen, 2018).

Engineer M explained that having future-focused goals shaped by positive expectations "made me very ambitious" and encouraged a proactive attitude toward pursuing opportunities. Engineer O similarly described how structured support and mentorship clarified his understanding of what he wanted from his career, saying it helped "to know what you want," which shaped his expectations and reduced the risk of disengagement. Engineer C linked goal clarity to both motivation and concrete action, such as undertaking professional certifications, reflecting the belief that such efforts would lead to favourable career outcomes. In contrast, Engineer K highlighted the emotional risks associated with unclear expectations: "Without clear goals, when work becomes difficult, you just lose hope." These narratives demonstrate how positive outcome expectations foster purposeful goal setting and sustained effort, while uncertainty or lack of vision can undermine motivation, a pattern consistent with SCCT and broader literature on goal clarity and persistence (Chiesa, Massei & Guglielmi, 2016; Lent et al., 2000).

Conversely, some participants reported that uncertainty and negative workplace experiences negatively shaped their career outcome expectations, which in turn hindered proactive planning and led to emotional disengagement. Engineer A provided a vivid account of how disillusionment with unmet expectations impacted her motivation: "I had lost my vision, I was just in survival mode, why did I study? Why did I waste my time?" Similarly, Engineer E described how a lack of project opportunities diminished her sense of progress, stating: "My development was put on the back end." These accounts reflect how unfavourable workplace conditions can weaken positive outcome expectations and disrupt goal-setting behaviour, a pattern echoed in literature on career shocks, including economic instability, toxic organisational cultures, and limited advancement pathways (Akkermans, Seibert, & Mol, 2018; Taylor, 2017; KFF, 2020).

Nevertheless, a notable theme that emerged from the data was that several participants demonstrated resilience and engaged in proactive goal setting despite experiencing adverse conditions that could have undermined their career outcome expectations. Engineer I described working in a "very demotivating and very depressing" environment, but intentionally set goals to counteract this negativity: "How did I overcome it? By setting those goals, to show that I'm proactive, I want to be promoted as soon as possible." This illustrates SCCT's emphasis on personal agency as a moderating force that can sustain motivation even when expectations are

challenged by environmental barriers (Lent & Brown, 2013). Similarly, Engineer F highlighted how his self-initiated goal setting enabled him to stay ahead: “If you want to progress in a career, it’s all about you. I go all out and ask, I’m the one that’s currently a bit ahead because of my proactivity and the goals that I had set for myself.” These examples reveal that while positive expectations often promote goal setting, individuals can also draw on agency to re-establish direction when expectations are threatened, positioning goal setting as both a consequence of and a response to evolving expectations.

For some participants, organisational exclusion and structural constraints initially disrupted their career outcome expectations and hindered progress toward established goals. However, these limitations ultimately prompted critical reflection and strategic goal reassessment. Engineer T, for example, faced institutional barriers where promotion was contingent upon academic publishing, criteria misaligned with his engineering responsibilities. He noted that this disconnect “slowed down” his progression and led him to “reflect to see what might have gone wrong and consider a career pivot” from an academic career into industry. Similarly, Engineer I, who was placed in a male-dominated team with no structured mentorship, described the managerial trajectory as “mentally and physically exhausting.” This experience led her to re-evaluate her career path and pursue postgraduate studies in search of a more sustainable and fulfilling role. These cases reflect how structural misalignment and exclusion can initially undermine career expectations but also trigger adaptive goal revision, an important dynamic within SCCT’s recognition of the reciprocal relationship between context, cognition, and behaviour (Lent & Brown, 2013).

Structural constraints played a pivotal role in reshaping participants’ goal trajectories. Engineer T described systemic barriers within his research institution, where career advancement depended on academic publishing, an expectation misaligned with his engineering responsibilities. This misfit compelled him to “reflect to see what might have gone wrong” and ultimately consider a pivot to industry. Despite severe financial hardship and job insecurity, Engineer J maintained a strong sense of direction: “I knew that I wanted to study further and grow career-wise.” Engineer B responded to organisational instability, including pay cuts and reduced work hours, by exploring international opportunities and transitioning toward a business-oriented focus. Similarly, Engineer E, affected by retrenchments, expressed “fear about job security” but began contemplating a career

shift and enrolling in a Master's programme in sustainable energy. These cases highlight the adaptive nature of goal revision in response to structural adversity, aligning with literature that recognises career adaptability and goal recalibration as essential responses to contextual disruptions (Akkermans et al., 2018).

Further examples illustrate how misaligned workplace realities can prompt constructive realignment of career goals. Engineer N adjusted his aspirations upon recognising that "most of the technical things will be outsourced to consultants," leading him to reconsider the depth of technical engagement in his role. Similarly, Engineer K revised his career direction after observing that professional registration held less value in his context than anticipated, prompting a shift toward pursuing technical leadership. Engineer H, dissatisfied with the limited technical exposure in his programme, reflected, "I'm not getting the right technical skill," and exited the programme early to pursue opportunities that better aligned with his goal of developing strong technical expertise. These cases exemplify the adaptive recalibration of goals in response to evolving occupational realities, consistent with SCCT's emphasis on the dynamic interplay between contextual factors and self-directed goal setting (Lent & Brown, 2013).

In sum, the findings support the proposition that positive career outcome expectations generally facilitate structured and proactive goal setting, in line with SCCT's assertion that such expectations shape motivation, direction, and persistence in career development (Lent et al., 2000; Klassen & Klassen, 2018; Chiesa et al., 2016). Engineers G, D, M, O, and C exemplified how exposure to real-world work, clarity of role, and growing confidence contributed to purposeful and sustained goal pursuit. However, the data also indicate that negative experiences, when met with personal agency, can lead to goal recalibration and even renewed commitment, challenging overly deterministic readings of SCCT. Engineers I, F, A, and B demonstrated that resilience, reflective thinking, and proactive adaptation were critical in navigating uncertainty and regaining momentum.

Thus, while positive expectations often drive goal clarity and forward movement, uncertainty and disruption do not inherently impede progress. Instead, they may activate adaptive strategies, revised aspirations, and a reinforced sense of agency. These findings highlighted SCCT's emphasis

on the dynamic interplay between personal cognition, behaviour, and environmental context, and highlight the importance of equipping early-career engineers not only with technical exposure but also with psychosocial resources to support effective career navigation, even in adverse conditions.

5.3.7 Self-Efficacy Underpins Ambitious Goal Setting

The seventh proposition was, engineers with higher self-efficacy are more likely to set ambitious and well-structured goals, driven by their confidence in their ability to succeed. Drawing on the tenets of SCCT, self-efficacy, which is defined as an individual's belief in their ability to execute tasks and achieve goals, operates as a central determinant of motivation, perseverance, and goal orientation (Bandura, 1994; Lent, Brown, & Hackett, 1994). The interview data strongly supports this proposition, illustrating how engineers who developed confidence through experiential learning, mentorship, and structured development environments translated that self-belief into ambitious and forward-thinking career planning.

Several participants explicitly linked their sense of efficacy to their goal-setting behaviour. Engineer C stated that belief in her abilities "gave me the courage to take on a project management role last year, which was a significant step forward." Engineer F described being "a bit ahead" of her peers due to "my proactivity and the goals that I had set for myself," adding: "I don't wait for anyone to say no, I go all out and ask." Her strong self-efficacy enabled her to pursue certifications and aspire toward executive leadership. Engineer H's structured goal of achieving professional registration following his Master's degree reflects a confidence grounded in technical mastery. Similarly, Engineer N noted that "for you to lead, you have to have that solid foundation," emphasising the link between technical proficiency and leadership aspirations; an example of self-efficacy as a foundation for future-oriented goal setting.

For many participants, early career experiences after completing the graduate programme served as the catalyst for developing self-efficacy, allowing them to recognise their potential and develop clearer visions for their future. Engineer M described how taking on challenging projects post-GDP "gave perspectives of where I could go, what I could do," motivating him to pursue professional registration as a Candidate Engineer with ECSA, a milestone he had initially targeted within five years but achieved in three. His growing confidence will enable him to "choose the jobs in the market that I want." Engineer O similarly noted that ongoing guidance and mentorship

after the programme “directed her thinking” and helped her initiate goal formulation. These accounts align with findings by Lent, Ireland, Penn, Morris & Sappington (2017) and Wu et al. (2020), who found that self-efficacy developed through work experiences enhances career goal clarity and planning.

However, self-efficacy also manifests in less formal but equally intentional ways during early career stages. Engineer A, despite facing exclusionary dynamics in her workplace environment that affected her confidence, channelled her “huge drive” into acquiring practical exposure and developing self-reliance. Though her career progression was temporarily derailed, she focused on “getting as much exposure and as much experience practically,” reflecting the pursuit of developmental goals even when outcome expectations are challenged. Engineer J similarly expressed confidence in her technical skills but lamented the disconnect between qualifications and job market entry: “It’s still a struggle for us to get jobs.” These reflections highlight how external constraints after the graduate phase may hinder goal attainment but do not necessarily suppress the act of goal setting.

Moreover, several participants illustrated that high self-efficacy can fuel resilience, reflection, and strategic adaptation in the face of structural barriers or adverse organisational cultures. Engineer A described her self-esteem dropping from “10 to 4.5” after her mentor perceived her as a “threat” and “shut her down.” Feeling as though her “qualification means nothing,” she nonetheless committed to independent learning and “actively applied” for permanent positions, demonstrating a self-efficacy-driven effort to regain control. Similarly, Engineer I, despite lacking mentorship and operating in a male-dominated environment, found traditional leadership routes “mentally and physically exhausting,” which led her to proactively pivot toward a more flexible role and postgraduate study.

Other participants displayed self-efficacy by reassessing their career goals in response to structural or contextual limitations encountered in their post-GDP work environments. Engineer T, for example, experienced promotional delays due to criteria prioritising academic publishing, prompting reflection and consideration of alternative career directions. Engineer K adjusted his ambitions upon realising that professional engineering registration held less value in his company

than anticipated, stating, “I cut out on my thought about this area of progression,” and shifted focus toward technical leadership. Engineer N proactively recalibrated his goals after recognising that “most of the technical work will be outsourced.” These examples illustrate how early-career engineers, through their workplace learning experiences after the GDP, engage in goal recalibration when confronted with contextual barriers. This behaviour aligns with SCCT’s emphasis on adaptability and personal agency in navigating career development (Lent & Brown, 2013).

Despite environmental pressures, engineers demonstrated goal persistence and strategic reorientation. Engineer B, navigating uncertainty, pay cuts, and reduced work weeks, considered “going abroad” and shifted her focus to business. Engineer E, impacted by retrenchments, explored new opportunities and pursued a Master’s in sustainable energy to maintain relevance. Engineer J, despite experiencing profound fear during the COVID-19 pandemic, retained a clear aspiration: “I knew that I wanted to study further and grow career-wise.” These cases exemplify how self-efficacy can serve as an anchor for goal setting even under destabilising conditions. Literature consistently affirms that individuals with higher self-efficacy are more likely to set challenging, structured goals, persist in the face of obstacles, and maintain greater motivation (Bandura, 1994; Lent et al., 1994). Engineer C’s courage to step into a leadership role and Engineer F’s proactive pursuit of professional development both exemplify this. SCCT further asserts that outcome expectations, shaped by one’s confidence in their abilities, influence the likelihood of engaging in effortful, future-oriented behaviour (Lent et al., 2000). Participants such as Engineers H and N, who linked technical mastery to leadership ambitions, align with Hackett & Lent (2017) and Wu et al. (2020), who found that engineers with strong self-efficacy are more likely to pursue advanced training, networking, and leadership roles.

While the findings overwhelmingly support the proposition, they also reveal its complexity. For instance, Engineer A’s resilience in the face of exclusion and Engineer J’s continued learning aspirations amidst economic uncertainty reflect how ambitious goal setting can coexist with fluctuating self-confidence, shaped by both internal agency and external structures. Cumulatively, the findings affirm that self-efficacy is a foundational enabler of ambitious and structured goal setting among early-career engineers. It fuels persistence, enables reorientation in the face of

disruption, and amplifies the developmental impact of graduate programs. Importantly, this relationship is not linear. Rather, it is influenced by personal, organisational and economic contexts, reinforcing SCCT's core principle of reciprocal interaction between person, behaviour, and environment.

5.3.8 Organisational Influences Significantly Affect Individuals' Outcome Expectations

The eighth proposition was that organisational influences (such as its culture, leadership practices, support systems, policies, mentoring opportunities, and performance management processes) play a critical role in shaping what individuals believe they will gain from their work and career efforts (i.e. their outcome expectations). Within the framework of SCCT, these organisational variables function as contextual affordances that can either enable or constrain perceived opportunities, goal formulation, and persistence (Lent, Brown & Hackett, 1994; Lent & Brown, 2013).

