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Simelane, Phumelele Nolwazi Carol

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Skilled emigration from the South African petrochemicals sector: Determinants, retention strategies, and implications.

By

Ms. Phumelele Nolwazi Carol Simelane

(738615)

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University of the Witwatersrand

Supervisor: Prof Nedson Pophiwa

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ABSTRACT

This thesis examines the emigration of skilled personnel from South Africa's petrochemical sector, with particular focus on engineers, the determinants of their departure, and potential retention strategies. The study is situated within the broader challenge of brain drain, which threatens both South Africa's economic stability and the long-term sustainability of strategic industries. The central argument is that current policies and strategies are insufficient to retain highly skilled professionals in the petrochemical sector. Through a mixed-methods approach, combining qualitative interviews with industry stakeholders and quantitative surveys of professionals, the research explores both internal and external drivers of emigration. Findings indicate that skilled workers emigrate not only for economic reasons but also due to socio-political instability, limited career advancement, and unfavourable working conditions. This emigration weakens national development goals, as industries like petrochemicals rely on technical expertise for innovation and growth. The study reveals that economic factors, job dissatisfaction, and limited career opportunities are the primary drivers of emigration. Moreover, skilled professionals often integrate successfully into host countries, reducing the likelihood of return. Political and economic instability in South Africa further accelerates this trend. These findings underscore the urgent need for the state and industry to rethink policies and implement more effective strategies to retain talent. Recommendations include improving working conditions, offering competitive remuneration, and creating clearer career progression pathways. Stronger collaboration between educational institutions and the petrochemical industry is also advocated to build a sustainable skills pipeline. Additionally, policy revisions in emigration management are highlighted as critical for curbing brain drain. The thesis further situates the issue within global debates on brain drain and brain gain, and evaluates the implications of skilled emigration for workforce dynamics, technological advancement, and knowledge transfer. It concludes that addressing the emigration of skilled personnel requires a multifaceted approach involving government, private sector, and community support. By implementing targeted retention and attraction initiatives, South Africa can foster talent retention, enhance the competitiveness of its petrochemical sector, and contribute to broader national development. Ultimately, the study aims to enrich the discourse on skilled migration in developing economies by offering evidence-based insights and pragmatic

strategies to strengthen resilience and sustainability in South Africa’s petrochemical industry.

DEDICATION

Dedication

I dedicate this work to my beloved late parents: my father, **Mr. Vincent Simelane** (11 September 2003), and my mother, **Mrs. Winnifred Susan Simelane** (20 September 2019).

Baba, the PhD is finally done. Here is the *red gown* you always wanted, not the black one like every “Tom, Dick, and Harry.” That joke always made me laugh, knowing how much work and sacrifice any qualification demands. Your wisdom and wit continue to inspire me, giving me renewed hope and strength to soldier on.

Mother, you finally have a doctor from your womb. And yes, I am not a surgeon, but I will proudly carry the names you gave me: *Nolwazi*, “mother of knowledge”, and *Phumelele*, “the successful one”.

This work is also for my dearest daughter, **Ms. Wandile Mpontshane**. You pushed me beyond my limits, even when I tried to have a little fun, with your stern reminder: “I hope the PhD is on point.”

To my partner, **Keith Gordon (Kiki) -** I am speechless at your support and understanding. Thank you for everything.

To all the participants in this study: your contributions have enriched a sector full of complexity, dynamism, and boundless opportunities for research.

And to God the finisher: I am alive only because of Your grace and mercy.

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Finally, I acknowledge the financial support provided by the National Agricultural Marketing Council internal bursary scheme in collaboration with the Agricultural Sector Education and Training Authority (AgriSeta), which made this research possible.

To everyone who has contributed, directly or indirectly, to this thesis, thank you for being an integral part of this academic accomplishment. Your involvement has made a lasting impact on my personal and professional growth. God bless you in abundance.

DECLARATION

I, Phumelele Nolwazi Carol Simelane, hereby and duly declare that the PhD thesis “Emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector.” is the outcome of my work under supervision, and it has not been submitted before for any degree or examination in any university or institution, and that all the sources I have utilised or quoted have been indicated and duly acknowledged by means of referencing.

Ms. Phumelele Nolwazi Carol Simelane

Signature:

Date:

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ABBREVIATIONS

AMEF	African Mineral and Energy Forum
ATR	Annual Training Report
ATMACA:	An Examination of Academically Successful Secondary School Students
CAIA	South African Chemical and Allied Industries Association
CDE	The Centre of Development & Enterprise
CEO	Chief Executive Officer
CEPPWAWU	Chemical, Energy, Paper, Printing, Wood and Allied Workers Union
CHIETA	Chemicals Industries Education and Training Authority
DHA	Department of Home Affairs
ECSA	Engineering Council of South Africa
GDP	Gross Domestic Product
GETI	Global Energy Talent Index
IEA	International Energy Agency
IDC	Industrial Development Corporation of South Africa
IOM	International Organisation for Migration
ILO	International Labour Organisation
IIoT	Industrial Internet of Things
NIDS	National Income Dynamics Study
UNIDO	United Nations Industrial Development Organisation.
OECD	Organisation for Economic Co-operation and Development.
NPEA	National Petroleum Employees' Association
MIS	Management Information Systems
QLFS	Quarterly Labour Force Survey
RSA	Republic of South Africa
SAPIA	South African Petroleum Industries Association
SA	South Africa
SACWU	South African Chemical Workers' Union

SGD	Sustainable Development Goals
SRF	Social Research Foundation
SETA	Sector Education & Training Authority
SD	Standard Deviation
SSP	Sector Skills Plan
Stats SA	Statistics South Africa
SAMP	Southern African Migration Project
STEM	Science and Technology, Engineering and Maths
USA	United States of America
UK	United Kingdom
UNESCO: The United Nations Educational, Scientific and Cultural Organisation	
UNCTAD	United Nations Conference on Trade and Development
WOESA	Women in Oil and Energy South Africa
WSP	Workplace Skills Plan
WHO	World Health Organisation
VOCS	Victims of Crime Survey

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1 Chapter 1: Introduction and background

1.1 Introduction

South Africa (SA) is currently experiencing a serious shortage of skilled workers, especially in engineering. This shortage has had an adverse effect on South Africa's socioeconomic growth and development Rasool & Botha, (2011). This skill shortage has been compounded by several additional challenges that are faced by the engineering field in South Africa. Some of these challenges include lack of ability to strengthen the engineering educational enterprise, lack of engineering innovation capabilities, lack of development of entrepreneurship and downright lack of public awareness and support for the engineering enterprise in the country ECSA (2020).

In recent years South Africa has faced the challenge of skilled professional emigration, particularly among engineers. The UNESCO Report (2021) highlighted that many experienced engineers are leaving South Africa for Europe, America, the Middle East, and Australia. The report gave a few reasons for the causes of the departure of engineering professionals from SA, some of which included improved employment prospects and stability. The report identified the shortage of skilled workers as one of South Africa's biggest risks, with a significant drain on critical skills. This situation is compounded by the insufficient production of technical graduates by local universities, which fail to meet the industry's demand for skilled professionals. Furthermore, Bhorat, Mayet & Visser (2021) suggested that engineering professionals are emigrating from SA due to economic, safety, and sociopolitical as well as personal reasons. Nationally, South Africa is experiencing a significant drain of skilled workers, with a notable impact on critical sectors like petrochemicals.

The emigration of experienced and professional engineers from SA has had some dreadful effects on the economic development of the country. For instance, Lawless (2020) reported that emigration of engineers is forcing SA to hire foreign engineers as one of the strategies to close the skills gap. However, hiring foreign engineers comes at a higher cost, thereby diminishing the local economic benefits. Similarly, Crush, Chikanda & Skinner (2019) have condemned the emigration of experienced and

professional engineers from SA, which they argued has resulted in delayed and poorly executed projects and is also demonstrated by crumbling infrastructure in water systems, roads, and energy networks. Furthermore, Crush, Chikanda & Skinner (2019) indicated that emigration of experienced professionals has led to depletion of institutional knowledge in SA, and this has had adverse effects on mentoring and skills transfer to the next generation of engineers.

Therefore, this study seeks to better understand the determinants and impact of emigration by South African professional engineers from the petrochemicals (chemicals and energy) sector. The aim is to understand the actual determinants associated with South African engineers leaving for work opportunities in other countries. In addition, the study seeks to understand the implications of human resources in implementing retention strategies within the sector. The contextual meaning of emigration in this study refers to the act of leaving a resident country or place of residence with the intent to permanently settle elsewhere. This is different from migration, which involves voluntary or involuntary movement of people within a country or across international borders due to several reasons such as natural disasters, conflicts, etc. Migration of people does not necessarily imply permanent change of residence.

The impetus for this study arises from a body of literature indicating that numerous sectors in South Africa are grappling with persistent skills shortages. Reports from various economic and labour studies highlight an increasing trend of *brain drain*, with highly skilled professionals emigrating to countries such as Australia, Canada, the United Kingdom, and New Zealand in search of better opportunities, career advancement, and improved quality of life. For instance, the health sector has experienced the migration of specialised medical practitioners, while the engineering and information technology sectors have seen a notable loss of experienced professionals to global markets. This combined challenge of talent scarcity and the outflow of critical skills forms the central theme of the study, reflecting a phenomenon that aligns with broader international patterns. The analysis focuses specifically on the period from 2010 to 2024, a timeframe during which the rate of skilled emigration and its impact on the South African labour market have become increasingly pronounced.

Furthermore, the study will explore if the petrochemicals sector has effective retention strategies to prevent personnel from leaving and its implications. There is also an interest in the concept of brain gain when skilled personnel return from the host country as to what mechanisms and strategies exist to integrate them back into the work environment and utilise the skills acquired. This study will outline the study background, problem statement, research questions, literature review and applicable methodology.

1.2 Background to the research study

In examining the emigration of skilled petrochemical engineers from South Africa, existing scholarly material reveals multifaceted causes and impacts of migration, positioning this research within a critical area of investigation concerning South Africa's economic and industrial sustainability.

South Africa's petrochemical industry is a cornerstone of its industrial base, contributing significantly to the national economy through employment, technological innovation, and export revenues. However, the sector faces a critical challenge: the emigration of skilled professionals. This outflow exacerbates the existing skills shortage, hindering the industry's capacity to innovate and compete globally. The South African government has recognised this issue, acknowledging the detrimental impact of skilled emigration on economic growth and development. In response, there have been calls for comprehensive policies to retain and attract skilled talent, emphasising the need for a strategic approach to human capital management in key sectors like petrochemicals.

This study aims to bridge gaps in the understanding of engineering-specific brain drain, an issue less explored than the emigration of medical professionals. Rasool & Botha, (2011). By examining the determinants influencing engineers' migration intentions, particularly those within the petrochemical sector, the study will contribute to both academic discourse and practical policy development on skills retention and brain drain mitigation strategies.

Globally, the petrochemical industry is undergoing significant transformations, driven by factors such as the shift towards sustainable energy sources, technological advancements, and economic fluctuations. These changes have led to a redistribution

of skilled labour, with professionals moving to regions offering better opportunities and working conditions. For instance, major oil companies are relocating specialised engineering and geologist jobs to countries like India to leverage lower labour costs and an expanding skilled workforce. Such trends highlight the global competition for skilled professionals in the petrochemical sector.

South Africa continues to face a significant shortage of engineering skills across all sectors of the economy including the petrochemical industry. This shortage is aggravated by the emigration of skilled professionals, which is posing a considerable threat to South Africa's built environment and industrial sectors (Development Policy Research Unit, (2022).

The issue of skilled emigration in South Africa is not new. Historically, factors such as political instability, economic challenges, and limited career advancement opportunities have driven skilled professionals abroad. Over time, this has led to a 'brain drain,' where the country loses its most talented individuals to more developed economies. Debates have centred around the causes of this emigration and the effectiveness of various retention strategies. While some argue that improving local conditions can stem the tide, others believe that global mobility is a natural outcome of a globalized economy.

The emigration trends of engineers from South Africa are particularly concerning as it has been revealed that mostly highly skilled engineers leave the country in droves, impacting the entire skills development value chain Facchini, Mayda & Mendola, (2019); Chetty, (2020). Furthermore, it has been shown that over the past 30 years, South Africa has lost significant professionals to emigration. The Southern African Migration Project (2023) showed that between 1989 and 2003, about 520,000 South African professionals emigrated. The above report further indicated that this emigration trend has been persistent with an approximately 9% annual increase in emigration rates. Additionally, it has been revealed that only a small fraction of professions return to South Africa, and many of these returnees are not engineers.

The petrochemical industry is integral to South Africa's economy, accounting for significant GDP contributions, employment, and foreign exchange earnings (National Planning Commission, 2012). Engineers within this sector play essential roles in

refining, optimising, and innovating production processes for fuel, plastics, and other petroleum-based products. However, as documented in the works of Shangase & Mbohwa (2020) and Lass & Steenkamp (2019), there has been a consistent trend of petrochemical industry engineers emigrating from South Africa too. This is exacerbating a critical skills shortage and impeding the industry's potential.

The Development Policy Research Unit (2022) conducted a study on the impact of international migration on South Africa's skills supply and demand, focusing more on mining and industrial sectors of the economy (it scantily referred to the petrochemical industry). The study revealed that considerable numbers of highly educated and skilled engineers in the mining and industrial sectors were emigrating from South Africa for better opportunities elsewhere abroad. It was also reported that this emigration was leaving a huge gap in the supply of engineers in the job market within the country (Siwela & Van der Bank, 2021). To counter this movement of engineers from South Africa, the government has crafted and implemented several policy interventions. These interventions from the South African government involved improving local working conditions, offering competitive salaries, and creating clear career progression pathways to retain skilled engineers (Barkhuizen et al., 2019). However, none of these strategies have produced desired outcomes, as the emigration of skilled engineers from South Africa is relentless and is now straining South Africa's technical capacity and economic development.

Academically, this topic is significant as it intersects various disciplines, including economics, human resource management, and industrial policy. Understanding the determinants of emigration and effective retention strategies can contribute to the broader field of labour mobility and human capital development. Practically, addressing this issue is crucial for ensuring the sustainability and competitiveness of South Africa's petrochemical sector. By developing targeted retention strategies, the industry can mitigate the adverse effects of skilled emigration, fostering a more resilient and innovative workforce.

1.3 Research Problem

South Africa is confronted with a grave emigration of skilled engineers, which has exacerbated critical skills shortages in key sectors such as energy, construction, and

petrochemicals (Facchini, Mayda, and Mendola, 2018). The skills deficit that has been created by emigration of engineers from South Africa is hindering the country's ability to implement large-scale infrastructure projects and is weakening its global competitiveness, requiring targeted retention strategies and policy interventions (Mbiyozo, 2018). The government of South Africa has responded by crafting and implementing several interventions to address talent drain through emigration such as competitive remuneration, career development programs, supportive work environments, and macro-level policy interventions Moses and Yu, (2019). Despite these interventions from both government and private sector, emigration of engineers is relentless Buwembo, (2017); Mattes and Mniki, (2019).

The South African petrochemical industry, a vital contributor to the nation's economy, is grappling with a significant outflow of skilled professionals. This trend is particularly concerning given the sector's reliance on (expertise for innovation, safety, and competitiveness. Factors such as political instability, economic uncertainty, and limited career advancement opportunities are prompting skilled individuals to seek employment abroad.

This emigration is not only depleting the talent pool but also affecting the industry's capacity to meet global standards and adapt to technological advancements. The Fuels Industry Association of South Africa has identified skills development as a strategic focus area, emphasising the need for industry transformation and the promotion of human resource development to ensure the sustainability of skills in the sector. They argue that in 2024 alone, over 10,000 individuals from this group are estimated to have left the country, adding to the cumulative total since 1985.

The persistent emigration of skilled professionals from South Africa’s petrochemical sector represents a critical threat to the country’s industrial development and human capital sustainability. As global demand for highly skilled engineers intensifies, South Africa faces the dual challenge of talent outflow and domestic skills scarcity, particularly in sectors vital to economic growth and energy security. This study aims to investigate the demographic profile, trends, and underlying determinants of emigration among professional engineers in the petrochemical industry. It further seeks to evaluate the long-term implications of this brain drain on sectoral performance and national development objectives while identifying strategic retention

measures that organisations and policymakers could adopt. The research is situated within broader debates on global skilled labour mobility, human capital theory, and national capacity building (Docquier & Rapoport, 2012; Meyer & Brown, 1999; World Bank, 2022). It responds to urgent calls to strengthen local retention frameworks, considering South Africa's skills exodus (HSRC,2021); Department of Higher Education and Training, (2020), offering evidence-based insights for reform and policy innovation.

Preliminary Data and Statistics

The 2025 Allianz Risk Barometer ranked the shortage of skilled workers among the top 10 risks for South African businesses, highlighting the critical need for effective retention strategies in relation to skilled worker shortage.

Petroleum, chemical, rubber, and plastic products accounted for 24.4% of South Africa's manufacturing output in 2024, underscoring the sector's economic significance. However, challenges such as higher input costs, a lack of readily available skills, and ongoing logistics bottlenecks have led to a 0.4% decline in total manufacturing production compared to 2023 in relation to the economic impact. A significant number of South Africans, particularly those aged between 25 and 40, are leaving the country. More than half of the nation's graduates have the potential to emigrate, indicating a substantial risk to the domestic talent pool.

Therefore, this now requires a renewed and thorough investigation to get to the bottom of the determinants and retention strategies of skilled personnel emigrating from South Africa, particularly from the petrochemical sector. The current study seeks to explore the factors influencing engineers' decisions to emigrate and to assess the effectiveness of existing retention strategies within the sector.

Research Gap and Contribution

While substantial research has investigated brain drain among medical professionals, limited scholarly attention has focused on engineers within the petrochemical sector, leaving a significant knowledge gap (Rasool & Botha, 2011; Brink, 2012). This study addresses this void by isolating the motivations and deterrents specific to South African petrochemical engineers and examining how existing retention strategies

could be adapted to better serve this demographic. Drawing on scholarly insights from the fields of migration studies and human capital management, the research aims to contribute a targeted analysis that will support the development of effective retention policies within South Africa's petrochemical sector. This investigation not only highlights key emigration factors but also explores innovative retention strategies that can mitigate the adverse impacts of brain drain, positioning South Africa to retain critical skills within this essential sector.

Despite significant research on brain drain, much of the literature focuses on medical professionals, often overlooking the emigration of engineers within specialised industries such as petrochemicals. Additionally, while various factors related to skill shortages in South Africa have been documented, there is limited empirical analysis on the specific determinants prompting engineers to emigrate from the petrochemical sector (CDE, 2010; (Rasool & Botha, 2011). By addressing this gap, this study aims to develop a nuanced understanding of the factors that drive engineers to seek opportunities abroad, as well as to identify retention strategies that can mitigate this trend.

This study will fill a significant gap in the literature by focusing on the emigration of engineers within the South African petrochemical sector. By identifying specific factors influencing engineers' migration decisions, the study will provide a foundation for more effective retention strategies. It will also highlight the broader implications of this brain drain, contributing to a deeper understanding of how emigration impacts South Africa's efforts to achieve sustainable economic growth and development. Finally, through a rigorous analysis grounded in push and pull migration theory, this research will present evidence-based recommendations for policy interventions, aiming to curb the brain drain and support South Africa's vision of a robust and competitive petrochemical industry.

In conclusion, the study of petrochemical engineer emigration from South Africa presents a vital opportunity to understand and counteract the detrimental effects of brain drain on the sector's sustainability and the nation's economy. By bridging this knowledge gap, this research aims to equip policymakers and industry leaders with evidence-based strategies to foster a supportive environment for engineers, ensuring that their expertise remains a local asset rather than an export.

1.4 Purpose Statement

The purpose of the study is to ascertain emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector. The focus is also on examining the current strategies employed by organisations in the sector and examining how these approaches address the broader economic, political, and social factors that influence skilled migration. By synthesising insights from notable scholars and leveraging quantitative data, the study intends to identify and recommend evidence-based solutions that mitigate talent loss, foster industry resilience, and promote sustainable development within South Africa's petrochemical landscape.

This work seeks to fill a critical gap in the literature by specifically addressing migration trends, barriers to retention, and policy needs within this key sector, thereby offering actionable insights to both policymakers and industry leaders. This version narrows the focus on skilled migration in the petrochemical sector while recognising specific gaps, notably in understanding the unique challenges of Black/African engineers. It positions the study to build on foundational work by Crush, Tevera, and others, clarifying the study's contribution to the field.

The thesis investigates the phenomenon of South African engineers migrating from the petrochemicals sector against the backdrop of recent economic and political shifts. Over the past twenty years, South Africa has experienced a significant loss of engineers, largely attributed to deteriorating economic and political conditions. This research aims to build upon the existing body of work by various scholars who have contributed to publications, reports, and journals analysing the factors influencing engineer migration in South Africa.

Tengeh (2012) has made significant contributions to the discourse on skilled labour migration through his publication *Skilled labour migration from South Africa* in the *International Journal of Economics and Research*. In addition, Tevera, a recognised scholar in migration studies, has collaborated extensively with Crush on several works examining the patterns, drivers, and implications of skilled migration from South Africa (Crush & Tevera, 2010; Tevera & Crush, 2019).

Peberdy (2006) has contributed to the literature on labour migration and development through her analysis of the globalisation of skills, with a particular focus on African

engineers in the international labour market. This is exemplified in her article *'The globalisation of skills: African engineers in the international labour market',* published in *Geoforum*. Similarly, Fourie (2008), whose research interests include migration and labour markets, has examined the economic implications of migrant remittances in South Africa. His study, *Migrant remittances in South Africa: A case study of the Eastern Cape province*, published in the *South African Journal of Economics*, offers valuable insights into the role of remittances in regional economic development. Moreover, Richard Black, a professor of human geography specialising in migration studies, has shed light on irregular migration patterns in southern Africa, which contributes to the broader understanding of migration dynamics on the continent.

Despite the valuable contributions of these scholars, there remains a gap in the literature concerning the determinants of emigration and retention strategies within the South African petrochemicals sector, particularly regarding the migration of African/Black engineers. This research aims to address this gap by examining the unique challenges and opportunities within the sector.

Chikanda's (2005) research on the migration of health professionals from Zimbabwe highlights the profound implications of skilled migration for healthcare systems and broader sustainable development. His findings indicate that the loss of qualified personnel exacerbates the challenges faced by already fragile health systems, undermining efforts to improve public health outcomes. More broadly, this outflow of skills poses a significant obstacle to achieving sustainable economic growth and meeting development targets such as the Millennium Development Goals across the African continent.

The shortage of engineering skills represents a critical challenge to the sustainability of South Africa's built environment sector. This scarcity constrains the government's capacity to drive the economic growth necessary for development and poverty eradication. A study conducted by the Construction Industry Development Board (CIDB) (2007) employed a quantitative research approach using a structured questionnaire administered to construction professionals in the Gauteng province, including architects, surveyors, engineers, construction managers, and project

managers. The analysis, which utilised mean item scores (MIS) and standard deviation (SD), revealed several strategies to mitigate the engineering skills gap. These include promoting science, technology, engineering, and mathematics (STEM) subjects at the high school level, strengthening career counselling in schools, and expanding opportunities for on-the-job training. Such measures are seen as vital to restoring the skills pipeline within the built environment sector (CIDB, 2007).

Emigration and migration cannot be fully understood without placing them within the broader context of global power and capital asymmetries. Migration, as a global phenomenon, is deeply influenced by structural inequalities between the Global North and Global South, shaped by historical exploitation, colonial legacies, and economic policies that continue to create disparities in opportunities, wealth, and security across different regions. In this sense, migration reflects the inequities embedded within a capitalist world system that privileges some while systematically disadvantaging others, contributing to an ongoing cycle of inequality and dependence.

Formulation of hypotheses of the study

A total of six hypotheses were formulated for the study to test the significance of pull and push factors in driving professionals to emigrate from South Africa. The hypotheses are as follows.

Hypothesis statement 1

(H0): Economic factors are **NOT** significant push factors for emigration of engineers from South Africa.

(H1): Economic factors are significant push factors for emigration of engineers from South Africa.

Hypothesis statement 2

(H0): Social factors are **NOT** significant push factors for emigration of engineers from South Africa.

(H2): Social factors are significant push factors for emigration of engineers from South Africa.

Statement of Hypothesis 3

(H0): Political factors are **NOT** significant push factors for emigration of engineers from South Africa.

(H3): Political factors are significant push factors for emigration of engineers from South Africa.

Statement of Hypothesis 4

(H0): Economic factors are **NOT** significant pull factors encouraging emigration of engineers from South Africa.

(H4): Economic factors are significant pull factors encouraging emigration of engineers from South Africa.

Hypothesis statement 5

(H0): Social factors are **NOT** significant pull factors encouraging emigration of engineers from South Africa.

(H5): Social factors are significant pull factors encouraging emigration of engineers from South Africa.

Hypothesis statement 6

(H0): Political factors are **NOT** significant pull factors encouraging emigration of engineers from South Africa.

(H6): Political factors are **NOT** significant pull factors encouraging emigration of engineers from South Africa.

1.5 Research Questions

The emigration of skilled professionals from South Africa has emerged as a critical policy and development concern, particularly in high-demand sectors such as

petrochemicals. As global competition for technical expertise intensifies, South Africa faces the dual challenge of retaining its limited pool of skilled engineers while mitigating the adverse effects of talent outflow on national industrial capacity. The petrochemical sector, being a cornerstone of the country's manufacturing and energy value chain, is particularly vulnerable to this brain drain, which threatens to undermine its sustainability, competitiveness, and contribution to economic growth.

This study explores the emigration patterns of professional engineers and other skilled personnel within the South African petrochemical industry. It seeks to develop an in-depth understanding of the demographic profile of those leaving, the trends and levels of their exit, the key determinants driving emigration decisions, and the long-term developmental implications for the sector. Furthermore, the research investigates practical and policy-based retention strategies that could be adopted to curb the loss of high-value skills and ensure the resilience of South Africa's industrial future.

By addressing these dimensions, the study aims to contribute to the national discourse on human capital preservation and inform strategic interventions targeted at talent retention in one of the country's most technically intensive and economically significant sectors.

The research questions are as follows:

1.4.1 What is the profile of skilled professionals emigrating from SA, particularly from the petrochemicals sector?

1.4.2 What characterises the levels and trends of emigration of professional engineers from SA, particularly from the petrochemical sector?

1.4.3 What are the determinants of skilled professionals emigrating from SA, particularly from the petrochemicals sector?

1.4.4 What are the future developmental implications of human flight and the exodus on skills and overall development of the petrochemical sector in SA?

1.4.5 What are the possible retention strategies that organisations within the petrochemicals sector in SA can adopt to retain some of the engineers?

1.6 Rationale

Part of this research will include reviewing previous research on emigration of skilled labour within the context of South Africa. The missing stock of knowledge will be in the petrochemicals sector, where determinants will be looked at in different aspects, and will also look at the retention strategies and implications directed at the petrochemicals sector. What exists is the emigration of skilled labour that has been written about by writers such as Bhorat, Meyer, and Mlatsheni (2002). Skilled labour migration from developing countries: Study on South and Southern Africa. Brink in (2012) wrote about Factors contributing to the emigration of skilled South African migrants to Australia.