While many participants credited their GDPs for foundational confidence and clarity, these traits were often challenged or reaffirmed in the post-GDP phase. For instance, Engineer M, after being "groomed" through mentorship during the programme, noted that transitioning into independent roles required him to "rely on that foundation" to navigate ambiguous tasks and lead small teams. Similarly, Engineer D's "realistic pathways for growth" evolved as he encountered new performance expectations and shifting priorities, compelling him to revise his original career plan. These reflections suggest that the developmental gains from GDPs may influence post-GDP learning experiences, but it is in the post-programme environment where these gains are tested, adapted, or even recalibrated.

Organisational culture was also identified as a critical influence on outcome expectations. Engineer L praised her research-based company for exposing her to "so many career avenues" and a "whole new world of careers," demonstrating how an intellectually stimulating environment can expand perceived possibilities. Engineer C explained how her programme provided "realistic insights" and a "clearer view" of her trajectory, leading to increased job satisfaction. Engineer O affirmed that the programme "provided that guidance to know what you want," which "directed her thinking." These accounts align with literature emphasising that transparent and development-oriented organisational cultures foster strong outcome expectations (April & Govender, 2022; Ames et al., 2019; Bosch, 2019; Kaleem & Masood, 2020; Massimino & Turner, 2018; Ogbonnaya & Bevan, 2021).

Mentorship was repeatedly emphasised as a central mechanism through which organisations influence outcome expectations. Engineer E reflected that the programme provided a "guide to our mentors on how to tackle our development," which "exposed us to all the possibilities." Engineer V noted that: "mentors encouraged me to think long-term and set goals," while Engineer Q pointed to "regular check-ins with my supervisor" and "support from my immediate team" as sustaining his motivation and optimism. Engineer B noted a turning point after being assigned a new manager who "shared knowledge and provided a lot of guidance," positively shaping his expectations. Likewise, Engineer E credited her "very supportive" team for creating a "psychologically safe space." These accounts align with the literature on the career-shaping power of effective leadership and psychosocial support (Lips-Wiersma et al., 2016; Afande, 2015; Lent & Brown, 2013).

Nevertheless, the data also demonstrates that organisational influences can be highly detrimental when unsupportive, discriminatory, or misaligned with individual aspirations or broader market realities. In these contexts, engineers' expectations are not merely suppressed; rather, individuals with strong self-efficacy often respond by reassessing, adapting, or even radically shifting their career paths. Engineer I, as the "only female engineer on site" in a "very, very male-dominated industry," described organisational exclusion: "Even when you talk in meetings, they sometimes don't listen to you." Moreover, observing that managerial roles "don't really match the roles, responsibilities, and rewards," she adjusted her expectations and pivoted toward more flexible roles and further education. Engineer T recounted structural barriers requiring academic publications for promotion - an expectation misaligned with engineering practice - prompting a re-evaluation of his trajectory.

Participants also described goal realignment in response to misaligned job roles, structural rigidity, and broader economic pressures encountered after completing their GDPs. Engineer K, for example, discovered that professional engineering registration was not valued in his organisation, leading him to pivot toward a technical leadership track: "I cut out on my thought about this area of progression." Engineer N similarly adjusted his goals upon recognising that technical work was being increasingly outsourced. Although Engineer H had exited his GDP early due to inadequate technical exposure, it was the subsequent difficulty in securing a developmentally aligned role that

prompted a shift in focus toward practical skill-building. These narratives align with Massimino and Turner (2018) and Ogbonnaya & Bevan (2021), who argue that organisational misalignment and external constraints can disrupt developmental continuity and reshape career trajectories.

In economically distressed contexts, engineers were forced to reconsider their outcome expectations in response to volatility. Engineer B described the impact of "pay cuts," "reduced work weeks," and the closure of "major refineries," prompting her to consider "going abroad" and pivoting toward a "business focus." Engineer E, after experiencing retrenchments, expressed fear about job security and began exploring career shifts and postgraduate studies. Engineer J, despite "working for free" during a prolonged period, retained her ambition to study further and grow professionally. These reflections reinforce SCCT's assertion that environmental affordances and constraints directly shape outcome expectations, but that individuals with high self-efficacy can maintain agency and strategic adaptability (Lent & Brown, 2013).

Although many participants benefited from supportive environments, the data also illustrate that organisational support is uneven and often dependent on departmental cultures, managerial engagement, and resource availability. Engineer, I recalled that her programme "was initially like being thrown into the deep end," and Engineer F noted encountering "naysayers." Engineer A lost her sense of professional direction in a hostile environment, while Engineer E's developmental trajectory stalled due to not being placed on projects for six months. These cases support the view that organisational influence is not monolithic but shaped by localised conditions (Bosch, 2019).
Taken together, the findings strongly support the proposition that organisational factors significantly shape early-career engineers' outcome expectations. From mentoring and leadership to developmental structure and psychological safety, the organisational environment plays a central role in shaping how engineers perceive their potential for advancement and success. While positive cultures promote optimism, clarity, and investment in growth (April & Govender, 2022; Lips-Wiersma et al., 2016), negative or exclusionary contexts can generate doubt, disengagement, or reactive reorientation. Importantly, the data also demonstrates that self-efficacy operates as an influential force, enabling individuals to navigate, resist, and adapt to organisational limitations in pursuit of their career aspirations.

5.3.9 Structured Goal Setting Influences Targeted and Proactive Career Actions

The ninth proposition was, structured goal setting serves as a foundational step that shapes targeted career actions (such as pursuing promotions, seeking leadership roles, and acquiring advanced skills), which are aligned with long-term professional aspirations and upskilling efforts. Consistent with SCCT, structured goals function as self-regulatory mechanisms that enable individuals to plan, monitor, and adapt their behaviours toward professional development (Lent, Brown & Hackett, 2000; Chan, 2020; Clarke & Scurry, 2020).

The findings reveal that participants who set clear, structured goals were more likely to engage in deliberate and future-focused career actions. Engineer V articulated that "knowing I wanted to specialise in power systems pushed me to complete relevant certifications", directly linking long-term aspirations to short-term development. Engineer O, after deciding to transition into project management, began "doing additional project management courses," while Engineer R's "high expectations" prompted him to "seek out growth opportunities" and make "strategic decisions about upskilling." Engineer M identified the need to study "primary plant engineering" and "develop substation design entirely" in pursuit of a career in renewables. These targeted actions align with research emphasising that goal clarity encourages engineers to engage in skill-building and certification acquisition as career-enhancing strategies (Hackett & Lent, 2017; Nguyen et al., 2020; Wu et al., 2020).

Several participants described how their goal orientation led to the assumption of greater responsibilities or leadership preparation. Engineer C stated that her "goal to transition to a managerial role pushed her to complete additional certifications," while Engineer Q set a concrete goal "to lead a major project within two years," which he achieved through prioritising learning and development. Engineer W shared that his confidence "has driven him to volunteer as a lead engineer, preparing him for managerial roles," and Engineer N reported "polishing every skill that he has" as preparation for future leadership. These actions exemplify how goals serve as motivational structures, guiding engineers to pursue opportunities consistent with long-term growth (Chiesa, Massei & Guglielmi, 2016; Clarke & Scurry, 2020).

Several participants noted that while their GDPs introduced structured goal-setting practices, such as SMART goals, formal mentorship, and guided pathways, it was their ability to sustain or adapt these practices post-GDP that influenced long-term goal orientation. For instance, Engineer U reflected that the SMART goal-setting tools introduced during his programme continued to guide his planning: "It made it easy to carry that discipline into my current work." Engineer G shared that although the GDP helped him become "very clear of what I want," it was in the years that followed that he began "working towards something I'm clear about," suggesting continuity in goal pursuit. Engineer M and Engineer O echoed this sustained influence, with both describing how early guidance evolved into self-directed ambition and reflective decision-making in their post-GDP roles. These accounts align with Oruç (2022), Jelks and Crain (2020), and Pshembayeva et al. (2022), who argue that early exposure to structured development can yield lasting goal-setting behaviours, particularly when reinforced by continued autonomy and opportunity.

Goal setting also emerged as a critical resilience mechanism. Engineer G stated that setting specific goals allowed him to "gauge himself" and provided "the momentum of moving forward." Engineer K reflected: "Without clear goals, when work becomes difficult, you just lose hope, but when you have goals, you know you are just a few steps away." Engineer N similarly noted: "Having a goal is having something to work towards; it drives you." These perspectives align with Chan (2020) and Quinn et al. (2021), who argue that goals help regulate behaviour, sustain motivation, and build a sense of direction under pressure.

While most participants illustrated the transformative power of structured goals, several highlighted external constraints that disrupted their ability to act on those goals, prompting adaptive responses. Engineer A, while not initially motivated by "big goals," was propelled by a "huge drive" stemming from her background, pushing her to "focus on getting as much exposure and as much experience practically." Her narrative suggests implicitly structured goals, reflecting how personal values and motivation can substitute for formal planning under constrained conditions. However, as Engineer J observed: "It is still a struggle to get jobs despite having skills and goals," highlighting how macroeconomic factors can inform the translation of goals into outcomes.

Engineer T, working in a research institution, articulated a specific structural misalignment within his organisation that impeded his progression, stating that “Progression was restricted by criteria ’geared towards scientists’” disadvantaging engineers. This highlights a clear structural barrier where the established promotion criteria within the organisation were misaligned with the professional identity and career pathways of engineers. Engineer I, recognising that “they will never take me seriously” in her male-dominated workplace, revised her long-term objectives away from traditional leadership roles. Engineer T’s ambitions were similarly constrained by promotion criteria tied to academic publications, misaligned with engineering practice, leading to stalled progression. These cases illustrate how organisational barriers may necessitate the recalibration, rather than abandonment, of structured goals (Bosch, 2019; April & Govender, 2022).

Engineers also demonstrated strategic goal redefinition in response to market instability and career disillusionment. Engineer K discovered that professional engineering certification was undervalued in his organisation and shifted toward a technical leadership path. Engineer H left his programme due to a lack of technical exposure, and Engineer N realised most technical work would be outsourced, prompting him to “adjust” his goals. Engineer E, affected by retrenchments, proactively pursued a Master’s in sustainable energy to facilitate a career pivot. Engineer B experienced a stalled promotion and deepening uncertainty, leading her to consider “going abroad” and shifting to a business-oriented trajectory. These narratives reinforce that goal setting is not static but constantly reshaped through reflection, context, and resilience (Lent & Brown, 2013; Chan, 2020).

The literature strongly supports the role of structured goal setting in activating career behaviours. Personal goals are not only linked to self-efficacy and outcome expectations but also serve as planning tools that translate intent into action (Lent et al., 2000; Chan, 2020; Clarke & Scurry, 2020; Quinn et al., 2021). In the post-GDP phase, engineers who engaged in certifications (Engineer V), targeted learning (Engineer O), or technical mastery (Engineer M) exemplify how structured goals guide skill acquisition beyond initial developmental programmes. Engineers who pursued leadership development, such as Engineer C, Engineer Q, and Engineer W, further demonstrate how sustained goal clarity influences domain-specific professional behaviour. These patterns highlight how early-career professionals can internalise and apply structured goal-setting

frameworks in their ongoing career progression, even in the absence of formal programme scaffolding (Jelks & Crain, 2020; Oruç, 2022).

As the evidence indicates, structured goal setting is a critical driver of proactive career action among early career engineers. While contextual constraints, ranging from organisational discrimination to economic volatility, can hinder realisation, goals provide a psychological and behavioural anchor. They support learning, direct ambition, and sustain momentum through adversity. When supported by organisational systems and development programs, goal setting becomes not only a motivational mechanism but a strategic blueprint for career advancement.

5.3.10 Career Actions Facilitate Diverse Career Progression Pathways

The tenth proposition was that active engagement in concrete career actions (including pursuing promotions, seeking leadership roles, and acquiring advanced skills) is posited to be positively associated with varied manifestations of career progression, encompassing linear advancement, lateral moves, and transitions into managerial roles. This assertion aligns with theoretical models emphasising the centrality of career agency and intentional behaviour in shaping individual career trajectories (Clarke & Scurry, 2020; Godshalk, 2018).

Across the dataset, participants described how goal-directed career actions contributed directly to observable progression outcomes. For example, Engineer U was encouraged to volunteer for project management roles, while Engineer S proactively assumed team leader responsibilities and applied for a supervisory position. Engineer W, driven by confidence, volunteered as a lead engineer to prepare for future managerial responsibilities. Similarly, Engineer R's high expectations led him to "seek out growth opportunities" and "make strategic decisions about upskilling." Engineer N reported "polishing every skill that he has" in anticipation of leadership opportunities. These targeted behaviours echo the literature suggesting that proactivity, skill acquisition, and role assumption are key levers in career progression (Lent et al., 2000; Nguyen et al., 2020; Chiesa et al., 2016).

Many engineers made deliberate choices aligned with their aspirations. Engineer O expressed interest in project management, supported by her manager, while Engineer F pursued a postgraduate qualification in business administration to bolster his future leadership prospects.

Engineer C completed additional certifications as part of a transition to a managerial role. Engineer K enrolled in coursework for a Master's degree to ensure goal alignment, while Engineer Q engaged in continuous upskilling with leadership growth in mind. Engineer L and Engineer E similarly pursued postgraduate qualifications, either in response to developmental gaps or to remain competitive in uncertain labour markets. These actions reflect how structured goal setting translates into upward mobility and skills diversification (Clarke & Scurry, 2020; Lent, Ireland, Penn, Morris & Sappington, 2017).

Beyond formal study, participants linked strategic job role selection to their long-term goals. Engineer V became more intentional in seeking roles with growth and leadership potential. Engineer Q aligned his job choices with his developmental trajectory, while Engineer C sought positions consistent with her personal values and aspirations. Engineer L strategically aligned her postgraduate ambitions with her employer's research orientation. Engineer F's strong proactivity resulted in accelerated promotion, while Engineer D credited the structure of his GDP for enabling a clearer understanding of upward mobility. Engineer H made a deliberate decision to step away from a project management-focused role in favour of technical development, reinforcing the role of reflection in adjusting career pathways. Engineer I reported achieving her initial objective of becoming a process engineer through enrolling in specific university modules. Participants also noted that leadership experience, whether formal or informal, was perceived as an essential precursor to future advancement. For instance, Engineer W's volunteer work as a lead engineer was described as preparatory for managerial roles, and Engineer V noted that applying for a technical specialist position represented a "major step" in his career.

However, despite clear goal orientation and proactive behaviour, systemic and contextual challenges often impede the realisation of progression pathways. Engineer J described the ongoing difficulty in securing employment, even with relevant qualifications and proactive efforts. Engineer E experienced a prolonged period without project work, which delayed her development. Engineer I noted that "change management" within her organisation disrupted her plans by eliminating key roles. These cases demonstrate that career progression is not solely determined by individual agency but is also informed by structural and institutional variables, including organisational support and economic stability (Godshalk, 2018). Supportive environments were noted as enablers of accelerated progression. Engineer F attributed the speed of his development

to the mentorship received from senior colleagues, “My progression went quicker than I had thought it would because of the support that I got from the different men.” Engineer A, whose motivation stemmed from her background rather than formal goal setting, still actively pursued developmental opportunities, an example of informal goal orientation supporting experiential learning and growth.

At the same time, several participants described contradictions between career actions and outcomes, arising from exclusionary cultures, structural barriers, and misaligned organisational practices. Engineer C articulated how a combination of personal characteristics, specifically race and age, led to organisational resistance and structural barriers to her progression, stating that “Older employees felt threatened by younger Black engineers. They were not willing to provide opportunities.” Similarly, Engineer I, as the “only female engineer on site,” described being ignored in meetings and expressed that “they will never take me seriously”, leading her to reject traditional managerial tracks in favour of alternative career models that offered greater flexibility. Engineer T reported that working in a research-heavy role where advancement depended on publishing academic papers “slowed down” his progression, prompting consideration of a shift into industry. Engineer K discovered his company did not value professional engineering certification, undermining a previously held aspiration and necessitating a pivot to technical leadership. Engineer N, recognising that most technical work would be outsourced, adjusted his goals accordingly. Engineer H left his GDP midstream due to a lack of technical depth, choosing instead to pursue hands-on development. Engineer B, having endured uncertainty, pay cuts, and delayed promotion, considered “going abroad” and shifting toward a business-oriented career focus. Engineer E, impacted by retrenchments, proactively enrolled in a Master’s in sustainable energy to pivot and regain control of her trajectory.

Literature strongly supports the proposition that career actions, driven by self-efficacy, structured goals, and future-oriented thinking, facilitate diverse progression outcomes (Clarke & Scurry, 2020; Godshalk, 2018). Engineers who pursued leadership training, mentorship, and high-impact assignments (e.g., Engineer U, S, W, R, N, O, and F) demonstrate the value of proactive behaviour. Likewise, strategic decisions regarding roles and qualifications (Engineer V, G, K, Q, C, L, F, D, O, H) reflect intentionality in career navigation. Diverse trajectories, such as lateral moves,

managerial transitions, and upward technical specialisation, were common and reflect the non-linear nature of contemporary career paths, as proposed by Godshalk (2018).

Nevertheless, the data also confirms that career advancement is not guaranteed by effort alone. Structural barriers, including organisational cultures that resist diversity, unstable market conditions, and opaque promotion systems, can undermine even the most deliberate efforts. Still, many participants demonstrated that resilience, adaptability, and reorientation of goals and strategies enabled continued progress despite such obstacles. Taken together, the findings affirm that intentional and proactive career actions are critical enablers of diverse progression pathways among early-career engineers. While agency is a strong driver, its effectiveness is shaped by the surrounding organisational and socio-economic context. This highlights the importance of supportive ecosystems that recognise and reward individual effort while providing equitable pathways for development and advancement.

5.4 Alignment of Findings with Research Objectives

This study aimed to investigate the lived experiences of early career engineers who had completed GDPs, with a focus on understanding their career progression in the post-GDP phase. The findings from this study revealed a strong alignment between the research objectives and the ten propositions derived from the qualitative data.

The first objective of this study was to undertake a systematised review of the Social Cognitive Career Theory (SCCT) to identify conceptual and empirical gaps warranting further investigation. This review constituted a critical foundational phase that shaped the overall conceptual framing of the study, informed the development of the research propositions, and delineated the specific underexplored dimensions of SCCT relevant to early-career engineers emerging from Graduate Development Programmes (GDPs). Importantly, the ten propositions presented in this thesis do not directly address this objective; rather, they are the outcome of it. The review itself served as an antecedent analytical stage through which gaps in the SCCT literature were identified, thereby guiding the subsequent construction of the propositions and the empirical focus of the study.

The systematised review examined the extent to which SCCT has been applied to the context of GDPs and the post-GDP phase of early-career development. The analysis revealed several substantive gaps that this study sought to address:

1. **Empirical support gap:** Limited empirical evidence exists on the long-term influence of SCCT constructs on engineers' career development after their participation in GDPs ends. Much of the literature remains focused on early transitions or developmental stages, leaving later post-GDP experiences insufficiently theorised.
2. **Empirical multiplicity gap:** There is inadequate exploration of how SCCT interacts with socio-demographic variables - such as race, gender, and socioeconomic background; in shaping early-career trajectories. This gap is particularly salient in the South African engineering context, where structural and contextual inequalities continue to influence career opportunities and outcomes.
3. **Theory application gap:** Existing studies pay limited attention to how SCCT accounts for the development of soft skills - including communication, teamwork, and adaptability; during the post-GDP phase, despite these competencies being central to professional progression and workplace integration.

These gaps directly informed the formulation of the study's ten propositions. Each proposition operationalises one or more dimensions of the gaps identified through the review. For example:

- Proposition 2: Personal Characteristics Shape Organisational Influences responds to the empirical multiplicity gap by examining intersections between SCCT constructs and socio-demographic factors.
- Propositions 3, 4, 5, and 8, which focus on post-GDP learning experiences and organisational influences, address the empirical support gap by exploring the evolution of SCCT constructs in later stages of early-career development.

Through this explicit alignment, the systematised review not only informed the theoretical foundation of the study but also provided a coherent line of sight from the identification of gaps to the development of empirically testable propositions. This ensured conceptual continuity,

methodological integrity, and theoretical contribution to SCCT within the context of engineering career development.

The second research objective sought to explore the career progression experiences of graduates since completing their GDP, including the impact of COVID-19 and associated lockdowns. This objective is directly addressed in Proposition 1, which shows how external contextual disruptions, particularly the pandemic, altered career outcome expectations and forced early-career engineers to reassess their aspirations, timelines, and opportunities. Proposition 2 also contributes to this objective by demonstrating how personal characteristics such as race, gender, age, and socioeconomic background influenced the manner in which individuals experienced progression within their organisations, often compounding or constraining opportunities. Further, Proposition 4 illustrates how learning experiences in the post-GDP phase influenced participants' expectations about their careers and shaped the direction of their progression, while Proposition 10 reveals how participants actively engaged in diverse career actions, such as promotions, lateral moves, or pivots into leadership roles, illustrating the varied nature of career pathways post-GDP.

The third research objective focused on identifying the role of self-efficacy, goal setting, and environmental factors in the development of new skills and competencies by early-career engineers. This was addressed through several propositions. Proposition 3 showed that post-GDP learning experiences, particularly mentorship, coaching, feedback, and challenging assignments, played a significant role in enhancing self-efficacy and building professional confidence. Proposition 5 further linked these learning experiences to goal setting, showing that such experiences were instrumental in helping participants clarify their ambitions and set achievable career goals. Proposition 6 revealed that engineers with positive career outcome expectations, shaped by early post-GDP experiences, were more likely to engage in purposeful goal setting, while those facing uncertainty often revised their strategies. Proposition 7 emphasised the central role of self-efficacy in driving ambitious, structured career goals, with participants who possessed a strong belief in their abilities demonstrating more proactive career planning and resilience in the face of adversity. Proposition 9 supported this by showing that structured goal setting led to targeted career actions such as acquiring advanced skills, pursuing professional registration, or volunteering for leadership roles, all key indicators of skill development and competence.

The fourth research objective sought to examine the level of support graduates received in their careers after completing their GDPs. This was most clearly reflected in Proposition 3, which outlined how access to mentorship, feedback, and structured learning post-GDP was unevenly distributed and significantly influenced self-efficacy and skill development. Proposition 4 added depth by showing that the presence or absence of support influenced not only confidence but also longer-term career expectations. Proposition 8 addressed organisational influences more explicitly, showing how cultures, leadership styles, mentoring systems, and performance management processes shaped individuals' perceptions of support and development opportunities. In cases where organisational environments were exclusionary or misaligned with participant aspirations, engineers recalibrated their goals or sought new career paths. Proposition 9 further confirmed that supportive environments enabled engineers to sustain their goal orientation and engage in continuous learning and development, while Proposition 10 illustrated that the support (or lack thereof) received post-GDP had a direct impact on the actions engineers took to advance or redirect their careers.

In summary, the ten research propositions collectively provide a comprehensive account of how early-career engineers navigated the post-GDP phase, each contributing to one or more research objectives. The alignment of propositions with the objectives strengthens the internal coherence of the study and affirms the explanatory power of the SCCT framework in making sense of early-career development in complex, uncertain, and unequal environments such as the South African engineering sector.

5.5 Pattern Matching: Aligning Empirical Findings with the Conceptual Framework

To analyse the extent to which the conceptual framework informed by SCCT was reflected in the lived experiences of early career engineers, this study applied a pattern-matching logic. Ten research propositions were derived from the framework to represent anticipated relationships between personal characteristics, contextual factors, post-GDP experiences, and career-related outcomes such as self-efficacy, outcome expectations, goal setting, and actions. Pattern matching enabled a structured comparison between these theoretically derived propositions and the

empirical data gathered through interviews. This approach provided a means to assess convergence, divergence, or partial alignment between expected patterns and actual findings.

Table 5.2 below presents a summary of how each of the ten research propositions was supported, contradicted, or nuanced by the participants' post-GDP experiences. Each cell begins with a summary statement that captures the nature of the evidence in relation to the proposition, followed by illustrative examples drawn from participant narratives. Contradictory evidence refers to instances where participants' experiences directly challenged the proposition, while nuanced evidence reflects experiences that, although not fully contradictory, added complexity or conditional variation to the dominant pattern. This approach offers a more granular understanding of the lived realities of early career engineers and highlights both consistency and divergence within the data.

Table 5.2: Research Propositions with Supporting and Contradictory Evidence

Proposition	**Supporting Evidence from Research Findings**	**Contradictory or Nuanced Evidence from Research Findings**
1. Contextual Disruptions Shape Career Outcome Expectations	COVID-19 significantly disrupted career outcome expectations for many engineers in the post-GDP phase, prompting a re-evaluation of goals, heightened uncertainty, and altered aspirations. - Engineer A's placement was withdrawn due to retrenchments, causing anxiety and a sense of vulnerability. - Engineer B spoke of needing to "relook at your career aspirations" and considered emigration. - Engineers C, D, and I shifted career priorities towards flexibility, digital literacy, and work-life balance. - Engineer E described psychological strain, leading to openness to career change.	Not all participants perceived the pandemic as disruptive to their career expectations. - Engineer K reported remaining focused on his studies with no impact. - Engineer L, embedded in academia, experienced minimal disruption. - Engineer O retained optimism and continued applying for roles, believing "things would get better." - Engineer S noted robust remote support helped maintain focus, while Engineer F took proactive steps to reskill. *Nuanced*: The impact varied depending on career stage, sector, organisational support, and personal resilience. Engineer S noted robust remote support helped maintain focus, while Engineer F took proactive steps to reskill.