Ellis (2008) wrote on South Africa and international migration, where the role of skilled labour was looked at. In addition to that, Meyer (2002) wrote about the migration of skilled and highly skilled workers in South Africa: Case Study. This is an indication that migration of skilled workers is not something new, but this research will add on to the already existing knowledge and research work that has been done. The research will explore what the contradictions, challenges, oppositions of ideas and uncertainties are that exist within different literatures that have been reviewed.

With a particular focus on the petrochemicals industry, this research study seeks to offer valuable insights into the socioeconomic effects of a skills shortage in South Africa as a whole. . Moreover, the findings of this research might also assist the petrochemicals sector, private and public sector, government and other stakeholders such as the Departments of Labour, and Education, academic institutions, and different SETAs with possible solutions and recommendations to deal with the causes and effects of skills migration, skills shortage in the petrochemicals sector and in South Africa as a country. Most significantly, essential retention strategies that Human Resources Practitioners with the petrochemicals sector can explore for the first time, their perceptions of the determinants or causes, effects and possible interventions of industries in respect of the scourge.

1.5 Thesis Structure

Chapter One establishes the research foundation by defining the central problem—skilled emigration from South Africa's petrochemical sector and its broader socio-economic relevance. It outlines the study's aims, objectives,

background, and guiding research questions and concludes with an overview of the thesis structure, providing a clear roadmap for the study.

Chapter Two outlines the systemic, historical, and structural factors driving talent loss, examining global labour mobility, post-apartheid skills development, and the institutional dynamics of the energy and manufacturing sectors. It reviews past talent retention and localisation efforts in the petrochemical industry, highlighting gaps in policy, incentives, and workforce planning. This background provides the analytical and empirical basis for understanding emigration trends, identifying key drivers, and proposing evidence-based strategies to retain critical human capital in a sector vital to South Africa's industrial future.

Chapter Three outlines the theoretical and conceptual framework underpinning the study, integrating Push–Pull Migration Theory, Human Capital Theory, and Organisational Commitment and Retention Theory to examine skilled emigration and retention in South Africa's petrochemical sector. Push–Pull Theory addresses macro-level socio-economic and political drivers, Human Capital Theory explains how professionals assess the value and returns of their skills across labour markets, and Organisational Commitment and Talent Retention models provide micro-level insights into workplace dynamics and retention strategies. Together, these perspectives inform a conceptual model that links individual, organisational, and systemic factors to the research questions.

Chapter Four describes the research methodology and justifies the chosen design, employing a mixed-methods approach that combines a quantitative survey with qualitative in-depth interviews to explore skilled emigration and retention in South Africa's petrochemical sector. The chapter explains the use of methodological triangulation to enhance validity and reliability, details participant engagement procedures including sampling strategies and ethical considerations and outlines data collection protocols for both phases. Analytical techniques for interpreting quantitative and qualitative data are discussed to ensure coherence with the study's objectives. The chapter concludes with reflections on fieldwork, highlighting contextual challenges, practical limitations, and emergent insights that informed the analysis.

Chapter Five presents and critically analyses the empirical findings, linking them to the study's research objectives. It integrates results from both the survey and in-

depth interviews to provide a comprehensive view of emigration and retention dynamics in South Africa's petrochemical sector. The chapter begins with the demographic profiles of participants, including industry experts, engineers, and human capital practitioners, to contextualise their perspectives. It then examines pre-migration experiences, perceptions of the sector, and patterns and trajectories of skilled emigration. Determinants of emigration are analysed, highlighting variations in motivational factors across professional groups and identifying key international destinations for South African engineers. Qualitative and quantitative findings are presented together, supported by tables, figures, and interpretative commentary that draws out thematic trends and insights from the fieldwork.

Chapter Six explores the implications of emigration and related policy considerations. It critically evaluates South Africa's policy environment concerning skilled migration, focusing on industry strategies within the petrochemical sector. The chapter assesses the effectiveness of current skills development frameworks, retention initiatives, and migration governance mechanisms, and examines their influence on the mobility of high-level engineering talent. It also considers the broader socio-economic ecosystem, including stakeholders whose livelihoods are affected by global migration, and emphasises the role of economic incentives and investment in research, development, and innovation as levers for addressing skills flight.

Chapter Seven serves to consolidate the research by presenting a clear synthesis of key findings, directly answering the research questions and confirming the achievement of objectives. It translates these findings into practical, evidence-based recommendations for policymakers, industry leaders, and other stakeholders, while also outlining the study's theoretical and academic contributions. Additionally, it acknowledges the research's limitations and proposes avenues for future investigation, ensuring the work's relevance and applicability beyond the immediate study.

The findings of this study underscore the increasing loss of professional engineers from South Africa's petrochemical sector to more developed economies. Emigration is driven by a combination of organisational, economic, geopolitical,

and personal factors, highlighting the urgent need for coordinated policy reform. The study advocates for a multi-pronged approach, including public–private sector collaboration, enhanced international partnerships, and a strategic review of migration and retention policies, to mitigate the adverse effects of brain drain on national engineering and industrial innovation.

Chapter Seven consolidates the key findings, reflecting on the determinants of skilled emigration and the effectiveness of retention strategies. By synthesising quantitative and qualitative insights, the chapter evaluates theoretical, methodological, and policy implications, emphasising the necessity for sector-specific interventions to address the persistent exodus of engineering talent. Such interventions are critical for sustaining national development, industrial competitiveness, and economic resilience.

A core focus is the governance of skilled migration, highlighting the misalignment between South Africa's migration policies and the needs of high-skill sectors such as petrochemicals. The research demonstrates that targeted retention strategies, expanded skills development initiatives, and institutional coordination are essential for reversing brain drain. A multi-stakeholder approach involving government, industry, and academia is recommended to develop adaptive policies and training frameworks responsive to both local labour market needs and global talent competition.

The study situates South Africa's experience within broader migration theory, examining historical and contemporary trajectories of retention strategies in the post-apartheid era. It also addresses the racialised and psychological dimensions of emigration, noting that some white professionals left in response to socio-political changes, citing economic and security concerns, while deeper issues of identity, perceived loss of privilege, and uncertainty influenced decisions.

In conclusion, the study contributes to the understanding of skilled migration in the Global South and offers evidence-based recommendations to retain engineering talent. It calls for renewed investment in human capital development, inclusive national dialogue on migration, and evidence-led policy reviews that balance

national interests with global mobility realities. Directions for future research include longitudinal studies on return migration, sectoral analyses of retention effectiveness, and comparative studies across emerging economies facing similar emigration pressures.

2 CHAPTER 2 Literature Review

2.1 Introduction

This chapter aims to explore the existing research and studies that have examined emigration determinants for skilled personnel in South Africa. Debates on skill migration on a global and regional level within the petrochemical industry will also be discussed. Lastly, retention strategies and implications of skilled migration from sending countries will be discussed.

It provides a background to the study. This chapter provides a comprehensive overview of the systemic, historical, and structural factors that underpin this talent exodus. It interrogates the intersection of global labour mobility, skills development in post-apartheid South Africa, and the institutional dynamics of the energy and manufacturing industries. Moreover, it critically explores previous attempts at talent retention and localisation within the petrochemical industry, revealing gaps in policy coherence, incentive structures, and strategic workforce planning. This background establishes the analytical and empirical foundation necessary to examine emigration trends, identify key drivers, and propose evidence-based interventions for human capital retention in a sector essential to the country's industrial future.

2.2 The migration of South African engineers

The migration of South African engineers to various parts of the world can be attributed to several factors, including economic opportunities, career advancement, political stability, and personal motivations. South Africa has experienced economic challenges, including high unemployment rates and limited career advancement opportunities in certain sectors. South African engineers seek better-paying jobs and more promising career prospects abroad, particularly in countries with robust engineering industries like the United States, the United Kingdom, Canada and Australia (World Bank, 2021).

Many developed countries face shortages of skilled engineers, particularly in specialised fields such as software engineering, civil engineering, and mechanical engineering. South African engineers, with their high-quality education and diverse skill sets, are often sought after to fill these gaps (International Organisation for Migration, 2020).

In today's interconnected world, engineers often find opportunities to work on international projects or collaborate with colleagues from different countries. South African engineers may choose to relocate to other countries to gain exposure to diverse work environments, expand their professional networks, and access global career opportunities. Political instability, crime rates, and security concerns in South Africa may prompt some engineers to seek safer and more stable living conditions abroad. Countries with established political systems, rule of law, and social stability become attractive destinations for skilled engineers (United Nations, 2019).

Furthermore, the United Nations (2019) reports that South African engineers migrate to countries in search of higher standards of living, better healthcare systems, superior education opportunities for their children, and an overall improved quality of life.

Individual circumstances, such as family ties, personal preferences, and lifestyle choices, also play a role in migration decisions. Some South African engineers may have family members already living abroad or may seek opportunities for their spouses/partners in their chosen destination.

Historical ties between South Africa and certain countries, such as the United Kingdom and Australia, may facilitate migration through ancestry visas or cultural exchange programmes.

Exploration of the specific intricacies of Emigration and Migration

Migration, both voluntary and forced, is a dynamic phenomenon that has played a significant role in shaping societies, economies, and cultures globally. The concepts of *emigration* and *migration* are often used interchangeably, but they have distinct

connotations and implications. This part of the study focuses on making a clear distinction between these two terms. The intricacies of both phenomena, examining their causes, patterns, effects, and theoretical frameworks are also covered as below.

Definition and Scope: Migration and emigration

It is important to understand the contextual meaning of 'migration' and 'emigration' as used in this study. Migration is a broader term which involves movement of people either within a country or across international borders (Castles, de Haas & Miller, 2020). As suggested by Portes & Böröcz, 2016), migration is two directional as it involves movement of people into a country as well as out of a country with the intent of settling temporarily or permanently in a new location of choice. On the other hand, emigration is narrow as it refers to international departure of people to settle in another country (King, 2012). Therefore, emigration is a subset of migration as it focuses on the departure aspect of migration. **Figure 4.1** illustrates in brief the differences between migration and emigration.

Scholars have long debated the causes of emigration and have settled that people emigrate due to push factors such as economic hardship, political instability, conflict, and environmental disasters, Massey, Arango, Hugo, Kouaouci, Pellegrino & Taylor, (2014).They also argued that emigration can be caused by pull factors such as opportunities, good conditions in the destination country, that can include economic prospects, better living conditions and political freedom Massey, et al., (2014).

Aspect	Migration	Emigration
Definition	General term for the movement of people.	Specific to leaving one's country of origin.
Scope	Broad; includes internal and international movement.	Narrow; only involves international departure.
Focus	Both arrival and departure are considered.	Focuses solely on the act of leaving a country.

Figure 1. 1: Differences between migration and emigration source: King, (2012)

2.3 Theoretical Framework and Literature Context

In addressing this issue, this research draws on Lee's push and pull theory Lee, (1966), which provides a foundational framework to examine why South African engineers might choose to leave the country. Lee's theory posits that migration decisions are shaped by "push" factors that drive individuals away from their home country and "pull" factors that attract them to foreign destinations. Push factors, such as limited career advancement, political instability, and economic constraints in South Africa, could incentivize engineers to seek better opportunities elsewhere. Conversely, pull factors in other countries, like competitive salaries, advanced research environments, and stable socio-political conditions, make emigration appealing (Rasool & Botha, 2011).

Research on brain drain in Africa highlights a similar pattern across sectors. Studies demonstrate how the emigration of skilled professionals, including engineers, medical professionals, and academics, weakens the continent's development capacity, impeding its transition to a knowledge-based economy. (Chipangura, Mohamed & Mkhize, 2020). This study will contribute to the literature by focusing specifically on engineers within the petrochemical sector, a crucial industry for South Africa's economic stability but largely underexplored in terms of emigration studies

2.4 Emigration Trends Post Apartheid 1994

Since the end of apartheid in 1994, South Africa has witnessed notable emigration of professionals due to various socio-economic and political factors (Modi, 2003). Emigration from South Africa has been significant, particularly among skilled professionals. While precise data may vary, the migration research organization, the Southern African Migration Project (SAMP), has reported that between 1995 and 2010, over one million South Africans emigrated. The scale of emigration has impacted various sectors, including healthcare, education, and technology.

Emigration from South Africa is a complex and multifaceted phenomenon with various underlying reasons, a significant scale, and diverse impacts on both the country of origin and the destination countries. Croucher & McGrath (2018) argued that political concerns, such as corruption and governance issues, have led some South Africans to emigrate in search of political stability and better governance. They further claimed

that in some cases, emigration is influenced by racial tensions or social disparities, as individuals and families seek more inclusive and equitable societies abroad. However, Alison (2015) argued that the reason to emigrate is based on individual choices. He reiterated that the key reason for skilled emigration is attributed to the economic opportunities in that skilled individuals often seek better economic opportunities abroad, including higher salaries, better job prospects, and improved living standards.

Development Policy Research Unit (2022) reported that the other key reason driving professionals to emigrate from South Africa is political uncertainty, where political instability, issues of corruption, and concerns about the rule of law have driven skilled professionals away, as they would seek environments with more stable governance and stable political certainty based on individual perceptions.

South Africa has faced issues related to crime and personal safety, which have influenced some individuals and families to seek safer environments elsewhere. Access to quality education and healthcare can be motivators for emigration, particularly for families seeking better opportunities for their children's education and healthcare Altman & Esterhuizen, (2017). In addition, Altman & Esterhuizen (2017) claimed that economic opportunities often drive emigration. Thus, high unemployment rates, income inequality, and concerns about economic stability have prompted many South Africans to seek better economic prospects abroad.

Thus, the scale of emigration from South Africa has been significant. While exact numbers can fluctuate, it's estimated that hundreds of thousands of South Africans have emigrated over the years dating back as far as the 1994 post-apartheid era (Lawless, 2020). Popular destinations for South African emigrants include the United Kingdom, Australia, Canada, the Middle East, the United States, and New Zealand. The emigration from South Africa has often resulted in adverse effects on education, income, and employment. The departure of skilled workers and potential entrepreneurs can hinder economic growth and development. Families are often separated due to emigration, leading to emotional and social challenges (Bryant, 2010). South African emigrants contributing their skills and expertise to their host countries, particularly in sectors such as healthcare, engineering, and Information Technology, leave a gap at home. Their contributions can lead to economic and

technological benefits for the host countries (Mbiyozo, 2018). Furthermore, Mbiyozo (2018) argued that South Africa has also seen significant emigration of young people in recent years. Many young South Africans leave the country in search of better job opportunities and living standards, particularly in other African countries such as Botswana and Namibia. This trend has raised concerns about the loss of a talented and motivated population, as well as the potential impact on the country's development.

Alison (2015) argued that South Africa has also seen significant emigration of entrepreneurs in recent years. Many South Africans with business experience and expertise leave the country in search of better opportunities and more supportive business environments in other countries, particularly in Europe and North America. This trend has raised concerns about the loss of a dynamic and innovative population, as well as the potential impact on economic growth and development in South Africa.

2.5 Key drivers of emigration in South Africa

The post-apartheid era saw substantial changes in employment policies in South Africa, notably the implementation of Black Economic Empowerment (BEE). While this policy was aimed at redressing historical inequalities, BEE led to perceptions among some white South Africans, particularly Afrikaners, of reduced job prospects, prompting them to emigrate Theodore, Pretorius & Schenck, (2017). Crush, Chikanda & Skinner (2019) argued that concerns over economic stability in South Africa, comprising issues like currency volatility and policy uncertainty, have influenced decisions to emigrate.

Facchini, Mayda & Mendola (2019) were of the view that elevated crime rates in the post-1994 period in South Africa have been a significant push factor. Many skilled professionals cited personal safety concerns as a primary reason for relocating abroad. They also suggested that the pursuit of better educational opportunities for children and more favourable professional environments drove many families to emigrate, seeking systems perceived as more efficient or prestigious. On the other hand, Siwela & Van der Bank (2021) claimed that political developments, including

concerns about governance, corruption, and policy directions, have contributed to a sense of uncertainty, influencing emigration decisions for experienced professionals from South Africa. The above assertions were shared by several researchers who argued that many skilled South Africans, particularly those from white minority communities, have left the country due to concerns about crime, political instability, and limited job opportunities Tevera, 2008; Van der Berg, (2011).

Similarly, Moses & Yu (2016) reported that political uncertainty in South Africa has been a growing concern over overtime. They claimed that although South Africa's transition from apartheid to democracy in 1994 brought hope, over time, some individuals grew frustrated with perceived political instability, corruption, and governance challenges and were pushed to emigrate to seek better prospects abroad. However, Siwela & Van der Bank (2021) submitted that global emigration trends are complex and can vary from year to year, depending on global economic conditions, political landscape and other factors. Additionally, the COVID-19 pandemic, which emerged in early 2020, might have had a profound effect on the migration trends.

2.6 Critical debates on skilled migration

Globally, the emigration of skilled personnel has become a significant concern, particularly for developing countries that face a "brain drain" of skilled workers to more developed countries (Adams & Page, 2005). This phenomenon has been attributed to various factors, including political instability, limited job opportunities, and better salaries and benefits abroad (Saxenian, 2005).

In Africa, the emigration of skilled personnel is a significant challenge that affects the continent's development prospects (Sifaki-Pistolla et al., 2020). Many African countries have experienced a significant outflow of skilled workers, particularly doctors and nurses, to developed countries Ezeh et al., (2017). This "brain drain" has led to a shortage of skilled personnel in many African countries and has had a negative impact on their health systems and development prospects Bach, (2017).

There are arguments that point out that the positive aspect of the migration of skilled personnel has economic benefits, where migration of skilled personnel can have a positive impact on the economy of the host country. The influx of skilled workers can

benefit economic growth, increase productivity, and fill skill gaps in industries that are experiencing a shortage of qualified workers.

This argument exists according to a report by the World Bank that skilled migration can lead to a 1.5% increase in the Gross Domestic Product of the host country (Docquier et al., 2018). Other authors argue that skilled migrants bring with them valuable knowledge and skills that can be shared with their colleagues in the host country. This can lead to an increase in innovation and competitiveness, which can benefit the local economy (Chetty, 2020).

A study by the International Organization for Migration (IOM) found that the transfer of knowledge and skills from skilled migrants can lead to improvements in technology, business practices, and product quality (IOM, 2017). In addition, this report argued that skilled migrants often send remittances back to their home countries, which can help to alleviate poverty and stimulate economic growth. According to a report by the Migration Policy Institute (MPI), remittances sent by migrants in high-income countries amounted to $466 billion in 2017 (Kandel & Kao, 2018).

On the contrary, another argument is that the migration of skilled personnel carries issues of brain drain. The brain drain effect is viewed as one of the biggest negative consequences of the migration of skilled personnel (ECSA, 2020). When skilled workers leave their home countries, it can lead to a loss of valuable human capital, which can hinder economic growth and development. According to a report by the United Nations Conference on Trade and Development (UNCTAD), developing countries lose an estimated $200 billion per year because of brain drain UNCTAD, (2018). On the other hand, there are also arguments that social costs can have a negative impact, both in the host and home countries.

In the host country, brain drain can lead to a shortage of skilled workers in the home country, which can lead to higher wages and reduced access to services such as healthcare and education (Ezeh et al., 2017). They also argued that brain drain can lead to a loss of social cohesion, as skilled workers may leave behind family members and friends, which can have a negative impact on their communities.

Another negative impact has to do with ethical concerns, where it is argued that the migration of skilled personnel can raise ethical concerns, especially when it involves the recruitment of health workers from developing countries. This can lead to a shortage of healthcare workers in the home country, which can have a negative impact on the health of the population (WHO,(2012). The World Health Organization Report (2012) has called for ethical recruitment practices to be implemented to prevent the negative consequences of skilled migration in the health sector (WHO, 2010).

One of the most common arguments against migration of skilled personnel is that it leads to brain drain in developing countries. This is because skilled workers often leave their home country in search of better opportunities and higher salaries in developed countries. As a result, developing countries may lose their best and brightest minds, making it harder for them to develop and compete in the global economy (Adams & Page, 2003).

While brain drain is a concern, some scholars argue that migration of skilled personnel can also have positive effects on sending countries. For example, migrant workers may send money back to their home country, which can help to alleviate poverty and stimulate economic growth (Smyth & Nielsen, 2010). Additionally, some argue that the skills and knowledge gained by migrants while working in developed countries can be brought back to their home country, helping to build a more skilled and productive workforce (Docquier & Marfouk, 2006).

Scholars also argue that migration of skilled personnel can have positive effects on receiving countries. For example, skilled migrants can help to fill labour shortages in certain industries and contribute to innovation and economic growth (Peri, 2012). Additionally, some argue that the cultural diversity brought by skilled migrants can enrich societies and lead to social and economic benefits (Chiswick & Miller, 2008).

Therefore, migration of skilled personnel can have both positive and negative consequences, with the impact depending on a variety of factors such as the skill level of the migrants, the countries involved, and the sector in which the migrants are working. While there are economic benefits associated with skilled migration, it is important to address the negative consequences, such as brain drain and ethical

concerns, to ensure that the benefits are maximised and the negative consequences minimised.

Impacts of Emigration

Emigration can have profound consequences for both the sending and receiving countries by first looking at the:

Economic Impact

While remittances sent by emigrants can be a significant source of income for families and contribute to economic development in the home country, the emigration of skilled labour (often referred to as “brain drain”) can result in a depletion of human capital in the sending country (Docquier & Rapoport, 2012).

Social and Demographic Effects

Emigration can lead to demographic shifts, including depopulation in rural areas, and can disrupt family structures, particularly when emigrants leave behind children or elderly relatives. This can result in a phenomenon known as “transnational families”, where family members remain connected across borders through technology and remittances (Schiller et al., 1992).

Emigration and Migration: Power, Capital, and Global Asymmetries

Migration as well as emigration is extremely entrenched in global power dynamics and the distribution of capital. The global movement of people from one country to another is usually a reflection of economic inequalities, political instability, historical legacies of colonialism, and contemporary systems of global governance. In the next subsections, migration as well as emigration is discussed in the context of the broader debate about global, power and capital asymmetries.

Migration: A Reflection of Global Inequality

Migration is a broader term which involves movement of people, either internal (for example rural-urban migration) as well as international movement where people of one country cross national borders to settle in another country due to push and pull factors (Massey et al., 2014).

King (2012) explained that the migration of people often reflects global inequalities, where it is understood that people prefer to move from places of lower economic opportunity to areas with better prospects. People can also move from places where there is less political stability to areas which are more politically stable. Globalisation has facilitated free movement of people, although restrictions have been on the mobility of labour, especially from the Global South to the Global North Castles (de Haas & Miller, 2020).

This dichotomy highlights structural inequalities, where the wealthy and developed countries benefit from skilled and unskilled migrant labour while restricting entry through stringent immigration policies Castles, de Haas & Miller, (2020); Massey et al., (1993). For instance, the demand for healthcare personnel in the developed countries such as United States of America, United Kingdom and Canada has driven migration from countries like the Philippines and Nigeria and this is leaving these countries with depleted healthcare systems (Bhargava, Docquier & Moullan, (2011).

Emigration: Power Asymmetries and Capital Flight

Emigration which is a subset of migration is narrow in its scope as it refers to international departure of people to settle in another country of preference (King, 2012). Emigration is driven by several factors that are rooted in asymmetries of power, such as conflict, economic deprivation and environmental degradation. For instance, emigration from the Global South is commonly driven by labour opportunities in wealthier nations, mostly in the western world. Most of these immigrants who have settled abroad contribute significantly to the GDP of their original countries such as Nepal, Zimbabwe and El Salvador. However, leaders of these countries often fail to address structural underdevelopment (Adams & Page, 2005). Furthermore, wealthy elites in politically unstable or corrupt nations often emigrate to the destination of their

choice. They usually take substantial financial resources with them. This worsens inequality by depriving countries of vital capital (FitzGerald, 2016).

Most conflicts that are experienced in developing countries are arguably fuelled by global arms trade, and geopolitical interventions often result in mass emigration of people in search of political stability and security (Betts, 2013). This has been witnessed in Syria and Afghanistan. On the other hand, climate change is also to blame for the emigration of people from their country of origin. Climate change has disproportionately impacted low-income countries, and this has given rise to environmental emigration (McLeman & Smit, 2017). For example, environmental emigration is observed in Pacific Island countries where the risk of rising sea levels due to emissions largely produced by industrialised countries is high.

Given the economic situation and political landscape of South Africa, which are not in good shape compared to previous years, the drivers of increased emigration (as well as their ramifications on the economy) of professionals, especially engineers, to international destinations.

Impact of Skilled Emigration on the Petrochemical Sector

The emigration of petrochemical engineers presents complex challenges for South Africa's industrial landscape. The departure of these professionals leads to significant intellectual and technical resource loss, known as “brain drain”, which has severe repercussions on local industries, especially those requiring highly specialised skills (European Union, 2018). This phenomenon, as noted by Anderson (2017) and the CHIETA CEO, Yershen Pillay, not only widens skills gaps but also inhibits innovation, productivity, and sustainability within the petrochemical sector. According to Massey & Taylor (2004), brain drain in high-demand industries leads to reduced local investment in human capital and hinders sustainable growth, affecting the country’s aspirations to develop a knowledge-based economy.

This skills shortage is exacerbated by global trends toward cleaner technologies and lower carbon emissions, which demand new competencies that are largely unavailable within the local workforce. Mercer’s (2020) report on global talent trends identifies reskilling as a top priority for industries needing to adapt to such changes. The

petrochemical sector's movement toward green technology such as hydrogen projects (Pillay, 2021) intensifies the demand for advanced engineering skills, a need unmet due to the continual outflow of talent.

2.7 Impacts of Migration

Migration impacts both sending and receiving countries in diverse ways. This is briefly discussed below.

Economic Contributions

Migrants often contribute significantly to the economy of the destination country by filling labour shortages, particularly in sectors such as agriculture, construction, and healthcare. Remittances are a key aspect of migration, benefiting economies in countries of origin (Ratha, 2013).

Cultural Exchange and Integration

Migration leads to cultural exchange and the diversification of societies. However, it can also create challenges related to integration, including issues of identity, language barriers, and social cohesion (Vertovec, 2007).

Political Consequences

Migration can influence political landscapes, both in terms of domestic policies in the receiving country (e.g., immigration laws) and international relations between countries (e.g., bilateral agreements on labour migration) (Baker & Latham, 2017).

Consequences of Engineer Emigration from South Africa

The emigration of engineers in South Africa's petrochemical sector has multifaceted implications. First, there is the economic impact: skilled engineers contribute to productivity, innovation, and overall economic output. Losing these professionals affects not only the petrochemical sector but also South Africa's broader industrial capabilities, which are vital for maintaining competitiveness in the global market.

Moreover, the shortage of engineers hinders compliance with Employment Equity mandates, which aim to address racial and gender disparities in the workforce. Consequently, emigration exacerbates inequalities in high-skilled job opportunities, further affecting social cohesion and economic transformation goals.

Beyond immediate economic effects, the emigration of engineers also undermines South Africa's innovation and research capabilities. Engineers play a critical role in research and development (R&D), which fuels advancements in the petrochemical industry. As emigration drains this expertise, South Africa risks falling behind in technological advancements, resulting in a slower rate of industrial progress and lower productivity growth (Bhorat et al., 2015). This knowledge loss represents a profound setback for South Africa's aspirations to transition to a knowledge-based economy.