	- Engineer G and H reported career insecurity and fear of stagnation. - Engineer J worked unpaid for six months due to oversupply, undermining her career expectations.	
2. Personal Characteristics Shape Organisational Influence	Race, gender, and socioeconomic background significantly shaped participants' experiences of organisational culture and opportunities post-GDP. - Engineer I, a woman in a male-dominated environment, was frequently ignored in meetings. - Engineer B experienced better support under a Black manager and noted racial tension within the workplace. - Engineer C was excluded due to race and age, citing senior colleagues' resistance to young Black professionals. - Engineer A's rural background instilled resilience, but she faced race and gender-	Some participants attributed their progress primarily to individual agency rather than identity. - Engineer F and Engineer O both credited their proactivity for their advancement. - Engineer P (a white female) emphasised adaptability and did not report discrimination. *Nuanced*: Organisational context played a significant role, some engineers progressed due to supportive environments, while others faced systemic or cultural resistance that limited the influence of agency alone.

	related exclusion and was perceived as a "threat."	
3. Post-GDP Learning Experiences Enhance Self-Efficacy	Exposure to projects, mentoring, and training post-GDP enhanced self-efficacy by building competence and confidence. - Engineers G, Q, and R reported that real-world application of skills built confidence. - Engineer S stated that mentorship clarified his professional path. - Engineers O and M credited mentors with helping them "realise their potential." - Engineers U and B benefited from formal training and certifications that improved their skills. - Engineer Q gained confidence through senior recognition of his work.	In the absence of structure, self-efficacy development was constrained or delayed. - Engineer I, "thrown into the deep end," became demotivated and lost confidence. - Engineer A reported her mentor "shut her down," leading to diminished self-concept. - Engineer H and A built resilience without formal support but noted it was emotionally taxing. *Nuanced*: Organisational barriers (e.g., lack of sponsors, rigid hierarchies) often impeded otherwise proactive individuals like Engineers F, T, and K.
4. Post-GDP Learning Experiences Influence Career Outcome Expectations	Exposure to diverse work contexts and mentorship post-GDP led participants to redefine or reinforce career expectations.	When programmes lacked structure or were disrupted, outcome expectations became uncertain. - Engineer I lacked mentorship, which led to demotivation.

	- Engineers G, D, and C found clarity about career direction through project experiences. - Engineers O and L noted that mentorship provided direction and long-term planning. - Engineers M and B redirected their careers after discovering new interests. - Engineer Q and M's expectations were positively shaped by senior recognition and successful performance.	- Engineer O noted that unstructured learning made sustaining momentum difficult. - Engineer F reported limited support, hindering development. - Engineer A felt that exclusion eroded her confidence. - Engineers B, J, and N noted economic uncertainty negatively influenced confidence in future opportunities.
5. Post-GDP learning experiences significantly influence goal setting among early-career professionals	Mentorship, learning opportunities, and feedback after GDPs helped shape realistic and aspirational goals. - Engineers U, J, and O reported that guidance during and after the GDP helped set clear goals. - Engineers M, B, L, and E discovered or refined goals through work exposure. - Engineers U and Q noted that feedback helped realign expectations.	Some participants relied on self-driven goal setting due to insufficient external support. - Engineers F, O, and A set goals independently due to lack of mentorship. - Engineers N and L entered GDPs with pre-existing goals that were reinforced. - Engineer J and I experienced inconsistent support, which hindered structured planning. - Engineers B, E, N, K, and H redirected goals in response to economic instability.

	- Engineers G, D, M, C, and N showed increased clarity and motivation post-GDP.	
6. Career Outcome Expectations Drive Goal Setting	Positive outcome expectations fostered motivation, ambition, and structured goal setting. - Engineers G, D, M, and C developed clear and ambitious goals aligned with perceived opportunities. - Engineer O found that mentorship clarified expectations and guided planning. - Engineer K noted that goals helped sustain motivation in adversity.	Negative expectations and adverse environments initially disrupted goal clarity. - Engineer A described losing her "vision" and feeling trapped in "survival mode." - Engineer E's development was delayed by project scarcity. - Engineer I and T reassessed goals due to exclusion or structural misalignment. *Nuanced*: Engineers I and F demonstrated resilience by continuing to set and pursue goals despite adversity. Engineers B, J, and E recalibrated their goals in response to constraints.
7. Self-Efficacy Underpins Ambitious Goal Setting	Engineers with high self-efficacy were more likely to set and pursue aspirational goals.	Even with a strong internal drive, self-efficacy could be diminished by unsupportive environments. - Engineer A's self-esteem dropped due to being treated as a threat.

	- Engineers C, F, H, and N linked confidence in abilities to leadership or certification goals. - Engineers M and O developed long-term ambitions based on early success. - Engineer Q pursued a project leadership role based on feedback and confidence.	- Engineer J persisted with her goals despite working unpaid. - Engineers T, K, and N adjusted goals after realising structural misalignment with aspirations. *Nuanced*: Engineers A and I showed resilience and continued goal pursuit despite exclusion and systemic barriers.
8. Organisational Influences Significantly Affect Individuals' Outcome Expectations	Organisational culture, leadership, and mentoring systems significantly shaped perceived opportunities and career expectations. - Engineers L, C, and O experienced expanded possibilities due to positive cultures. - Engineers V, G, D, and M attributed clarity and motivation from leaders to post-GDP organisational support. - Engineers E, V, Q, and B credited mentorship with sustaining optimism.	Exclusionary or misaligned environments led to diminished expectations and disengagement. - Engineer A experienced identity-based exclusion and felt her degree was undervalued. - Engineer I's ideas were ignored in meetings as the only woman on site. - Engineers K, H, and N noted organisational priorities were misaligned with their developmental needs. - Engineer J, E, and B re-evaluated expectations due to economic and organisational instability.

9. Structured Goal Setting Influences Targeted and Proactive Career Actions	Engineers who set structured goals pursued certifications, promotions, and leadership roles aligned with their aspirations. - Engineers V, O, R, and M pursued specific learning goals. -Engineer V stated that "knowing I wanted to specialise in power systems pushed me to complete relevant certifications" - Engineers C, Q, W, and N prepared for promotion to leadership roles based on career planning. - Engineers U, G, M, and O sustained goal-setting discipline beyond the GDP. - Engineers G, K, and N reported goal clarity as a motivational anchor.	Even where goals were set, structural and economic constraints sometimes hindered execution. - Organisational bias and misalignment sometimes blocked goal enactment for several engineers, particularly those from historically marginalised groups or in environments with rigid structures - Engineer A had strong drive but lacked formal guidance. - Engineer J faced job scarcity despite having clear goals. - Engineer I, a female engineer, struggled in a highly masculinised environment where she was often "the only female engineer on site" *Nuanced*: Some engineers, like A and F, adapted their strategies under constrained conditions, maintaining progress despite systemic limitations.

10. Career Actions Facilitate Diverse Career Progression Pathways	Intentional career actions led to promotions, lateral moves, and entry into leadership roles across diverse pathways. - Engineers U, S, W, R, and N pursued growth opportunities actively. - Engineers O, F, C, K, Q, L, and E aligned education and experience with long-term aspirations. - Engineers V, Q, and C sought roles aligned with personal values. - Engineers W and V volunteered for leadership tasks as preparation for formal advancement.	Agency alone did not always result in progression; institutional and structural constraints frequently moderated outcomes. - Engineer J remained unemployed despite her efforts. - Engineer E's growth stalled due to retrenchments. - Engineer I's ambitions were disrupted by workplace exclusion. - Engineer A was "shut down" despite taking initiative. *Nuanced:* In constrained environments, participants adjusted goals or shifted sectors (e.g., Engineer K refocused on technical leadership). Progress was fastest in enabling contexts.

In summary, the findings provide strong empirical support for all three objectives and all research propositions. By drawing from participant experiences and contextualising them within the literature and the SCCT framework, the study offers a robust and detailed understanding of the early post-GDP career trajectory in the engineering profession.

5.6 Summary of Chapter

This study aimed to investigate the lived experiences of early career engineers who had completed GDPs, with a focus on understanding their career progression in the post-GDP phase. The findings from this study revealed a strong alignment between the research objectives and the ten propositions derived from the qualitative data.

The first research objective sought to explore the career progression experiences of graduates since completing their GDPs, including the impact of COVID-19 and associated lockdowns. This objective is directly addressed in **Proposition 1**, which illustrates how the COVID-19 pandemic acted as a contextual disruption, delaying exposure, increasing uncertainty, and prompting engineers to reassess their career aspirations, trajectories, and outcomes. **Proposition 2** expands on this by highlighting how personal characteristics such as race, gender, age, and socioeconomic background intersect with organisational cultures and influence career progression, often amplifying exclusion or disadvantage. **Proposition 4** further explains how post-GDP learning experiences helped shape career expectations by enabling engineers to clarify interests and redirect their goals. Lastly, **Proposition 10** demonstrates that despite varied challenges, participants actively engaged in a range of career actions, such as changing roles, upskilling, or entering leadership pathways, thereby illustrating diverse and adaptive career progression strategies.

The second research objective focused on identifying the role of self-efficacy, goal setting, and environmental factors in the development of new skills and competencies by early-career engineers. Several propositions addressed this objective. **Proposition 3** showed that mentorship, coaching, and exposure to challenging tasks in the post-GDP phase significantly enhanced self-efficacy by helping engineers build technical and professional confidence. **Proposition 5** illustrated how these developmental experiences also supported goal clarity and realism, equipping participants to set targeted and achievable career goals. **Proposition 6** revealed that participants with positive career outcome expectations, especially those shaped by post-GDP experiences, were more likely to formulate structured goals, while others facing uncertainty or organisational dysfunction recalibrated their aspirations. **Proposition 7** demonstrated that self-efficacy underpinned goal setting, with confident participants actively pursuing leadership, certification, and professional development.

Finally, **Proposition 9** linked structured goal setting to proactive career behaviours, such as strategic role selection, continued learning, and leadership preparation, all of which contributed to the development of key competencies.

The third research objective sought to examine the level of support graduates received in their careers after completing their GDPs. **Proposition 3** again offered critical insights, showing that while some participants benefitted from structured post-GDP mentorship and learning, others encountered uneven support that negatively impacted self-efficacy. **Proposition 4** reinforced the importance of these experiences by revealing how the presence or absence of support shaped both expectations and confidence. **Proposition 8** provided a broader view of organisational influences, illustrating how institutional cultures, leadership, and HR systems either fostered or constrained support, often based on identity and organisational structure. In settings where misalignment or exclusion prevailed, participants altered or redirected their career paths. **Proposition 9** further confirmed that supportive environments helped engineers sustain goal orientation and pursue continuous development, while **Proposition 10** illustrated that post-GDP support, or lack thereof, directly influenced the career actions taken by early-career engineers to either advance or reroute their trajectories.

In summary, the ten research propositions collectively provide a comprehensive and empirically grounded account of how early-career engineers navigated the post-GDP phase. Each proposition contributed to one or more research objectives, offering insight into the ways in which individual agency interacts with contextual realities to shape career development. The alignment between the propositions and research objectives strengthens the internal coherence of the study and affirms the explanatory power of the SCCT framework in understanding early-career progression in the South African engineering context, particularly within a landscape marked by uncertainty, structural inequality, and transformation imperatives.

While the first three objectives of the study are addressed through the detailed thematic findings presented in this chapter, the fourth sub-goal, to formulate recommendations on how early career engineers can be supported after GDP participation, will be addressed in the final chapter. Drawing on the insights and patterns identified in the thematic analysis, the concluding chapter will offer practical and evidence-informed recommendations aimed at enhancing post-GDP career support structures for early career engineers in the South African context.

CHAPTER 6: Conclusion and Recommendations

6.1 Introduction

Chapter 5 systematically presented the findings, demonstrating that the empirical data largely support the study's ten research propositions while also revealing nuances and complexities related to systemic inequality and external disruptions. This final chapter synthesises these key insights to fulfil the study's final objective: to formulate evidence-based recommendations. It concludes by restating the research aim and objectives, summarising the major findings, and articulating the study's theoretical contribution; extending Social Cognitive Career Theory (SCCT) into the post-GDP phase and addressing structural constraints; as well as its empirical contribution, offering actionable guidance for relevant stakeholders.

This chapter brings together the key insights of the study to provide a holistic synthesis of its findings, theoretical and empirical contributions, practical and policy implications, and recommendations for enhancing the post-GDP career development of early-career engineers in South Africa. It reflects on how the study's objectives were achieved, with particular emphasis on the fifth and final objective: to formulate evidence-based recommendations addressing the support needs of engineers after completing Graduate Development Programmes (GDPs).

Building on the thematic analysis and ten propositions developed in Chapter 5, the chapter demonstrates how the findings extend and deepen SCCT by incorporating the influence of socio-cultural, organisational, and structural dynamics into our understanding of early-career development. The chapter begins by restating the research aim and objectives (Section 6.2), followed by a summary of the key findings (Section 6.3). It then articulates the study's theoretical (Section 6.4) and empirical (Section 6.5) contributions before outlining the practical and policy implications of the research (Section 6.6). Section 6.7 presents a set of actionable recommendations directly addressing the fifth research objective. Finally, the chapter discusses the study's limitations (Section 6.8), suggests areas for future research (Section 6.9), and concludes with a reflection on the broader significance of the study (Section 6.10).