2.8 Retention Strategies and Policy Implications

Addressing the retention of engineers within the petrochemical sector necessitates both theoretical and empirical examination of retention strategies that align with industry-specific needs. Effective approaches include competitive remuneration, conducive working conditions, and career development opportunities, which have shown success in comparable sectors worldwide (Mercer, 2020; Hajro et al., 2021). Additionally, collaborations with academic institutions to promote relevant skills development, as advocated by CHIETA, would help to nurture a sustainable talent pipeline (National Planning Commission, 2012).

Current literature underscores the importance of aligning retention policies with engineers' personal and professional aspirations (Shangase & Mbohwa, 2020). However, a persistent gap remains in understanding which specific retention factors resonate most with petrochemical engineers, given the unique demands of the industry. By exploring these dimensions, the present study intends to generate insights that can inform both government and corporate policy frameworks, with the objective of reducing engineer emigration and fortifying South Africa's economic resilience.

Retention Challenges and Policy Implications

Retention strategies are crucial for addressing the exodus of engineering talent. However, current approaches such as competitive remuneration, career development programmes, and improved working conditions have proven inadequate in retaining skilled engineers within South Africa's borders. Effective retention measures must address both tangible (salary, career growth) and intangible (work environment, political stability) factors. Failure to do so risks worsening the skills shortage, with long-term negative repercussions for South Africa's economic and social objectives.

Policy reform is also essential in addressing emigration within the petrochemical sector. Developing evidence-based policies that directly address the reasons for emigration, such as improving career pathways, increasing investment in R&D, and ensuring greater political stability, could help retain engineering talent. This research aims to provide insights that will inform both industry and government policy, supporting a more sustainable approach to workforce management within the petrochemical sector.

2.9 Destination countries

According to the Statista Report (2023), the United Kingdom and Australia emerged as the most preferred destinations for South African emigrants. Similarly, (Mattes and Mniki, 2007) found that 24% of participants who were involved in their research study chose the United Kingdom as their top preferred travel location. Following this were the United States (19%), Australia (15%), Europe (7%) and Canada (5%), while Southern Africa was selected by 7% of respondents. Significant racial disparities existed. Compared to other pupils, Black respondents were more likely to believe that they will eventually settle in Southern Africa or North America. White students were more likely than others to see Australia or New Zealand as a likely destination. The distribution of emigrants from South Africa in 2020 by country of destination is shown in **Table 2.1.1.**

Table 2.1.1: Stock of emigrants from South Africa in 2020, by country of destination.

Country	Number of emigrants

United Kingdom	247 336
Australia	199 690
U.S	117 321
New Zealand	73 846
Canada	48 093
Germany	20 378

Source: Statista, 2023

The South African Engineers Migration Destinations

South African engineers migrate to various countries worldwide, with popular destinations often depending on factors such as economic opportunities, political stability, quality of life, and personal preferences. However, some countries are frequently cited as common destinations for South African engineers.

According to research and reports, some of the top destinations for South African engineers include the United Kingdom (UK), which is a popular destination for South African engineers due to its strong engineering industry, diverse job opportunities, and cultural ties between the two countries. Many South African engineers find employment in sectors such as construction, manufacturing, and technology in cities like London and Manchester (SANSA, 2019).

According to "Australia's Migration Program Statistics (2021). Australia has a high demand for skilled engineers, and South African engineers are often attracted to the country's robust economy, quality of life, and favourable immigration policies for skilled workers. Key industries for engineers in Australia include mining, construction, and infrastructure development.

Canada offers opportunities for South African engineers seeking employment in sectors such as aerospace, automotive, renewable energy, and information technology. The country's immigration programmes, such as the Express Entry

system and Provincial Nominee Program, attract skilled professionals from around the world, including South Africa. This is according to the "Express Entry Year-End Report 2020". Immigration, Refugees and Citizenship Canada, Government of Canada, (2020).

The UAE, particularly cities like Dubai and Abu Dhabi, is known for its rapid development and large-scale construction projects, making it an attractive destination for South African engineers, especially those specializing in civil engineering, infrastructure, and oil and gas (SANSA, 2019). Similarly, New Zealand is one of the destinations for South African engineers. New Zealand offers a good work-life balance, natural beauty, and welcoming culture over and above economic benefits (Government of New Zealand Report, 2022). The largest numbers of South African engineers are found in the United Kingdom, followed by Australia, the United States, New Zealand and Canada.

According to the data compiled by Statistics South Africa (2016), between 2006 and 2016 the most popular overseas destinations for South African émigrés were Australia (26.0%), the United Kingdom (25.0%), the United States (13.4%), New Zealand (9.5%), Germany (6.0%), American Samoa (United States territory) (4.4%), the United Arab Emirates (4.2%), Cuba (4.0%), Canada (3.0%), and China (2.0%). However, the flow of engineers emigrating from South Africa shifts from time to time based on changes in economic conditions, immigration policies, and global trends.

For the purposes of this research, it is essential to note that the choice of destination varies among individual engineers based on their career goals, personal circumstances, and preferences. Additionally, migration patterns may shift over time due to changes in economic conditions, immigration policies, and global trends.

The Migration profile of South African Engineers

The migration profile of South African engineers encompasses various factors such as destinations, industries, motivations, and demographics. For the purposes of this

research, it is worth noting that while specific data may vary over time and depending on the source, several key trends and characteristics have been observed during the period this research was conducted. As far as destinations are concerned, South African engineers migrate to various countries worldwide, with popular destinations including the United Kingdom, Australia, Canada, the United States, and countries in the Middle East. These destinations often offer opportunities in sectors such as construction, mining, technology, and infrastructure development United Nations Department of Economic and Social Affairs, (2021).

South African engineers are employed across a range of industries in their destination countries, including engineering consultancy firms, construction companies, manufacturing industries, oil and gas companies, and information technology firms. The choice of industry often depends on factors such as career interests, skills specialisation, and job availability in the destination country(Crush, & Tevera, 2010).

The motivations for South African engineers to migrate can include factors such as better career prospects, higher salaries, access to advanced technology and infrastructure, political stability, quality of life, and opportunities for personal and professional growth Tengeh & Zikhali, (2012). Economic factors, such as the exchange rate and cost of living, may also influence migration decisions.

South African engineers who migrate come from diverse demographic backgrounds, including recent graduates, mid-career professionals, and experienced engineers. Migration patterns may vary based on age, gender, education level, and specialisation within the engineering field (Hugo & Hugo, 2012). While some South African engineers migrate permanently, others choose to return to South Africa after gaining experience abroad. Return migration can contribute to knowledge transfer, skills development, and economic growth in the country. Factors influencing return migration may include family ties, career opportunities, and personal preferences (OECD, 2019).

Several White South Africans, most of them skilled, left the country in the years preceding and following the 1994 elections that represented the end of the apartheid era. As a result, the migration then mainly consisted of white South

African emigrants of British, Jewish (mostly via Latvian, German and Lithuanian ancestry) and, to a lesser extent, Afrikaner origin. A minority of English South Africans moved to Great Britain (often through the UK ancestry visa) due to socioeconomic concerns such as South Africa's high crime rate in the 1990s and early 2000s, a volatile South African rand, and poor performance of the economy. It is noted that Afrikaners and Black South Africans generally have much lower emigration rates than their English and Jewish counterparts. South Africans have largely settled in the UK, Australia, New Zealand, Canada, and the United States and, to a lesser extent, Zimbabwe, Ireland, the UAE, Israel (mostly those of Jewish faith), and Portugal.

A report published in 2022 by the Social Research Foundation states that black South Africans have identified the US and UK as among the global destinations they would like to live in, work and raise their children in, as many warm-up to the idea of emigrating for better employment and business opportunities (Social Research Foundation, 2022). The report indicates that there is a growing appetite among black South Africans to venture into other countries and reside there. In the past, the departure of white South Africans has been the norm.

It has been reported the chemical industry in South Africa is suffering, largely due to a shortage of chemical engineers, mechanical engineers, and data scientists (Ntuli, Allopi & Dhiren, 2014). The country has inadequate financial resources for training and education of engineering discipline. However, there are institutions in South Africa, such as CHIETA, which is responsible for education training authority for the chemicals sector, which covers nine sub-sectors including petrochemicals. CHIETA facilitates skills development in the sector and ensure that skills needs are identified and addressed through several initiatives in partnership with higher education institutes, public entities, training providers, and private organisations.

Chemical Industries Education and Training Authority SETA (Sector Education and Training Authority) in South Africa generates new knowledge and skill. This is the vocational skills training organization in South Africa. As of March 2011, there were twenty-one (21) SETAs. Each SETA is responsible for managing and creating learnerships, internships, unit-based skills programmes, and apprenticeships within its

jurisdiction. Every industry and occupation in South Africa is covered by one of the 21 SETAs.

There are a myriad of factors that impact on the performance of the chemicals industry and on the demand for skills in the sector. Some of these factors tend to increase the demand for high-level and specialised skills. The chemicals industry is dependent on professional and technical skills, which are in short supply locally and globally. Since there are extended lead times in training high-level and specialist engineering skills and increasing brain drain to overseas assignments, industry is increasingly vulnerable to occupational shortages.

In terms of racial equity in the chemicals industry, White individuals dominate managerial and professional positions, followed by Africans. African women are under-represented in managerial and professional jobs. As a result, transformation remains a key goal for the industry. In terms of emigration, the African community has also joined in leaving South Africa to work abroad.

The determinants of skills migration

There have been numerous arguments as to why people would emigrate from South Africa to seek employment elsewhere, though the exact number cannot be estimated because neither the Department of Home Affairs nor the Engineering Council of South Africa (ECSA) keep accurate records of these statistics (Styan, 2008). Johan Pienaar, ECSA's registrations manager, estimated that 300 registered professional engineers emigrated each year (Styan, 2008). The exodus of skilled workers to other countries has an impact on the labour market, including the petrochemicals industry. The emigration of skilled professionals such as engineers and scientists can deplete critical sectors like healthcare, education, industry and technology, hinders economic development and service delivery and often separates families, leading to social and emotional challenges for those left behind, especially children (Flore, 2015).

There is a growing realisation that developing countries, particularly those on the African continent, are losing a sizable proportion of their talented workers to affluent

countries. Development agencies such as the International Organization for Migration (IOM) (2001) and the World Bank (2000) have identified this issue, often known as 'brain drain', as one of the most powerful forces defining the landscape of the twenty-first century.

Globally, skilled workers are migrating from various underdeveloped countries. This phenomenon presents a challenge to policymakers in both sending and receiving countries, who must adapt to the reforms required to capitalise on this mobility. Skilled migration is frequently regarded as having a dominating and detrimental impact on countries of origin. Modern research and policy experience call this notion into question, providing a more nuanced picture. Countries of origin and host countries can benefit from skilled migration when it is correctly structured and monitored. On the contrary, policy efforts to reduce the emigration of skilled nationals may have unintended costs for originating countries, in addition to being ethically challenging.

This study attempts to identify which determinants – socio-political, economic, technology-inclined, ecological or environmental, and legal-related drivers – are directly impacting South Africa's ability to attract and retain engineers. Studying the emigration of engineers is important due to the critical role they play in economic development, innovation, and infrastructure. Engineers are key drivers of technological advancement and industrial growth, making their emigration a significant concern for both host and origin countries. This study is also crucial for determining the underlying patterns and perceptions of engineers regarding migration, as well as contributing to the foundations of building a retention strategy to retain them for the sake of South African socio-economic growth.

Skilled migration as a global phenomenon

On the economic factors as the primary impetus behind migration, the ILO (2015) report underscores disparities in economic conditions among countries, encompassing differences in income and employment opportunities as one of the drivers forcing individuals to seek enhanced economic prospects in host nations. It

emphasises that labour migration hinges on the demand for specific skills and workforce in sectors like agriculture, construction, healthcare, and technology within destination countries. Furthermore, the report emphasises that remittances transmitted by migrant workers to their countries of origin can make a substantial contribution to the economic advancement of sending nations.

The ILO (2015) report highlights that family reunification stands as a prevalent motivation for migration, with individuals aspiring to unite with family members who have already embarked on the migration journey. Additionally, it acknowledges that migration is oftentimes compelled by factors like conflict, persecution, and human rights violations, propelling people to seek refuge in foreign lands as refugees or asylum-seekers.

The United Nations Report (2023) elucidates that political instability, including conflicts and civil wars, can incite substantial mass migration as individuals seek refuge in more secure territories. Furthermore, it posits that the imposition of restrictive government policies and violations of human rights in sending countries can also act as compelling catalysts for people to depart from their homelands. The UN Report (2023) further underscores the impact on sending countries, underscoring the observed phenomenon of "brain drain" in which sending nations may experience a loss of skilled workers, potentially hindering their development. Additionally, the report underscores the significant role of remittances sent by migrants in bolstering the economic well-being of families and local communities, potentially ameliorating poverty.

The World Bank (2020) report delineates the impact on receiving countries, emphasising that migrant workers can make a valuable contribution to the economic growth of host nations through their skill sets. Moreover, the report underscores that migration can enrich the cultural tapestry, ushering in fresh perspectives and ideas. Yet, it acknowledges that the arrival of migrants can engender social and political challenges, including issues related to integration, social cohesion, and debates concerning immigration policies.

Therefore, consequences of migration can be exceptionally diverse, contingent on the specific context, policy measures, and the scale of migration. The ILO and a multitude

of international organisations undertake comprehensive research and proffer guidance on labour migration and its repercussions on development.

The ILO Report (2018) provided information on "Labour Migration and Development", stating a "New Paradigm for Partnerships". This report presents a new paradigm for partnerships between countries of origin and destination to promote the development benefits of labour migration, including improving working conditions, protecting the rights of migrant workers, and promoting the transfer of skills and knowledge.