Collectively, these sections demonstrate how the study contributes new knowledge while providing practical guidance for developing more inclusive, structured, and supportive systems that foster the growth and retention of early-career engineers beyond the GDP phase.

6.2 Restatement of the Research Aim and Objectives

The aim of this study was to explore the career development experiences of early career engineers in South Africa following their participation in Graduate Development Programmes (GDPs). Situated within the framework of SCCT, the study investigated how personal agency, environmental influences, and contextual realities interact to shape post-GDP career trajectories. A qualitative approach was employed to capture the nuanced and situated experiences of 25 engineering graduates across diverse sectors.

The research was guided by five key objectives. The first objective was to explore the career progression experiences of graduates since completing their GDPs, including the influence of COVID-19 and its associated lockdowns. The second objective focused on identifying the role of self-efficacy, goal setting, and environmental factors in helping graduates develop the skills and competencies required in their early engineering careers. The third objective examined the level of support received by graduates in the post-GDP phase, including organisational practices, mentoring, and access to developmental opportunities. The final objective, which is addressed in this chapter, was to formulate practical recommendations on how early-career engineers can be better supported after completing GDPs. Collectively, these objectives formed the analytical foundation of the study and framed the interpretation of the qualitative data.

6.3 Summary of Key Findings

This study explored the post-GDP career development experiences of early career engineers in South Africa, using SCCT as the guiding framework. The findings, derived from rich qualitative data, were organised into ten research propositions across four major themes. These findings address the study's first four objectives and provide a detailed understanding of how early career engineers navigate the transition from structured GDPs into independent professional roles within complex and often unequal environments.

The first key finding is that contextual disruptions, especially the COVID-19 pandemic, had a significant impact on career outcome expectations. Participants experienced career shocks that led to uncertainty, delayed professional exposure, and re-evaluation of career plans. This disruption was more pronounced for those in sectors affected by lockdowns or organisational retrenchments.

Secondly, the study found that personal characteristics and identity markers, particularly race, gender, and socio-economic background, profoundly shaped engineers' access to opportunities and their experiences within organisations. Engineers from marginalised backgrounds often faced exclusion, slower progression, or the burden of constantly having to prove their competence. However, these challenges also prompted resilience, agency, and goal reorientation in some cases.

The third major finding relates to the central role of post-GDP learning experiences in shaping self-efficacy and career goal setting. Participants who had access to mentorship, feedback, technical training, or professional registration support reported higher confidence and more aspirational, structured career goals. In contrast, inconsistent support, organisational misalignment, or lack of exposure diminished engineers' confidence and future orientation.

Fourth, the study highlighted how organisational environments either enabled or constrained career development. Supportive organisational cultures, inclusive leadership, and transparent performance systems contributed positively to career progression. Conversely, exclusionary environments, unclear promotion pathways, and systemic bias led some participants to stall, exit, or redirect their careers. These organisational influences were deeply intertwined with outcome expectations and goal-directed behaviours.

Finally, the study reinforced that career development is not a linear or purely individual process. While self-efficacy and goal setting are important, they are significantly influenced by the external environment. Structural barriers, identity-based challenges, and organisational culture all play critical roles in shaping how early career engineers advance, adapt, or recalibrate their goals.
In summary, the findings offer a holistic and contextually grounded understanding of career development post-GDP. They confirm and extend SCCT by illustrating how socio-cultural, organisational, and contextual factors interact with personal agency to shape the early professional lives of engineers. The next section builds on these insights to provide practical, policy, and theoretical contributions to the field.

6.4Theoretical Contribution

This study provides robust qualitative evidence that empirically substantiates the core propositions of SCCT, particularly those concerning self-efficacy, outcome expectations, and goal setting. Across the dataset, participants consistently articulated how post-GDP learning experiences, comprising on-the-job training, structured feedback, mentoring relationships, and exposure to challenging assignments, served as pivotal mechanisms for cultivating professional self-efficacy. These findings

corroborate SCCT's theoretical claim that mastery experiences and social persuasion constitute critical pathways through which individuals develop confidence and sustain task engagement (Bandura, 1994; Lent, Brown, & Hackett, 1994). Furthermore, such learning processes meaningfully shaped participants' career outcome expectations, with many describing an emergent clarity in professional vision, an expanded awareness of potential career trajectories, and strengthened conviction in their future success. Importantly, career goals emerged not as fixed endpoints but as dynamic constructs, continuously refined through ongoing experiential learning, thus aligning with SCCT's principle of reciprocal determinism among person, behaviour, and environment (Lent & Brown, 2013). The data further reinforce the theory's proposition that individuals possessing heightened self-efficacy tend to articulate more ambitious, structured goals and engage in proactive, goal-directed behaviours (Hackett & Lent, 2017).

A key theoretical contribution of this research lies in its extension of SCCT's applicability to the post-GDP career phase, a developmental stage that remains markedly underexplored within SCCT's traditional focus on educational transitions and early workforce entry. This study illuminates the complex, multifaceted processes characteristic of the post-GDP period, including skill consolidation, leadership development, professional identity reconstruction, and organisational navigation. Skill consolidation encompasses the contextual application and refinement of competencies honed during GDPs, as new professionals move from academic training to workplace performance, a gap often highlighted in graduate surveys that note deficits in mentorship and structured onboarding (Osman & Gerwel, 2023). Leadership development frequently arises informally through increased responsibility and stretch roles, particularly when GDP participants transition into leadership or managerial positions without formal training, echoing challenges documented among engineers shifting into management roles in South Africa (Maphumulo, 2023). Professional identity reconstruction involves graduates renegotiating their self-concept and professional roles in response to workplace expectations, an experience corroborated by qualitative studies exploring identity formation among South African engineers, especially those from historically disadvantaged backgrounds (Carey, 2018; Matli & Ngoepe, 2021).

Lastly, organisational navigation refers to the strategic interpretation of informal norms, power dynamics, and institutional constraints in complex workplace environments, areas often left unaddressed by structured programmes and requiring high levels of self-agency (Matli & Ngoepe, 2021). Rather than a phase of passive career continuity, the post-GDP landscape emerges as an active, often turbulent arena of negotiation, realignment, and recalibration. These findings compellingly

argue for expanding SCCT's analytical scope beyond initial career entry points to encompass the full temporal spectrum of career development (Duffy et al., 2016; Lent, 2022).

This research critically advances SCCT by problematising the linear assumption embedded in some of its formulations, that high self-efficacy and positive outcome expectations directly yield favourable career outcomes. The findings reveal how adverse contextual conditions, including organisational toxicity, economic instability, and pandemic-related disruptions, can significantly disrupt or delay the realisation of individual agency into tangible career advancement. While SCCT acknowledges the salience of contextual affordances and barriers, this study provides granular, nuanced evidence demonstrating that such external factors can overpower even highly efficacious and goal-driven individuals (Akkermans, Seibert, & Mol, 2018; Lent & Brown, 2013). Crucially, these contextual constraints do not negate agency; rather, participants responded with adaptive strategies, manifesting resilience, self-directed learning, and strategic career pivots, that reflect a recursive, recalibrated form of agency rather than disengagement. These insights resonate with contemporary calls for an ecologically valid, context-responsive SCCT framework that embraces non-linear, iterative, and adaptive career trajectories (Hite & McDonald, 2020; Rudolph & Zacher, 2020).

This study makes a vital theoretical intervention by addressing SCCT's underdeveloped engagement with systemic inequality. Although SCCT allows for individual variability, critiques have highlighted its insufficient attention to how race, gender, and socio-economic status operate as structural moderators of career development (Byars-Winston & Rogers, 2019). By integrating an intersectional perspective, this research reveals how social identity functions not merely as an individual attribute but as a structural condition fundamentally shaping access to career opportunities. Narratives, particularly from Black women engineers, elucidate the compounded marginalisation experienced through exclusion from high-value assignments, biased performance assessments, and obstructive leadership practices. These persistent inequities challenge SCCT's implicit assumption that personal agency alone suffices to overcome structural barriers, compelling an expansion of the theory to explicitly incorporate critical race, feminist, and decolonial perspectives that foreground institutional power relations as key determinants of career trajectories.

Another critical contribution concerns SCCT's assumption that structured goal setting reliably precipitates successful career actions and outcomes. While numerous participants actively pursued upskilling, leadership roles, and career reorientation aligned with their goals, others encountered systemic stagnation, discriminatory practices, and misaligned promotion criteria that thwarted goal

attainment. These findings reinforce the argument that goal achievement is inherently conditional, contingent not only on individual cognition but also on institutional responsiveness and environmental congruence (Bosch, 2019; Ogbonnaya & Bevan, 2021). Moreover, adversity frequently served as a catalyst for strategic recalibration; participants revised aspirations, sought postgraduate qualifications, or pursued alternative career pathways in response to structural impediments. This adaptive agency represents a sophisticated, forward-looking resilience that remains under-theorised in traditional SCCT models, highlighting the need for a reconceptualisation that recognises strategic recalibration as a legitimate and empowering career response (Lent, 2021).
In sum, this study affirms the enduring relevance of SCCT's foundational constructs while simultaneously pressing the theory toward greater contextual, structural, and temporal nuance. By situating early-career engineers' experiences within the turbulent post-GDP landscape of South Africa, a milieu shaped by historical inequities, economic uncertainty, and evolving labour market demands, this research challenges the universality of agentic assumptions and linear career progressions. Instead, it advocates for a contextually grounded SCCT that incorporates structural contingencies, identity-based constraints, and dynamic goal recalibration over time. These theoretical advances not only extend SCCT's explanatory power but also enhance its practical utility for designing equity-focused, developmentally responsive career interventions in post-pandemic, post-colonial, and rapidly transforming professional contexts.

6.5 Empirical Contribution

This study makes several significant empirical contributions to the evolving body of knowledge on early career development within South Africa's engineering sector, with a particular focus on the underexplored post-GDP phase. While existing scholarship tends to concentrate on graduate recruitment, onboarding processes, and the structure of GDPs (Samuel et al., 2020; Clarke, 2017), there remains an evident gap concerning the developmental trajectories that engineers follow after completing these structured programmes. By foregrounding the lived experiences of 25 early-career engineers from diverse racial, gendered, and organisational contexts, this study provides a richly textured and contextually grounded account of the transition beyond the GDP window, a phase that is frequently overlooked in both local and international literature (Mpangeva & De Braine, 2024; Naidoo, 2021).

First, this research offers critical insight into how early-career engineers navigate the shift from the scaffolded environment of GDPs to the more autonomous, ambiguous, and often precarious conditions of mainstream professional roles. Participants' experiences were marked by stark variability: while some encountered enabling environments with continued mentoring,

developmental stretch assignments, and affirming leadership, others faced organisational neglect, marginalisation, and institutional inertia. This divergence highlights the inconsistency of post-GDP support structures and suggests that, in the absence of intentional organisational investment, the momentum built during graduate development can dissipate quickly, exacerbating attrition risks and undermining long-term retention (Pillay et al., 2020). These findings call for the establishment of formalised, longitudinal support systems to sustain learning and engagement beyond initial career entry.

Second, the study provides empirical evidence of how macro-level disruptions, most notably the COVID-19 pandemic, intersect with micro-level career development processes. Although global scholarship has begun to document the pandemic's effects on youth employment and graduate transitions (Akkermans, Richardson, & Kraimer, 2020; Jackson & Tomlinson, 2022), this research presents occupation-specific, localised data from South Africa's engineering profession. Participants described how pandemic-related lockdowns and economic contraction curtailed practical exposure, limited project-based learning, and delayed professional registration opportunities. The pandemic functioned as a career shock (Akkermans, Richardson, & Kraimer, 2020), prompting many to reassess their goals, consider emigration, or diversify their professional trajectories, illustrating the non-linearity and contingency of early career development in volatile contexts.

Third, this study foregrounds the powerful role of social identity in shaping engineers' post-GDP experiences. Although issues of transformation and diversity have long been acknowledged in South Africa's engineering pipeline (Akoojee, 2012; Department of Higher Education and Training, 2020), this research offers rich narrative evidence demonstrating how race, gender, and class continue to influence access to opportunity, mentorship, visibility, and career progression. Black women engineers, in particular, spoke of exclusion from informal technical networks, performative diversity practices, and the emotional burden of 'proving' competence in male-dominated environments. These accounts reinforce critiques that current transformation efforts often fail to address the deeper structural and cultural barriers within organisations (Byars-Winston & Rogers, 2019), and they strengthen the call for intersectional approaches to talent development and retention.