The ILO Report (2018) outlines various key highlights and recommendations that look at the shift in partnership paradigm. It advocates a shift from traditional migration approaches that primarily focus on economic gains for destination countries to a new paradigm emphasising mutual benefit for both origin and destination countries. It promotes the idea that labour migration should be approached as a tool for development, not just for economic growth in host nations. This includes improving the working conditions and rights of migrant workers while fostering the transfer of skills and knowledge. The report underlines the importance of protecting the rights of migrant workers, regardless of their legal status.

The report also calls for measures to ensure decent working conditions, fair wages, and access to social protection for migrants. It recognises the potential for labour migration to facilitate the exchange of skills and knowledge between sending and receiving countries. This can contribute to economic growth and development in both contexts. The report emphasises the need for countries to cooperate on migration issues, jointly developing policies and frameworks that consider the interests and rights of both origin and destination countries.

The World Economic Forum (2019) highlights that to maximise the benefits of migration, the report recommends mechanisms for the recognition of qualifications and certifications across borders, ensuring that migrant workers' skills are utilised effectively. The report encourages efforts to ensure that social protection benefits, such as pensions and health care, can be portable for migrant workers, allowing them to access these benefits regardless of their location. It calls for improved access to

services, including legal aid, healthcare, and education, for migrant workers and their families in both origin and destination countries.

The ILO Report (2018) acknowledges the specific challenges faced by female migrant workers and underscores the importance of gender-sensitive policies and measures. It highlights the necessity of coherent and consistent policies across areas such as labour, education, and social services to ensure that migration contributes to development goals. In essence, this report suggests a reimagining of migration as a tool for development, with the welfare and development of both sending and receiving countries at the forefront. It encourages a more equitable and mutually beneficial approach to labour migration, promoting not only economic growth but also the improvement of working conditions, rights, and skills transfer for migrant workers. The emphasis on collaboration and cooperation between countries is a central theme throughout the report.

"The ILO's Multilateral Framework on Labour Migration outlines the ILO's principles and guidelines for a rights-based approach to labour migration. This framework also provides guidelines on the protection of the rights of migrant workers and their families, including the promotion of decent work for all. The framework also outlines a comprehensive set of principles and guidelines for approaching labour migration from a rights-based perspective. The report places human rights and dignity at the core of labour migration, emphasising the need to protect and promote the rights of migrant workers and their families throughout all stages of the migration process. It underscores the importance of safeguarding the fundamental rights of migrant workers, including equality of treatment, freedom from discrimination, and access to social protection, irrespective of their legal status. The report advocates for decent work for all migrant workers, ensuring that employment is characterised by fair wages, safe working conditions, and social protection. It emphasises the principle of non-discrimination, stressing that migrant workers should not face discriminatory practices based on their nationality, race, gender, or other characteristics. The report recognises the vulnerability of certain groups of migrant workers, such as domestic workers and irregular migrants, and calls for special measures to ensure their rights and well-being.

It promotes the social integration of migrant workers, acknowledging their role in contributing to host countries and the importance of fostering harmonious relationships between migrant and host communities. The report highlights the necessity of providing migrant workers with access to justice mechanisms to address grievances and violations of their rights. It supports the principle of keeping families together and ensuring the rights of migrant workers and their families to family life.

The report advocates for cooperation and partnerships between countries of origin and destination to ensure the protection of migrant workers and the fulfilment of their rights. It encourages the collection of data on labour migration to inform evidence-based policies and ensure the effective implementation of rights-based approaches.

The ILO (2017) report provides an overview of the migration, employment, and labour market trends in Asia, including the factors that drive migration, the challenges faced by migrant workers, and the role of labour market policies in promoting decent work for all. This report offers a comprehensive insight into migration, employment, and labour market dynamics in the Asian context. Key aspects of the report include the factors propelling migration in Asia, such as economic disparities, labour market imbalances, demographic changes, and social factors, highlighting the diversity of migration drivers across the region. It sheds light on the numerous challenges faced by migrant workers, encompassing issues like exploitation, discrimination, and the absence of labour rights, which often result from irregular migration and a lack of social protection.

The report underscores the pivotal role of labour market policies in fostering decent work for all, emphasising the significance of inclusive policies, social protection, and occupational safety and health standards in securing the rights and well-being of migrant workers. It provides a comprehensive overview of labour market trends in Asia, recognising the diverse roles that migrant workers play, including both low-skilled and high-skilled labour, in contributing to economic growth and development in host countries.

The report acknowledges the gender-specific challenges faced by female migrant workers and underscores the importance of gender-responsive policies and practices. It also highlights the imperative of social integration, emphasising the role of policies and practices that encourage harmonious relationships between migrant and host communities. The report advocates for the collection of data and evidence to inform policy development and decision-making in addressing labour market challenges and promoting the rights of migrant workers.

Technology, climate change, globalisation, and demography are seen as key megatrends within the context of the world of work and are projected to play a defining role in the upcoming years, if not now (ILO, 2018). It is critical to ensure the understanding of how these trends might influence work, skills, and society to prepare for the changes to come for the sustainability of industry or businesses. According to the International Labour Organisation Report (2013) on the Tripartite Technical Meeting on Labour Migration, it emphasises the importance of having in place processes for skills recognition to prevent brain waste and deskilling, poor labour market integration and deterioration of working conditions for all workers. This was motivated by a lack of skills recognition processes, especially for low- and medium-skilled migrant workers. This has resulted in migrants frequently encountering difficulties in articulating their experiences from the destination countries into better human resources development opportunities on their return.

Fragomen's Worldwide Immigration Trends Report (2024) tracks the changes surrounding the key drivers and themes of immigration policy by analysing several key evolving political, economic, and cultural factors.Aspects that include the evolving immigration policy landscape and short- and long-term implications for the mobility of employees and their employers are covered. They argue that global competition for talent continues despite the effects of the pandemic. The findings indicate that 87% of companies have skills gaps or expect to within a few years.

Global Power Asymmetries in Migration

The asymmetries of power and capital are especially evident when examining migration trends. Historically, colonialism established the Global North as the

economic centre, extracting resources, labour, and wealth from colonies. These historical processes set in motion long-term patterns of economic dependency and underdevelopment in the Global South, which in turn push many individuals to seek opportunities elsewhere (Bhargava, Docquier & Moullan, 2011). Post-colonial states, particularly in Africa, Asia, and Latin America, are often marked by weak infrastructure, unstable political systems, and limited economic opportunities, propelling skilled and unskilled workers alike to emigrate to wealthier nations (Massey, et al., 2014).

O'Reilly (2016) in *The Routledge Handbook of Immigration and Refugee Studies* suggests that migration today is driven by both structural and individual-level motivations that are shaped by global inequalities. He further suggests that migrants from the Global South are often seeking opportunities unavailable in their home countries due to neoliberal economic policies that prioritise privatisation and market liberalisation over public investment and social welfare. These policies exacerbate inequalities and compel people to move toward countries where capital and job opportunities are more abundant, though often inaccessible.

The Need for Theorizing Migration in Power and Capital Flows

Morawska's (2012) work on historical-structural models of migration emphasises the importance of contextualising migration within the larger global flow of capital and power. Morawska (2012) argues that migration flows are not random but are structured by the dynamics of capital, labour, and political alliances that favour wealthy nations. The "pull" factors in wealthier countries, such as higher wages and better living conditions, are closely tied to their historical and current positions as centres of capital and industry. Meanwhile, the "push" factors in poorer countries are largely the result of underdevelopment, political instability, and economic policies that serve the interests of wealthier nations (Shachar, 2017). The movement of people, therefore, follows the same pathways as the movement of capital, highlighting the structural inequalities between sending and receiving countries.

This theorisation is vital in framing migration as more than an individual choice; it is an outcome of global systems that perpetuate inequality. Migration is often a means for individuals to access the wealth, safety, and opportunities that are unequally distributed across the globe. However, as many theorists argue, the migration of

labour also serves the needs of capital in host countries, often fulfilling labour shortages in low-wage sectors or areas where local populations are unwilling to work. Thus, migration under neoliberalism reinforces global labour hierarchies and supports the extraction of labour from poorer nations to wealthier ones.

Issues of Race, Gender, and Class in Migration

The dynamics of race, gender, and class play a critical role in shaping migration patterns and outcomes. Migration is not a neutral or universal experience; it is deeply stratified by identity and social position. For example, migrants of African or Middle Eastern descent often face systemic discrimination and barriers in Western host countries, encountering stereotypes and racial biases that affect their employment opportunities, legal status, and social integration (Wallerstein, 2018).

Gender also intersects with migration in significant ways. Feminized labour sectors, such as domestic work and caregiving, draw many migrant women, often from marginalized backgrounds, who fill roles in care economies that are undervalued and underpaid in receiving countries Adams & Page, (2005). These women are frequently subject to exploitative working conditions and lack the labour protections afforded to citizens, reflecting the gendered nature of migration within capitalist structures.

Class further complicates migration, as skilled migrants are often more readily accepted and given better opportunities compared to unskilled migrants who may face restrictive immigration policies and exploitative working conditions. Wealthy nations prioritize migrants who can contribute economically, underscoring the ways in which capital dictates who is “welcome” and who is not welcome. Barkhuizen, et al. (2019).

The Critique of Capitalist, Neoliberal, and Eurocentric Paradigms in Migration

The capitalist and neoliberal frameworks that govern much of the global economy prioritize profit and efficiency over equity and justice, often to the detriment of migrants. King, (2012). The Eurocentric paradigm that underpins much of migration policy in the Global North tends to portray Western nations as inherently more desirable or “civilized” destinations, reinforcing a colonial view that valorises Western life and disparages life in the Global South. This perspective is not only outdated but deeply problematic, as it overlooks the agency of migrants and the intrinsic value of their home countries Facchini, Mayda & Mendola, (2018).

Neoliberal policies in migration encourage labour mobility to meet economic demands in host countries, yet they often disregard migrants' rights and well-being, viewing them as temporary economic inputs rather than as individuals with lives, families, and aspirations Crush, Chikanda & Skinner, (2019). This commodification of migrant labour serves to reinforce global inequalities, as migrants are expected to leave when their labour is no longer needed, underscoring the disposable view that neoliberal capitalism takes toward non-citizen labour.

Muted Questions of Equity and Justice

As O'Reilly (2016) and Morawska (2012) both suggest, debates about migration are often divorced from questions of equity and justice. The focus on managing migration flows, border control, and economic integration frequently overshadows the more complex issues of migrant rights, social equity, and global justice. Migrants, particularly those from marginalised backgrounds, face systemic inequalities and are denied full participation in their host societies, where their labour is valued but their rights and well-being are often overlooked.

To address these inequities, scholars argue that a reframing of migration within a justice-centred approach is essential (O'Reilly, 2023); Development Policy Research Unit Report, (2022). This approach would shift the conversation from merely managing migration to fostering environments that promote fair labour practices, protect migrants' rights, and recognize the structural forces that compel migration in the first place. Only by engaging with these larger questions can we move toward a more equitable understanding of migration that challenges the deep-rooted inequalities perpetuated by current systems of power and capital.

The growing migration of skilled South African citizens within the Petrochemical Sector

In South Africa, emigration of skilled personnel has become a significant concern, particularly in the wake of the country's transition to democracy in the 1990s (Bryant, 2010). Many skilled South Africans, particularly those from white minority communities, have left the country due to concerns about crime, political instability, and limited job opportunities Tevera, (2008). This trend has raised concerns about the

loss of human capital and the potential impact on the country's development prospects (Van der Berg, 2011).

According to Statistics South Africa (Stats SA), the emigration of skilled personnel from South Africa has been a significant trend over the past few decades. A recent report by Stats SA (2020) revealed that between 2011 and 2016, over 420,000 South Africans emigrated to other countries, and a significant proportion of them were skilled personnel.

The report also highlighted that the emigration of skilled personnel from South Africa was primarily driven by determinants such as limited job opportunities, better salaries and benefits, and concerns about crime and safety in the country. Based on this report, the top destinations for South African skilled migrants were the United Kingdom, Australia and the United States.

South Africa is further challenged with the problem of achieving the balance between obtaining enough students and having enough lecturers and professionals to teach and train them (Cameron,(2008). According to Lawless (2020), there are simply not enough lecturers in the system for South Africa to meet its goal of graduating 1 000 more engineers a year than the current level of 1 300. Lecturers are reportedly swamped with work and have become indentured ‘slaves to the system’ (Altman & Esterhuizen, 2017). Furthermore, Lawless (2020) states that, “Within tertiary institutions, respect for the lecturing professionals has ceased to exist. They are faced with a choice between sticking it out in academia with its modest financial rewards and many stresses or offering their services in a workplace that has a desperate need for engineering professionals and artisans. It is not a healthy environment for them to be in.” This does not bode well for the future training of engineers in South Africa.

Once students have graduated, they still need to obtain appropriate experience and be guided by a mentor for them to become fully fledged engineers (Bhorat, Mayet & Visser, 2021). However, without experienced engineers who have the time and capacity to integrate new engineers into the system, they will remain relatively ineffective. For this reason, many companies and institutions have embarked upon

exercises to recruit retired engineers to fulfil a mentoring and training role (Facchini, Mayda & Mendola, 2019).

2.10 The rationale for the study in relation to the literature analysis and discussions

The mass exodus of skilled professionals from the petrochemical sector creates incapacity for the country. Part of the scope of this research encompasses a comprehensive review of prior studies on the emigration of skilled labour within the context of South Africa. However, a notable gap in existing literature pertains to the petrochemicals sector, wherein determinants are examined from various perspectives alongside an exploration of retention strategies and their implications for this specific industry. Noteworthy works within the domain of skilled labour migration from South Africa include studies by H. Bhorat, JB Meyer, and C. Mlatsheni (2002), who delved into the broader landscape of skilled labour migration within South and Southern Africa.