Fourth, the study empirically illustrates the reciprocal dynamics of self-efficacy, goal orientation, and career action within the post-GDP context. Aligned with Social Cognitive Career Theory (SCCT), participants who benefitted from affirming feedback, inclusive leadership, and structured developmental opportunities reported strengthened self-efficacy, more ambitious career goals, and engaged in agentic behaviours, such as pursuing further qualifications, seeking professional registration, or assuming leadership roles (Lent et al., 1994; Lent & Brown, 2013). Conversely, those

operating in unsupportive or exclusionary contexts experienced depleted confidence, career stagnation, or recalibrated aspirations. These findings affirm the centrality of environmental reinforcement in sustaining self-efficacy and highlight the fragility of motivation in the face of persistent structural and relational barriers (Bandura, 1997; Hackett & Lent, 2017).

Taken together, these empirical insights offer a timely and locally grounded contribution to the field of career development. They advance understanding of the nuanced, context-sensitive processes that shape engineering careers in a post-apartheid, post-pandemic South Africa. In doing so, the study extends theoretical debates around SCCT, career shocks, and intersectionality while also generating practical implications for employers, HR practitioners, professional bodies, and policymakers seeking to enhance early-career retention, equity, and professional growth in the engineering sector. By documenting the conditions under which early-career engineers either thrive or flounder after GDPs, this study provides an essential evidentiary basis for more inclusive and sustainable talent development strategies.

6.6 Implications and Recommendations

In addressing the fifth objective of this study, a range of implications and evidence-informed recommendations are presented. They are structured by stakeholder responsibility, with the aim of supporting the long-term development of early career engineers in the post-GDP phase. These implications extend beyond individual workplace interventions to systemic policy and institutional frameworks that shape the engineering profession in South Africa. The recommendations are therefore categorised according to the primary actors responsible for implementation: employers and HR practitioners, professional bodies, higher education institutions, government departments, and early career engineers themselves.

6.6.1 Employers and HR Practitioners.

Engineering employers bear primary responsibility for the career development of engineers post-GDP. The findings highlight the need to institutionalise structured post-GDP frameworks, including rotational placements, career development planning, regular check-ins, and feedback mechanisms aligned with professional growth. Embedding developmental KPIs into performance management systems is essential to shift organisational focus from compliance to capability building. Furthermore, access to mentorship and coaching should be formally integrated into talent development strategies. While informal mentoring relationships often foster psychological safety and cultural resonance, they risk excluding those without the social capital to initiate such connections. Formal mentoring

structures with clear milestones, mentor support, and identity-informed pairings offer greater equity and consistency (Owusu-Agyeman, 2022). Employers must also equip line managers and technical leaders with training in inclusive leadership, unconscious bias, and equitable sponsorship. Such interventions are particularly critical in male-dominated or racially exclusive environments, where engineers from historically disadvantaged backgrounds continue to face systemic barriers to visibility and advancement.

6.6.2 Professional Bodies and Sectoral Institutions.

The Engineering Council of South Africa (ECSA) and Sector Education and Training Authorities (SETAs) are well-positioned to play a coordinating role in establishing post-GDP development standards across the sector. These bodies should develop and accredit national mentoring schemes aligned to ECSA's professional registration requirements. While the study assumes that engineers should ideally be registered or near registration by the end of the GDP, data suggest that many early-career engineers remain unsupported in navigating this milestone. Professional bodies can provide clearer guidelines and transitional support mechanisms to address this gap. In addition, sectoral bodies could incentivise inclusion through transformation-linked scorecards, tracking demographic equity in early career pipelines. While the implementation of broad-based transformation scorecards ultimately resides with the government, professional councils can collaborate with the Department of Trade, Industry and Competition (DTIC) and the Department of Employment and Labour to recommend inclusion benchmarks tied to professional development outcomes.

6.6.3 Higher Education Institutions and Graduate Programme Providers.

Stronger collaboration between universities and employers is essential to ensure a seamless transition from GDPs into autonomous professional roles. The study recommends curriculum enhancements that include workplace readiness, navigating exclusion, resilience-building, and long-term career planning. Alumni tracking and institutionalised follow-up with GDP graduates can improve feedback loops and inform curriculum reform. Universities, in partnership with GDP employers, should co-design developmental content and embed Social Cognitive Career Theory (Lent et al., 1994; Lent & Brown, 2013; Lent et al., 2022) into training methodologies to equip graduates with the self-efficacy, goal clarity, and outcome expectations necessary for sustainable career progression.

6.6.4 Government Departments.

The study identifies several government actors as key custodians of policy implementation. The Department of Higher Education and Training (DHET), the Department of Employment and Labour,

and the Department of Trade, Industry and Competition (DTIC) hold responsibility for ensuring alignment between educational policy, employment equity legislation, and sector transformation targets. These departments should establish or strengthen national frameworks that mandate post-GDP development support, promote inclusive talent pipelines, and incentivise collaboration between employers and universities. Policy tools such as revised scorecards, national youth employment strategies, and the National Development Plan (NDP) provide mechanisms through which the state can encourage systemic change in the engineering sector.

6.6.5 Early Career Engineers.

While systemic change is essential, the role of individual agency cannot be overlooked. Drawing on SCCT, the study finds that engineers who engage proactively in mentoring relationships, build career self-efficacy, and set clear goals are more likely to navigate the uncertainties of the post-GDP environment successfully (Lent & Brown, 2013) . Peer networks and communities of practice also emerged as critical sources of support, particularly for engineers facing social exclusion or limited organisational integration. Institutions and employers should actively support the formation of these networks, which strengthen resilience and promote belonging among early-career professionals.

This study highlights the value of SCCT in understanding early career development. Organisations can use SCCT as a guiding framework to design interventions that build self-efficacy, clarify outcome expectations, and support goal setting among young professionals. Human Resources and Learning & Development practitioners can be trained to use SCCT-based diagnostics to assess and respond to early career talent needs, ensuring that psychological enablers of performance are integrated into career development models.

In summary, the study's implications call for a multi-level, coordinated response that spans organisational practices, professional standards, educational reforms, and national policy. Implementing the recommendations outlined above will not only enhance the career outcomes of early-career engineers but also contribute meaningfully to South Africa's broader goals of youth employment, transformation, and STEM development.

6.7 Limitations of the Study

While this study offers important insights into the post-GDP experiences of early career engineers in South Africa, several limitations must be acknowledged to contextualise its findings and guide future research.

Firstly, the study employed a qualitative research design with a purposive sample of 25 participants. While this approach enabled a rich, in-depth exploration of lived experiences, the findings are not intended to be statistically generalisable to all early career engineers in South Africa. Instead, the study aims for analytical generalisability, which refers to the extent to which theoretical concepts or insights derived from a particular study can be applied to other similar contexts or populations beyond the immediate sample (Yin, 2018). Unlike statistical generalisation, which relies on large, representative samples, analytical generalisability emphasises the transferability of findings based on the robustness of the research design and the depth of contextual understanding (Weis & Willems, 2017)). This approach enables the study to contribute meaningfully to theory development and practical application within comparable engineering or professional development settings.

Secondly, the sample, while diverse in terms of race, gender, and engineering sector, was limited to participants who had completed GDPs and were willing to reflect on their experiences. It is possible that those who were most dissatisfied, disengaged, or excluded may have opted not to participate. As such, there may be underrepresentation of the most vulnerable voices within the early-career engineering population.

Thirdly, the study focused exclusively on the South African context, where unique socio-economic and historical factors, particularly those related to race, transformation, and institutional inequality, play a central role in shaping career experiences. While this context-specific focus is a strength, it may limit the transferability of findings to other national or regional settings without similar socio-political dynamics.

Fourth, although the study captured retrospective accounts of post-GDP career development, it relied on self-reported data**,** which is subject to recall bias, perception distortion, or social desirability effects. Participants' narratives were shaped by their subjective interpretations of events and may not fully capture the perspectives of employers, mentors, or organisational leaders.

Lastly, the research focused on experiences during and after the COVID-19 pandemic, which had a profound impact on the engineering labour market. While this provided a unique lens for examining disruption and adaptation, it also means that some findings may be time-sensitive or reflective of a particular historical moment. Further research is needed to determine whether the patterns observed continue to hold in post-pandemic conditions.

Despite these limitations, the study offers robust, credible, and contextually grounded insights that contribute meaningfully to both academic and professional discourses on career development in

engineering. The limitations also point to fruitful directions for future inquiry, as discussed in the following section.

6.8 Suggestions for Future Research

Building on the insights and limitations of this study, several opportunities emerge for future research that could further advance understanding of early career development in engineering, particularly in post-GDP contexts.

6.8.1 Longitudinal Studies on Career Trajectories

This study captured a snapshot of participants' experiences at a particular point in their early careers. Future research could adopt a longitudinal design, following engineers over time to examine how their career goals, self-efficacy, and outcome expectations evolve over five to ten years post-GDP. Such studies would provide a more dynamic understanding of career progression, identity development, and professional resilience.

6.8.2 Organisational and Managerial Perspectives

This study deliberately delimited its scope to focus exclusively on the lived experiences of early-career engineers, providing a detailed understanding of their challenges and needs in the post-GDP phase. While this insider perspective offers valuable insights, it does not capture the viewpoints of organisational decision-makers who shape talent development policies and practices. Future research should therefore incorporate the perspectives of line managers, HR professionals, and senior technical leaders to triangulate and enrich the findings presented here. Exploring how these key stakeholders perceive mentorship, transformation, and career progression could reveal critical misalignments or synergies between institutional frameworks and employee experiences. Such multi-perspective analysis would contribute to a more comprehensive understanding of the enablers and barriers to effective post-GDP support within engineering organisations.

6.8.3 Comparative Studies Across Sectors or Regions

Given the sectoral variation observed in this study, where participants employed across diverse industries such as manufacturing, mining, FMCG, petrochemical, research, telecommunications, and energy reported differing post-GDP experiences, future research could explore these differences in greater depth. The study found that engineers working in sectors like mining and petrochemicals often faced more structured and formalised post-GDP development programmes, while those in

FMCG or research sectors reported more informal and less consistent support. These sector-specific variations influenced access to mentorship, career progression clarity, and exposure to developmental opportunities, which were clearly reflected in the results. Comparative case studies investigating how organisational culture, industry norms, and resource availability affect career development across these varied sectors could provide a nuanced understanding of the contextual factors shaping early career trajectories post-GDP.

6.8.4 Intersectional Analysis of Underrepresented Groups

Although this study addressed issues of race, gender, and socio-economic background, more focused research on the intersectional experiences of Black women engineers, first-generation graduates, or engineers with disabilities is warranted. These groups may face unique barriers or developmental pathways that are not yet fully captured in the literature.

6.8.5 Evaluation of Post-GDP Interventions

As organisations begin to implement structured post-GDP interventions, future research could evaluate the effectiveness of these initiatives. For example, studies could assess whether mentorship programmes, leadership pipelines, or rotational assignments actually improve self-efficacy, retention, or progression. Rigorous evaluations using mixed methods would generate evidence to inform best practice in talent development.

6.8.6 SCCT in Global South Engineering Contexts

Finally, future research could further test and adapt SCCT in Global South contexts. There is a need to expand SCCT by incorporating structural inequality, policy environments, and identity-based exclusions that shape career outcomes in settings like South Africa. Cross-cultural comparative studies could contribute to refining the theory and making it more globally responsive.

By pursuing these lines of inquiry, future researchers can build on the foundation established by this study to deepen understanding of engineering career development and contribute to more equitable and supportive systems for early career professionals.

6.9 Conclusion of the study

This study set out to explore the post-GDP career development experiences of early career engineers in South Africa, applying SCCT to understand the dynamic interplay between individual agency,

organisational support, and broader contextual forces. Through qualitative analysis of 25 narratives across race, gender, and sectoral lines, the research uncovered how career outcomes are shaped, and often reshaped, by learning experiences, identity-based challenges, and structural constraints.

The findings revealed that while GDPs provide a foundational launchpad for engineering careers, their long-term impact depends heavily on what follows: the presence or absence of sustained mentorship, clear advancement pathways, inclusive workplace cultures, and enabling conditions for self-efficacy and goal pursuit. This study affirmed the central constructs of SCCT while extending its explanatory power by demonstrating that, in the Global South context, post-colonial inequalities, economic instability, and institutional exclusion influence early career trajectories as much as personal confidence and aspirations.

Career progression, therefore, is not simply a function of individual motivation or talent but is shaped by intersectional experiences situated within systems that either amplify or constrain potential. Participants from marginalised backgrounds often needed to demonstrate resilience and adaptive agency in the face of limited support, while those in more enabling environments benefited from structured guidance, recognition, and growth.

The study contributes theoretically by contextualising SCCT within a South African engineering landscape marked by transformation imperatives, persistent inequities, and institutional complexity. Empirically, it offers rich insights into the lived realities of young professionals who are often celebrated during GDPs but neglected in the critical years that follow. Practically, it provides policy- and practice-oriented recommendations for engineering employers, HR leaders, professional bodies, and universities to build more equitable, structured, and sustainable systems of post-GDP support.