Additionally, Brink's work in 2012 sheds light on the factors contributing to the emigration of skilled South African migrants to Australia, while Ellis (2008) contributed insights into the role of skilled labour in South Africa's international migration dynamics. Furthermore, Meyer's (2002) study specifically focused on the migration patterns of skilled and highly skilled workers within South Africa. The following subsections discuss common challenges in the petrochemical sector.

2.10.1 Decreased Operational Efficiency

Decreased operational efficiency in the petrochemical sector can have several adverse results, impacting both the industry and the broader economy. These consequences can manifest in various ways and affect safety, environmental sustainability, profitability, and overall competitiveness. Reduced operational efficiency may lead to an increase in safety incidents and accidents within petrochemical facilities. Inefficient processes, inadequate maintenance, and operational errors can contribute to a higher risk of incidents, endangering the lives of workers and the surrounding communities (Mannan, 2017). Inefficiencies in the petrochemical sector can result in higher emissions, waste generation, and

environmental pollution. Failure to optimise processes and implement sustainable practices may contribute to negative environmental impacts, affecting ecosystems and public health. Decreased operational efficiency often leads to more frequent breakdowns and unplanned shutdowns. This can result in significant downtime for production facilities, affecting the supply chain, delaying product deliveries, and leading to financial losses (Towler & Sinnott, 2013).

Inefficient operations contribute to higher production costs, resource wastage, and lower overall productivity. This can lead to reduced profit margins, making it challenging for companies to compete in the global market Turton, Bailie, Whiting & Shaeiwitz, (2012). Industries that lag in operational efficiency may struggle to remain competitive in the global market. Efficient operations are often linked to innovation and the ability to adapt quickly to market demands. A lack of efficiency may hinder a company's ability to invest in research and development (World Economic Forum, 2018). All this has adverse effect on employee wellbeing and retention.

According to (Simchi-Levi, Schmidt & Wei,2014), inefficiencies within the petrochemical sector can disrupt the entire supply chain. Delays in production and distribution can impact downstream industries that rely on petrochemical products, affecting various sectors of the economy. A lack of operational efficiency may lead to difficulties in meeting regulatory requirements and compliance standards. Non-compliance can result in legal challenges, fines, and damage to a company's reputation (U.S. Environmental Protection Agency, (2020). Efforts to enhance operational efficiency in the petrochemical sector often involve adopting best practices, investing in technology and automation, and prioritising safety and environmental sustainability. Regular audits, training programmes, and continuous improvement initiatives are crucial for mitigating the adverse effects of decreased operational efficiency.

2.10.2 Environmental Factors and Safety Risks

The petrochemical sector is subject to ongoing critical debates concerning its environmental impact and safety risks. These debates are crucial, as they involve balancing the industry's economic contributions with potential adverse effects on the

environment and public safety. The petrochemical sector is a significant contributor to greenhouse gas emissions and climate change. There is an ongoing debate about the industry's responsibility to reduce its carbon footprint, transition to cleaner technologies, and contribute to global efforts to combat climate change (International Energy Agency [IEA], (2019).

According to Geyer, Jambeck & Law (2017), the production and disposal of plastics derived from petrochemicals contribute to environmental pollution. There is an ongoing debate about the responsibility of the petrochemical industry to address plastic waste through recycling, circular economy initiatives, and the development of alternative materials. Safety risks in petrochemical facilities, including the potential for accidents, chemical spills, and explosions, are subjects of ongoing debate. Balancing the need for production efficiency with maintaining high safety standards is a central point of discussion (Mannan, 2017). The effectiveness of regulatory frameworks and industry practices in ensuring environmental protection and safety is a debated topic. Discussions revolve around the need for stricter regulations, transparent reporting, and the role of industry self-regulation (U.S. Chemical Safety Board, 2016).

The impact of petrochemical operations on the health of nearby communities and the concept of environmental justice are subjects of ongoing debate. Discussions often revolve around the need for transparent communication, community engagement, and addressing the disproportionate burden of environmental risks on marginalised communities. (Bullard, 1993). There is ongoing debate about the role of technological innovation in reducing environmental impact and safety risks in the petrochemical sector. Discussions include the feasibility of implementing advanced technologies, such as artificial intelligence and process automation, for risk mitigation Zhang, Zhang & Lou, (2019). The petrochemical industry faces challenges in obtaining and maintaining public trust. Debates here revolve around the industry's efforts to secure a social licence to operate, communicate transparently with the public, and address concerns related to environmental and safety risks (Davies & Cohen, 2019).

2.10.3 Technological Stagnation

Debates around technological stagnation in the petrochemical sector are influenced by various factors. While advancements have been made, concerns exist regarding the pace of innovation and the sector's ability to address evolving challenges. The EIA (2021) argues that the petrochemical sector has been slow to adopt and invest in sustainable and green technologies, which could contribute to environmental challenges. The reliance on traditional processes and feedstocks raises concerns about the sector's long-term viability. Other discussions revolve around the level of investment in research and development within the petrochemical sector. Some argue that insufficient funding for innovation hampers the industry's ability to explore and implement breakthrough technologies IEA, (2019).

Critics suggest that stringent regulations may act as a barrier to the rapid adoption of new technologies in the petrochemical sector. Balancing compliance with environmental standards and fostering innovation is seen as a challenge (OECD, 2019). Some argue that the petrochemical industry has been slow in embracing digitalization and Industry 4.0 technologies. The integration of smart technologies, data analytics, and automation could enhance efficiency and competitiveness (World Economic Forum, 2018). However, concerns exist about the competitive landscape of the petrochemical sector and whether market dynamics incentivise companies to invest in technological advancements. A lack of competition or market monopolies may reduce the impetus for innovation (Cefic European Chemical Industry Council, 2021).

Some argue that a lack of global collaboration and knowledge sharing in the petrochemical industry hinders progress. Encouraging cooperation on technological challenges could expedite the development and implementation of innovative solutions (UNIDO). The transition to bio-based feedstocks and the adoption of a circular economy approach are debated. Critics argue that resistance to these shifts may impede progress toward a more sustainable and innovative petrochemical sector (Ellen MacArthur Foundation, 2019). These debates highlight the challenges and differing perspectives on technological stagnation in the petrochemical sector.

2.10.4 Difficulty in Succession Planning

Succession planning in the petrochemical sector involves preparing for the replacement of key personnel, particularly those in leadership positions, to ensure a smooth transition and the continued success of the organisation. Several key factors and critical debates surround succession planning in this industry. One critical debate revolves around whether succession planning as presented by Charan, Drotter & Noel (2001); should prioritise technical expertise in the petrochemical field or emphasise leadership and management skills. Balancing both is essential for continuity and effective decision-making. The petrochemical industry often operates globally, and there is a debate about the importance of a diverse and globally experienced leadership team. Some argue for a focus on a diverse talent pool to bring varied perspectives and experiences. Adler, N. J. (2002). Succession planning in the petrochemical sector must address key technical roles, where specialised knowledge is crucial. There is a debate about how to identify and groom individuals with the necessary technical expertise to fill these critical positions (Rothwell, 2010).

The petrochemical sector faces challenges related to knowledge transfer, especially with an ageing workforce. The debate centres around how to effectively transfer critical knowledge from experienced professionals to younger employees and retain institutional knowledge (Kram & Isabella, 1985). There is a debate about striking the right balance between addressing short-term leadership needs and developing a long-term succession plan. Organisations must ensure continuity while also investing in the development of future leaders, as argued by Conger & Fulmer (2003). With the increasing role of technology and digitization in the petrochemical sector, there is a debate about the importance of including individuals with strong digital skills in the succession planning process (Ross, Beath & Goodhue, 1996).

Organisations debate whether to prioritise internal talent development or seek external candidates for leadership roles. Striking the right balance and having a flexible approach based on the specific needs of the organisation is crucial (Ready & Conger, 2007). Organizations debate the extent to which they should have emergency succession plans in place, especially considering unexpected events like the sudden departure or incapacitation of key leaders (Charan, Barton & Carey, 2014). The

petrochemical industry is dynamic, and the debates around succession planning may evolve based on industry trends, technological advancements, and workforce demographics. Organisations in this sector must continually reassess their succession planning strategies to stay responsive to changing conditions.

2.10.5 Loss of Industry Expertise

The brain drain and loss of critical skills and industry expertise in the petrochemical sector can have significant implications for innovation, safety, and overall competitiveness. Several key factors contribute to this phenomenon, leading to critical debates within the industry. According to the World Economic Forum (2018), the petrochemical sector faces challenges in retaining skilled professionals due to the global nature of the industry. Skilled workers may be attracted to opportunities in other countries with better compensation, work environments, and career prospects.

The petrochemical sector competes with other industries, including technology and renewable energy. Skilled professionals may be drawn to these sectors, where innovations and advancements are seen as more dynamic and environmentally sustainable (Renn& Walker, 2008). Inadequate investment in employee training and development programs may contribute to the loss of critical skills. Skilled workers may seek opportunities in industries that offer better prospects for professional growth (Fawzy & Nichani, 2016).

Perceptions of the petrochemical industry as being less attractive or innovative can impact job satisfaction. Skilled professionals may leave the sector for industries perceived as more rewarding or aligned with personal values. Rose, M., & McMillan, J. (2017). The petrochemical industry often grapples with an ageing workforce. The lack of effective succession planning and knowledge transfer mechanisms may lead to the loss of critical skills as experienced professionals retire.Capgemini Research Institute. (2018). Economic and political instability in certain regions can drive skilled workers away from the petrochemical sector. Factors such as currency fluctuations, political unrest, and uncertain economic conditions may contribute to brain drain (OEC World, 2021).

The increasing adoption of technology and automation in the petrochemical sector may require a shift in skill sets. Workers may leave if they feel their current skills are becoming obsolete and not aligning with the industry's technological advancements (Deloitte, 2020). Addressing these challenges requires a holistic approach, including investments in talent development, by the South African government and the private sector, including fostering a positive work environment, and adapting to technological advancements. Continued research and industry-wide discussions are essential to finding effective solutions to retain critical skills and expertise in the petrochemical sector.

2.10.6 Reduced Competitiveness

Reduced competitiveness in the petrochemicals sector is a complex issue that involves various critical debates. Several key factors contribute to discussions on the challenges and opportunities facing the industry. The debate often revolves around the availability and pricing of feedstocks, such as crude oil and natural gas, which are essential raw materials for the petrochemical industry. Fluctuations in feedstock prices can significantly impact the competitiveness of petrochemical products (Ashford & Hall, 2011). Petrochemical companies face challenges related to global market dynamics, including competition from emerging economies, geopolitical uncertainties, and trade policies. The debate focuses on strategies for maintaining competitiveness in a rapidly changing global market (International Energy Agency, 2018).

There is an ongoing debate about the impact of environmental regulations on the petrochemical industry's competitiveness. Stricter environmental standards and the need for sustainable practices may increase operational costs and pose challenges for compliance (Davis & Luketa, 2019). The adoption of advanced technologies and Industry 4.0 practices in the petrochemical sector is a subject of debate. Some argue that embracing innovation is crucial for competitiveness, while others discuss the challenges and risks associated with implementing new technologies World Economic Forum, (2019). The resilience of petrochemical supply chains is a critical debate, especially in the context of disruptions caused by events such as natural disasters, pandemics, or geopolitical tensions. Discussions focus on strategies to enhance supply chain resilience and minimize risks (Simchi-Levi, Schmidt& Wei, 2015). The petrochemical industry is grappling with the global energy transition and the shift

towards sustainable practices. There are debates about the industry's role in a low-carbon future and the challenges of balancing economic competitiveness with environmental responsibility (International Energy Agency, 2020).

Some debates focus on the need for petrochemical companies to diversify their product portfolios and focus on value-added products. Discussions often explore strategies for moving beyond commodity chemicals to enhance competitiveness European Chemical Industry Council, (2019). Workforce-related challenges, including skill shortages, labour costs, and workforce development, are debated in the context of petrochemical industry competitiveness. Discussions revolve around strategies for attracting and retaining skilled talent (Society of Petroleum Engineers, 2019). It is worth noting that the petrochemical industry's competitiveness is influenced by the dynamic interaction of these factors. These debates are ongoing, and industry stakeholders, policymakers, and researchers continually engage in discussions to address challenges and identify opportunities for improvement.

2.10.7 Talent Recruitment and Retention Challenges

The petrochemical sector faces several critical debates and challenges in talent recruitment and retention. Key factors contributing to these challenges include a rapidly changing industry landscape, skill shortages, and demographic shifts. The World Economic Forum (2018) argues that the petrochemical sector is undergoing rapid technological advancements, including digitalisation, automation, and artificial intelligence. There is a debate about the industry's ability to attract and retain talent with the necessary skills to navigate these technological changes. The factors are the shortages of workers with expertise in emerging technologies coupled with the need for continuous upskilling and training programmes.

The industry is grappling with an ageing workforce, according to Deloitte (2020), and there's a debate about how to attract and retain younger talent to ensure a sustainable workforce for the future. This factor is associated with the retirement of experienced professionals leading to a knowledge gap and limited measures to ensure that there are adequate skills transfers to the younger engineers joining the sector. Moreover, attracting and retaining younger generations with different career expectations. The

petrochemical sector faces global competition for skilled professionals, and there's a debate about how companies can attract and retain top talent in the face of this competition. Key factors such as the international mobility of skilled workers are unavoidable, as is the attractiveness of other industries and sectors.