Ultimately, the study reinforces the imperative that talent development must be continuous, inclusive, and intentional. If South Africa is to harness its full engineering potential and meet its transformation and development goals, the post-GDP phase must be recognised not as an afterthought but as a strategic priority. In fulfilling the fifth and final research objective, to formulate actionable recommendations supporting early career engineers after GDP participation, this study has drawn directly from empirical findings to propose evidence-informed, context-sensitive strategies aimed at improving post-GDP developmental frameworks, addressing systemic inequities, and enhancing support during this pivotal career stage. These recommendations, targeting employers, HR practitioners, universities, and policy-makers, offer a blueprint for more equitable, sustainable, and impactful post-GDP career development within South Africa’s engineering sector.

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Appendices

Appendix A – Ethical Clearance

Rhodes University Human Research Ethics Committee
Main Admin Building, Drostdy Road, Makhanda, 6139, South Africa
PO Box 94, Makhanda, 6140, South Africa
t: +27 (0) 46 603 7314
e: ethics-committee@ru.ac.za
https://www.ru.ac.za/researchgateway/ethics/
NHREC Registration number: RC-241114-045

3 September 2024

Ms Sibongile Magwagwa, ,

Rhodes Business School

Email: g22M9268@campus.ru.ac.za

Review Reference: 2024-8034-9039

Dear Ms Sibongile Magwagwa

Re: Engineering graduates' experience of career progression after participating in graduate development programmes

Researcher: Ms Sibongile Magwagwa

Supervisor(s): Prof Noel James Pearse

This letter confirms that the above research proposal has been reviewed by the Rhodes University Human Research Ethics Committee (RU-HREC) and **PROVISIONALLY APPROVED PENDING GATEKEEPER PERMISSION**.

Gatekeeper permission is required from: Ms Refilwe Buthelezi, President, Engineering Council of South Africa.

Once the Gatekeeper permission letter/s has been received please forward it to the Ethics Coordinator, to finalise your ethics approval.

If your study also involves participants who do not need gatekeeper permission because they are participating in their individual capacity, and you would like to commence data collection with these participants, you may apply to the committee for Partial Approval to do so. Email your request to ethics-committee@ru.ac.za.

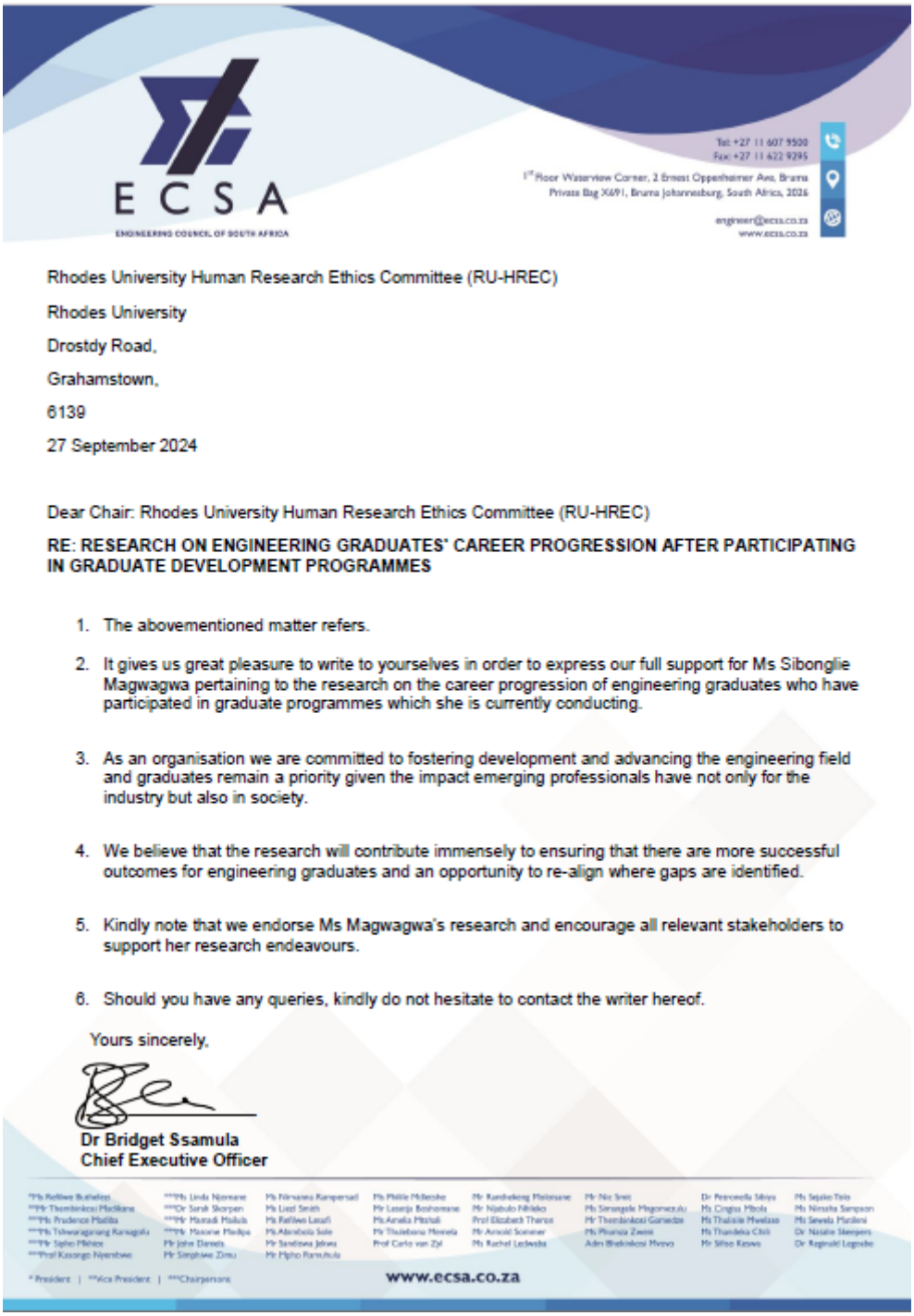
Sincerely,

Janet Hayward

Dr Janet Hayward

Chair: Rhodes University Human Research Ethics Committee (RU-HREC)

Appendix B – Gatekeeper Access Letter: Engineering Council of South Africa



ECSA
ENGINEERING COUNCIL OF SOUTH AFRICA

Tel: +27 11 607 9500
Fax: +27 11 622 9295
1st Floor Waterview Corner, 2 Ernest Oppenheimer Ave, Bruma
Private Bag X691, Bruma Johannesburg, South Africa, 2026
engineer@ecsa.co.za
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Rhodes University Human Research Ethics Committee (RU-HREC)

Rhodes University

Drostdy Road,

Grahamstown,

6139

27 September 2024

Dear Chair: Rhodes University Human Research Ethics Committee (RU-HREC)

RE: RESEARCH ON ENGINEERING GRADUATES' CAREER PROGRESSION AFTER PARTICIPATING IN GRADUATE DEVELOPMENT PROGRAMMES

1. The abovementioned matter refers.
2. It gives us great pleasure to write to yourselves in order to express our full support for Ms Sibonglie Magwagwa pertaining to the research on the career progression of engineering graduates who have participated in graduate programmes which she is currently conducting.
3. As an organisation we are committed to fostering development and advancing the engineering field and graduates remain a priority given the impact emerging professionals have not only for the industry but also in society.
4. We believe that the research will contribute immensely to ensuring that there are more successful outcomes for engineering graduates and an opportunity to re-align where gaps are identified.
5. Kindly note that we endorse Ms Magwagwa's research and encourage all relevant stakeholders to support her research endeavours.
6. Should you have any queries, kindly do not hesitate to contact the writer hereof.

Yours sincerely,

Dr Bridget Ssamula
Chief Executive Officer

Appendix C – Participant Invitation Letter

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PARTICIPANT INVITATION LETTER

Project Title: Engineering Graduates' Experience of Career Progression After Participating in Graduate Development Programmes

Summary

Ms Sibongile Magwagwa from the Rhodes Business School, Rhodes University has received ethical clearance [2024-8034-9039] to conduct a study on Engineering Graduates' Experience of Career Progression After Participating in Graduate Development Programmes

Benefit to participants

1. Engaging in this research will allow you to reflect on your career journey, helping you gain deeper insights into your own career progression, challenges, and achievements. This process of reflection may lead to greater self-awareness and personal development.
2. You will contribute to a growing body of knowledge about the effectiveness of Graduate Development Programmes (GDPs) and their impact on early career engineers. This may help improve future programmes and benefit new graduates entering the engineering field.
3. The insights you share can help shape the design and implementation of future GDPs. Your experience might influence policies within companies, educational institutions, or government bodies that sponsor or support such programmes.

Your participation

Participation is voluntary and all responses will be kept strictly confidential. You may withdraw from the research study at any stage.

7. You will be invited for an interview. This interview will delve deeper into specific aspects of your career experiences after the GDP, providing an opportunity to share more in- depth reflections.
8. The interview will last approximately 90 minutes and can be conducted either in person or virtually, depending on your preference.
9. Before participating, you will be required to provide informed consent, acknowledging your understanding of the study's purpose, what is required of you, and your right to withdraw at any point.

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How do you become a participant

If you wish to participate in the study, you may reply on the email address below:

sibongilem@uj.ac.za

A separate consent form will be provided to you and once you have signed the consent form you will be a participant in the study.

If you require further information, please contact Ms Sibongile Magwagwa or the Rhodes University Human Research Ethics Committee (details below).

Rhodes University, Research Office, Ethical
Review Ethics Coordinator: ethics-
commitee@ru.ac.za
t: +27 (0) 46 603 7314
Room 204, Main Admin Building, Drostdy Road, Makhanda,
6139

Appendix D – Informed Consent

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PARTICIPANT INFORMED CONSENT

INFORMED CONSENT DECLARATION

(Participant)

Project Title: Engineering Graduates' Experience of Career Progression After Participating in Graduate Development Programmes.

Sibongile Magwagwa from the Rhodes Business School, Rhodes University has requested my permission to participate in the above-mentioned research project.

The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

4. The purpose of the research project is to investigate the lived experiences of the career progression of engineering graduates of Graduate Development Programmes with a focus on early career engineers

5. The objectives of this research are to:
   5.1. Analyse the career progression experiences of graduates since they completed their GDPs, including the impact of COVID-19 and its associated lockdowns.
   5.2. Explore the role of self-efficacy, goal-setting, and social support in helping graduates to develop new skills and competencies required as early career engineers.
   5.3. Explore the level of support the graduates of GDPs have received in their careers since the completion of the GDP.
   5.4. Formulate recommendations on how early career engineers can be supported after GDP participation.

6. The Rhodes University has given ethical clearance to this research project and I have seen/ may request to see the clearance certificate.

7. By participating in this research project I will be contributing towards the advancement of career development literature from the perspective of graduates. Providing the researcher with my personal experiences will provide a unique contribution to existing literature.

8. I will participate in the project by answering questions and discussing my own experiences of career progression after completing a graduate development programme.

9. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences.

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10. I will not be compensated for participating in the research.

11. There may be risks associated with my participation in the project. I am aware that

1.1. the following risks are associated with my participation:

1.1.1. I may disclose the names of the organisations wherein I was employed as a graduate trainee.

1.1.2. Personal or professional information shared during the study could be inadvertently disclosed. This could include opinions about my employer, experiences with colleagues, or details about my career progression that I may prefer to keep private.

1.1.3. Reflecting on and discussing personal experiences, especially negative ones, could cause me emotional distress. I may have to recall challenging periods, setbacks, or disappointments in my career, which could be upsetting.

1.1.4. I may disclose medical information of myself and others in as far as Covid-19 is concerned when deliberating on its effects during my participation in a graduate development programme.

1.2. The following steps have been taken to prevent the risks:

1.2.1. the researcher will ensure anonymity and security of data at all times during the research.

1.2.2. All names and information of the organisations discussed will be kept confidential

1.2.3. I will also have the opportunity to go through the transcripts, and indicate if I would prefer for something not to be used in the research.

1.2.4. If I feel uncomfortable at any time during the interview, I may ask for a pause and proceed with the interview at a later opportunity.

2. The researcher intends publishing the research results in the form of a thesis, conference proceedings and possible journal articles. However, confidentiality and anonymity of records will be maintained and that my name and identity will not be revealed to anyone who has not been involved in the conduct of the research. I understand that my details such as names, surnames, business names as well as any other type of detail that might reveal my identity, will be replaced with pseudonyms to remain anonymous.

3. I will receive feedback in the form of a copy of the thesis that results from the study.

4. I am aware that the interview would be recorded.

5. Any further questions that I might have concerning the research or my participation will be answered by Sibongile Magwagwa, cell number 076 271 4341, telephone number 011 559 2826, email address: smagwagwa@gmail.com. Alternatively, I may contact Ms Magwagwa's academic supervisor, Professor Noel Pearse on telephone number 046 603 8963/8617; email address: N.Pearse@ru.ac.za.

6. By signing this informed consent declaration, I am not waiving any legal claims, rights or remedies.

7. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

8. Request to take pictures, video and voice recording for this study would need my approval.

9. I may confirm approval of the ethics application pertaining to this research with the Rhodes University using ethics application number 2024-8034-8996 as reference.

I, …….. have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

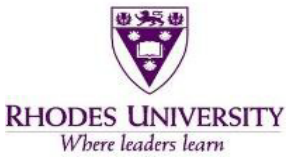
I have not been pressurised in any way and I voluntarily agree to participate in the above- mentioned project.

……. ……. ……

Participants signature **Witness** **Date**

Rhodes University, Research Office, Ethics
Ethics Coordinator: ethics-commitee@ru.ac.za t: +27 (0) 46 603 7727
f: +27 (0) 86 616 7707
Room 220, Main Admin Building, Drostdy Road, Grahamstown, 6139

Appendix E – Interview Guide



Interview Guide

Engineering graduates' experience of career progression after participating in graduate development programmes

Thank you for participating in this interview. It is anticipated that the interview will take approximately 90 minutes.

I am doing this research to explore the career progression of early career engineers who completed their participation in Graduate Development Programmes during COVID-19, through the lens of Social Cognitive Career Theory.

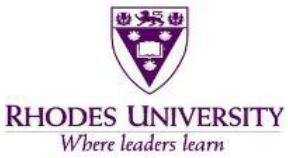
This research will explore incidences that relate to the five objectives, which are to:

1. Conduct a systematic review of the SCCT theoretical framework to identify research gaps to be addressed in this study.
2. Analyse the career progression experiences of graduates since they completed their GDPs, including the impact of COVID-19 and its associated lockdowns.
3. Explore the role of self-efficacy, goal-setting, and social support in helping graduates to develop new skills and competencies required as early career engineers.
4. Explore the level of support the graduates of GDPs have received in their careers since the completion of the GDP.
5. Formulate recommendations on how early career engineers can be supported after GDP participation.

Your input will add to the advancement of career development literature from the perspective of graduates in the South African context with its dual emphasis on talent development while promoting redress legislation. You will receive a copy of this interview schedule upon request.

Your answers and comments will be kept confidential. Nothing you say will then be identified with you personally, to ensure anonymity. Your signature on the consent form indicates your

consent for this interview. With your permission, this interview will be recorded only to ensure completeness and accuracy. You also have the right to withdraw from the interview at any time.



May we continue with the interview?

The research method for this research is qualitative with the use of semi-structured interview questions. This means that the interview will seek to gather in-depth qualitative data that provides insights into personal experiences, challenges, and coping strategies related to the career progression of early career engineers who are graduates of graduate development programmes and the impact of COVID-19 on their career trajectories.

Do you have any questions before we begin?

Interview Guide Questions

Please answer the questions as openly and freely as possible. There are no right or wrong answer, as these are your experiences that you are sharing with me. If you find a question too intrusive, please indicate that you want to skip that question.

A: Personal Background Questions:

12. What is your date of birth? / What age category do you belong to? Twenties, Thirties, Forties, Fifties, Sixties, Seventies? Or other?
13. Do you want to be classified as male, female, or non-binary?
14. What is your nationality?
    - Are you South African or a South African Resident?
15. What is your racial classification?

    4.1 Are you Black African, Colored, Indian or White?

2 What is the highest level of education that you completed?

2.1. What field of engineering did you study?

3 In which sector are you employed in?

B: The Role of Graduate Development Programmes in shaping Self-Efficacy

1. Can you describe how your participation in the Graduate Development Programme influenced your confidence in performing your job duties?

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6. How confident were you in your engineering skills when you completed your graduate development program?
7. In what ways did mentorship or support received during the Graduate Development Programme affect your self-efficacy in your engineering role?
8. Were there specific accomplishments or feedback from supervisors or colleagues that boosted your confidence in your engineering skills?
9. What factors or experiences contributed most to the development of your self-efficacy as an early career engineer?

C: The Impact of COVID-19 on Self-Efficacy

10. How did the shift to remote work or changes in your work environment during the COVID-19 pandemic affect your confidence in your ability to perform your job effectively?
11. Can you describe any specific challenges you faced during the pandemic that impacted your self-efficacy, and how you managed to overcome them?
12. How did the availability (or lack) of support systems and resources during the pandemic influence your belief in your ability to succeed in your professional role?
13. In what ways did opportunities for learning and professional development during the COVID-19 pandemic impact your self-efficacy?
14. How did the COVID-19 pandemic affect your mental health and well-being, and what impact did this have on your self-efficacy in your professional life?

D: The Impact of Self-Efficacy on Career Progression

1. How confident are you in your technical skills and knowledge as an engineer? How does this confidence impact your career choices?
2. How has your confidence in your skills and abilities affected your willingness to seek out and take on leadership roles or advanced responsibilities in your career?
3. In your career journey, how has your self-efficacy evolved or changed over time, if at all?

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4. Can you provide specific examples of how your self-efficacy has influenced your career choices and decision-making?
5. Can you provide an overview of your career progression journey since completing your graduate development program? What positions have you held and what responsibilities have you taken on as you've progressed in your career?

E: The Role of Graduate Development Programmes on Goal Setting

1. What were your career goals when you started your graduate development program, and how have they evolved over time?
2. How did your participation in the Graduate Development Programme influence the initial career goals you set for yourself at the start of your professional journey?
3. In what ways did the mentorship, training, or resources provided by the Graduate Development Programme assist you in setting realistic and achievable career goals?
4. How did the experiences and feedback received during the Graduate Development Programme impact your ability to adjust or realign your career goals as you progressed?
5. Were there new skills or knowledge areas you prioritised to achieve your goals?

F: The Impact of COVID-19 on Goal Setting

1. How did the onset of the COVID-19 pandemic affect the career goals you had set prior to its occurrence?
2. In what ways did the pandemic influence your short-term and long-term career goals differently? Were there specific goals you had to prioritise or defer?
3. How did you adjust your career goals in response to the pandemic's challenges and uncertainties?
4. How did your pursuit of career goals influence your learning and skill development during the pandemic?
5. What role did available support systems and resources during the pandemic play in helping you reassess and set new career goals?

G: The Impact of Goal Setting on Career Progression

1. How has setting specific career goals helped you achieve important milestones in your career progression?
2. Can you describe how having clear goals has influenced your motivation and drive to advance in your career?
3. In what ways has goal setting provided clarity and focus, helping you to prioritise tasks and make decisions that enhance your career progression?
4. How has your ability to set and adjust goals impacted your resilience and adaptability in navigating career challenges and opportunities?
5. How have your long-term career goals shaped your actions and decisions, and what role have they played in your overall career development and advancement?

H: The Role of Graduate Development Programmes on Career Outcome Expectations

1. How did the Graduate Development Programme shape your expectations regarding career progression and potential future roles within your field?
2. In what ways did the Graduate Development Programme help you establish realistic and attainable career goals based on industry standards and opportunities?
3. How has your participation in the Graduate Development Programme influenced your perception of its value in meeting your career outcome expectations?
4. How has the Graduate Development Programme influenced your job satisfaction and expectations for career growth and development?
5. Can you discuss how the insights and experiences gained from the Graduate Development Programme have informed your expectations about your career trajectory and future opportunities?

I: The Impact of COVID-19 on Career Outcome Expectations

1. How has the COVID-19 pandemic influenced your expectations regarding your career progression and future job opportunities?
2. Have your career outcome expectations changed in response to shifts in your industry or sector because of the pandemic? If so, how?

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3. How has the prevalence of remote work during the pandemic affected your expectations regarding job location, work-life balance, and overall career trajectory?
4. Have your career outcome expectations shifted in terms of what you prioritise in a job or employer post-pandemic? If yes, what factors have influenced this shift?
5. How has the unpredictability of the job market during the pandemic influenced your expectations regarding career stability, growth opportunities, and adaptability to changing industry trends?

J: The Impact of Career Outcome Expectations on Career Progression

1. How have your expectations regarding career outcomes influenced the trajectory of your career progression thus far?
2. Can you describe how having clear expectations for career outcomes has motivated you to pursue specific career paths or opportunities that align with those expectations?
3. How do you incorporate your career outcome expectations into your decision-making process when planning for your career advancement or professional development?
4. How do you navigate unexpected changes or setbacks in your career progression while still striving to meet your career outcome expectations?
5. Have your career outcome expectations evolved over time, and if so, how have you adjusted your career progression strategies to align with these changing expectations?

Thank you for this interview. The information you provided will be very helpful in providing a holistic understanding of the career trajectories of early career engineers during the unique challenges posed by COVID-19.

Appendix F – Coding Manual

No.	Label	Type	Definition	Description of Occurrence	Qualifications and Exclusions	Reference
1	Self-Efficacy	Deductive	Confidence in one's ability to succeed in professional tasks and navigate career development.	Captures how participants describe growing confidence through learning, successful performance, mentoring, or feedback. Often linked to post-GDP experiences and personal agency.	Qualification: Mentions of growing confidence or belief in one's skills. Exclusion: No mention of confidence or ability to perform.	Brown & Lent, 2019; Bandura, 1994
2	Career Outcome Expectations	Deductive	Beliefs about likely results of career actions (e.g., success, progression, stability).	Refers to how participants talk about what they expect from their career based on contextual or organisational experiences; including	Qualification: Refers to positive or negative expectations about future roles or career success. Exclusion: General job experiences without future-oriented expectations.	Lent, Brown & Hackett, 2000

				pessimism, optimism, or shifting perspectives.		
3	Goal Setting	Deductive	The process of defining structured career development objectives and planning actions to achieve them.	This code captures how participants set or refine career goals through deliberate strategies like development plans or reviews. It reflects internal motivation and external influences, linking closely to self-efficacy, outcome expectations, and personal agency.	Qualification: Mentions of setting or adjusting goals using structured tools or clear strategies. Exclusion: Vague goals without structure or planning.	Lent, Brown & Hackett, 1994; Clarke & Scurry, 2020
4.	External disruptions	Deductive	External events like COVID-19, economic instability, and government policy changes that affect early-career	This code captures how external factors like COVID-19, economic shifts, and policy changes disrupted career opportunities, causing delays, reduced hiring,	Qualification: Mentions of career delays or changes due to COVID-19, government policies, or economic shifts.	Cao & Hamori, 2022

			engineers' career development.	and altered training. Participants felt uncertain or frustrated, often adjusting their career paths and expectations in response.	Exclusion: Challenges unrelated to broader external disruptions.	
5	Personal Characteristics	Deductive	Individual identity attributes such as race, gender, age, language, and socioeconomic background that shape career experiences.	This code captures how participants' unique personal identities affect their confidence, access to opportunities, and perceptions of fairness. It includes how these characteristics shape their interpretation of career challenges and access to support within the workplace.	Qualifications: Mentions of identity-related influences on experiences or opportunities. Exclusions: No reference to individual demographic characteristics.	Byars-Winston & Rogers, 2019.
6	Organisational Influences	Deductive	Structures, cultures, and practices within the workplace that	This code includes factors such as mentorship structures,	Qualifications: Refers to organisational culture, systems, or decision-	Lent, Brown & Hackett, 2000

			impact career development.	HR processes, access to training, and management styles. It reflects how organisational systems either support or constrain participants' career progression, particularly in relation to their identity and role within the company.	making affecting career progression. Exclusions: Experiences unrelated to organisational policies or structure.	
7	Post-GDP Learning Experiences	Deductive	Workplace learning that occurs after the formal GDP period, including mentorship, coaching, training, and role transitions.	Reflects ongoing development and how it strengthens competence, adaptability, and career orientation.	Qualifications: Includes mention of continued learning or support after the GDP. Exclusions: Training or learning that occurred only during GDP.	Mirabelli, Barlow, Sanders, Ko, Jensen & Cross, 2023; Craps, Pinxten, Knipprath & Langie, 2022.
8	Career Actions	Deductive	Concrete career behaviours such as applying for	Focuses on proactive steps participants take to	Qualification: Mentions specific career moves or	Lent & Brown, 2019

			promotions, upskilling, or shifting roles.	progress - whether linear, lateral, or into leadership	professional development efforts. Exclusions: Passive roles or career movement unrelated to deliberate action.	
9	Career Progression Pathways	Deductive	The different routes through which early-career engineers advance in their professions, including linear advancement, lateral moves, and transitions into leadership or specialised roles.	This code captures how participants describe their career paths after the GDP, including promotions, lateral moves, or shifts into technical or leadership roles. It reflects how they navigate opportunities based on performance, goals, and organisational context.	Qualification: Mentions of actual career moves after GDP, such as promotions, lateral shifts, or leadership roles. Exclusion: General ambitions without specific post-GDP career outcomes.	Craps, Pinxten, Knipprath & Langie, 2021