Interestingly, there is an ongoing debate about the lack of diversity in the petrochemical sector and the importance of fostering an inclusive work environment encompassed by the factors that deal with gender and ethnic diversity challenges and the impact of a lack of diversity on innovation and problem-solving. Catalyst (2018). The petrochemical industry has traditionally been associated with demanding work schedules and high-pressure environments, leading to a debate about the need to improve work-life balance and employee well-being. Employee burnout and mental health concerns are some of the factors that also have an impact of work-life balance on talent retention (McKinsey & Company, 2019).

Increasing emphasis on sustainability and environmental responsibility raises the question of how companies in the petrochemical sector can attract and retain talent by aligning with these values. Addressing these challenges requires a multi-faceted approach, including strategic workforce planning, investment in training and development, fostering a diverse and inclusive workplace, and adapting to changing expectations regarding work-life balance and corporate responsibility. Companies in the petrochemical sector are increasingly recognising the importance of talent management strategies to ensure a skilled, motivated, and sustainable workforce.

Secondly, importing these skills comes at a high cost. This implies that the massive exodus of skilled professionals from the petrochemical industry cannot be ignored. The high costs also contribute to or have an impact on the following:

a. Visa and Immigration Regulations

   The petrochemical sector, like many other industries, faces critical debates and challenges related to importing skills, particularly concerning visa and immigration regulations. The petrochemical sector often requires specialised skills and expertise that may not be readily available in the local labour market. As a result,

companies may seek to import skilled workers from other countries to fill critical roles (World Economic Forum, 2018). Stringent visa and immigration regulations can pose challenges for companies attempting to bring in foreign talent. Lengthy and complex processes may hinder the timely entry of skilled professionals, impacting project timelines and overall productivity (Bhagwati & Hanson, 2009). The financial costs associated with obtaining visas and navigating immigration processes can be substantial. Companies may need to allocate resources for legal fees, application costs, and compliance measures, contributing to the overall administrative burden (OECD,2014). There is an ongoing debate about the potential impact of importing skilled workers on the local workforce. Concerns may arise regarding job competition, wage suppression, and the development of local talent if companies prioritize foreign workers (United Nations, 2019). National immigration policies and regulations play a crucial role in determining the ease with which skilled workers can be imported. Debates often centre around the alignment of these policies with the needs of industries and the potential impact on the host country's economy. International Organization for Migration (IOM). Importing skilled workers can contribute to diversity within the workforce, bringing in a range of perspectives and experiences. However, challenges may arise in creating an inclusive work environment that fosters collaboration among a diverse group of professionals (Cox& Blake, 1991). The challenges associated with importing skills can vary based on the region and the specific dynamics of the petrochemical industry in that area. Local factors, economic conditions, and industry demands all influence the nature of the debate (Ferreira& Soares, 2016). These debates can evolve based on changes in immigration policies, economic conditions, and the evolving needs of the petrochemical industry.

2.10.8 Cost and Compensation or Remuneration

The petrochemical industry, critical to global economic infrastructure, is currently grappling with a significant challenge; this involves the massive exodus of skilled professionals. This phenomenon is driven by various factors, with remuneration and compensation playing a pivotal role. It is imperative to also examine the challenges associated with this mass departure, emphasising the complex interplay between

remuneration structures, compensation strategies, and the broader implications for the industry. Exploring the global talent competition, the sector has vast remuneration dynamics where skilled professionals in the petrochemical sector are often lured by lucrative offers from competing industries. The global nature of talent acquisition intensifies the competition for highly specialised workers.

In South Africa, it becomes close to being impossible to compete and counter offer the packages being offered. Where compensation benchmarks are conducted, the sector faces challenges in establishing competitive compensation packages that not only attract but also retain skilled professionals. Benchmarking against other sectors becomes crucial, raising concerns about affordability and sustainability (Mercer, 2021).

There is a noted impact on organisational knowledge and institutional memory as far as brain drain is concerned, the massive exodus results in a 'brain drain,' eroding institutional knowledge and expertise. This poses long-term risks to the industry's innovation capacity and ability to adapt to technological advancements. This has a cost that is associated with knowledge transfer that is replacing departing professionals requires extensive onboarding and knowledge transfer processes for new hires.

The costs associated with these processes contribute to the financial burden on organisations (Reilly & Karounos, 2009). Furthermore, there are operational disruptions that lead to significant project delays, as the departure of skilled professionals can lead to mega project delays, affecting the industry's operational efficiency. These delays can have cascading effects on production schedules and overall business performance; this may also affect the projections on service delivery and profits. Inadequate staffing levels due to the exodus pose risks to safety standards and regulatory compliance. The industry's reputation may suffer from incidents caused by understaffing and inexperienced replacements (Mannan, 2017).

Skilled professionals left behind may experience growing discontent due to the perceived inequality in remuneration. This can lead to decreased morale, lower productivity, and increased turnover, exacerbating the talent drain. Balancing the need

to retain talent with maintaining equitable compensation structures is a formidable challenge. Organizations must navigate this delicate balance to ensure fairness and employee satisfaction World at (Work, 2021). The massive exodus of skilled professionals from the petrochemical industry, driven primarily by remuneration and compensation challenges, poses multifaceted threats. Global talent competition, knowledge loss, operational disruptions, and compensation inequality are interconnected issues that demand strategic, comprehensive solutions. The industry must address these challenges holistically to safeguard its long-term viability and competitiveness in the global marketplace. It necessitates a delicate equilibrium between attracting and retaining skilled professionals and ensuring sustainable compensation practices that align with organisational and industry realities. Failure to navigate these challenges may result in a weakened petrochemical sector, impacting not only individual companies but also the broader economic landscape.

2.10.9 Skill Set Alignment

The petrochemical industry, characterised by its complex and specialised nature, often faces emigration challenges related to the skill set alignment of professionals seeking opportunities in host countries. The global nature of the petrochemical industry often prompts skilled professionals to seek opportunities beyond their home countries (Khadria, 2003). The migration of talent has become a prevalent trend, driven by the pursuit of career growth, international exposure, and better working conditions.

One of the primary challenges lies in aligning the skill sets of emigrating professionals with the specific needs of host countries (Migration Policy Institute, 2018). While petrochemical expertise is transferable, differences in technology, regulations, and industry practices may pose hurdles Rosenblum & Ruiz Soto, (2016). The recognition of foreign academic and professional credentials is a critical aspect influencing the integration of skilled professionals. Host countries may face challenges in evaluating and accepting qualifications obtained in different educational systems (Economic Policy Institute 2014).

Stringent licensing and regulatory requirements in host countries can impede the smooth integration of skilled professionals (Chellaraj, Maskus & Mattoo, 2005). Petrochemical engineers may face challenges in obtaining necessary certifications and licenses U.S. Department of Labour, (2021). Apart from technical skills, cultural and language differences can pose challenges in effective communication and collaboration (Suárez-Orozco & Suárez-Orozco, 2001). Emigrating professionals may encounter difficulties in adapting to the work culture of the host country Ward, Bochner & Furnham, (2001). The emigration challenges associated with skill set alignment in the petrochemical industry are multifaceted, encompassing issues related to global talent migration, skill mismatch, credential recognition, regulatory barriers, and cultural differences. Addressing these challenges requires collaborative efforts between sending and receiving countries, industry stakeholders, and academic institutions to create a more seamless and mutually beneficial migration environment.

Brain drain in the petrochemicals sector in South Africa, particularly concerning skills set alignment, knowledge transfer, and professional skills retention, is a multifaceted issue that has been addressed in various scholarly works. Synthesising literature on this topic provides insight into the challenges faced and potential strategies for mitigating the negative impacts. Several studies highlight the importance of aligning skill sets with the needs of the petrochemicals sector. Research by Tettey and Smit (2016) emphasises the significance of educational and vocational training programmes tailored to the industry's requirements. They argue that a disconnect between skills acquired through education and those demanded by the sector contributes to brain drain as skilled workers seek opportunities elsewhere.

The issue of knowledge transfer is explored in-depth by Mazzarol and Soutar (2002), who discuss the implications of knowledge loss due to emigration of skilled professionals. They emphasise the need for effective knowledge management practices within organisations to capture and transfer tacit knowledge before it is lost. Additionally, collaborative efforts between industry and academia are proposed to facilitate knowledge exchange and skill development. Strategies for retaining professional skills in the petrochemicals sector are examined by Govender et al.

(2018). They suggest that offering competitive salaries and benefits, career development opportunities, and a conducive work environment can help retain skilled workers. Furthermore, creating a culture of innovation and continuous learning within organisations is identified as crucial for employee engagement and retention.

Literature also discusses the role of policy interventions in addressing brain drain. Bhagwati and Dellalfar (2009) advocate for policies that incentivise skilled professionals to remain in South Africa, such as tax incentives or loan repayment schemes for individuals pursuing education in critical fields. They also highlight the importance of policies aimed at improving the overall business environment to attract and retain skilled workers. In addition, case studies and best practices from other countries facing similar challenges offer valuable insights. For example, research by Akinyemi and Adeyemi (2017) examines successful strategies employed by Nigeria to retain skilled professionals in the oil and gas sector, including investment in infrastructure, technology, and human capital development.

In synthesising literature, it becomes evident that addressing brain drain in the petrochemicals sector requires a holistic approach that encompasses skills development, knowledge management, organisational practices, and supportive policy frameworks. Collaborative efforts between industry stakeholders, government entities, and educational institutions are essential for fostering an environment conducive to skills retention and sustainable growth in the sector.

The importance of workforce integration and diversity in addressing brain drain in the petrochemicals sector is underscored by several scholars. Hlatshwayo and Meyer (2019) emphasise that fostering a diverse and inclusive workplace not only enhances employee morale and productivity but also contributes to skills retention by creating an environment where all employees feel valued and respected. Additionally, diverse teams are often more innovative and adaptable, which can be advantageous for companies in the rapidly evolving petrochemical industry (Cooke & Saini, 2010).

Literature suggests that incorporating workforce integration and diversity into retention strategies is critical for mitigating brain drain. Research by Nkomo and Hoque (2019) highlights the importance of implementing policies and programmes that promote

equal opportunities for career advancement and professional development among employees from diverse backgrounds. For instance, mentorship programmes, diversity training, and leadership development initiatives can help nurture talent and retain skilled professionals within the sector.

Structural barriers to workforce integration and diversity, such as unequal access to education and training opportunities, must be addressed to effectively retain professional skills. Mckinsey & Company (2017) argue that investing in education and skills development for under-represented groups, such as women and minorities, is essential for building a pipeline of diverse talent in the petrochemicals sector. Moreover, creating inclusive hiring practices and promoting diversity at all levels of the organization can help overcome biases and ensure that all employees have an equal opportunity to contribute and advance in their careers (Ely & Thomas, 2001).

Case studies and best practices from other industries or countries can offer valuable insights into effective strategies for promoting workforce integration and diversity in the petrochemicals sector. For example, research by Dabla-Norris et al. (2019) examines successful initiatives implemented in the technology sector to attract and retain diverse talent, such as flexible work arrangements, parental leave policies, and diversity-focused recruitment efforts. Adopting similar practices tailored to the specific needs of the petrochemical industry in South Africa can help enhance skills retention and mitigate brain drain.

Promoting workforce integration and diversity is essential for addressing brain drain in the petrochemicals sector in South Africa. By implementing retention strategies that prioritise inclusivity and equal opportunities, companies can create a more resilient and sustainable workforce while also fostering innovation and growth in the industry.

There is an indication that the technological advancements attract engineers to seek opportunities on a regular basis due to continuous technological advancements in the petrochemical industry that drive the need for skilled engineers who can then navigate and implement new technologies. Engineers proficient in areas such as process optimisation, automation, and digitalisation are particularly sought after. Literature indicates that process optimisation is one of the processes that involves improving the

efficiency of chemical processes to enhance productivity, reduce costs, and minimise environmental impact. Engineers in the petrochemical industry focus on optimising reaction pathways, improving yield, and maximising resource utilization (U.S. Department of Energy, 2019). Process engineers are thus on a list of skills that are in high demand.

Another aspect is automation in the petrochemical industry that involves the use of advanced control systems, sensors, and instrumentation to manage and control processes. Automation enhances safety, accuracy, and overall process control (Mannan, 2017). The petrochemical industry is adopting digital technologies, including the Industrial Internet of Things (IIoT), big data analytics, and artificial intelligence. This digital transformation, often referred to as Industry 4.0, enables real-time monitoring, predictive maintenance, and data-driven decision-making (World Economic Forum, 2017). These skills are also essential in the petrochemicals sector.

Advances in materials science, including nanotechnology, play a crucial role in developing new catalysts, polymers, and other materials with improved properties. Petrochemical engineers explore these innovations to enhance product performance and sustainability (Gao, Inoue& Shibata, 2019). As sustainability becomes a central focus, engineers are developing and implementing green chemistry principles. This involves designing processes that minimize the use of hazardous materials, reduce waste, and lower energy consumption (Anastas& Warner, 1998).

Engineers use advanced simulation and modelling tools to analyse and predict the behaviour of chemical processes. This aids in designing optimal processes, troubleshooting, and improving safety Zhang, Zhang & Attar, (2018). These are the insights into the various aspects of technological advancements in the petrochemical industry that have an impact into having engineers within the petrochemicals sector emigrating. The interconnectedness of global markets means that developments in one part of the world can impact industries and job markets in developed countries. Changes in the global supply and demand for petrochemical products can influence the need for engineers in developed nations.

The petrochemical industry is research-intensive, with a continuous need for innovation and development of new products and processes. Countries with strong R&D capabilities are likely to have a higher demand for petrochemical engineers. Regulatory frameworks and government policies play a significant role in shaping the demand for petrochemical engineers.

Changes in regulations, especially those related to environmental standards and safety protocols, can impact the workforce requirements in the petrochemical industry. The availability of qualified professionals is influenced by the education and training programs offered in a country. Developed nations with well-established engineering education systems tend to produce a steady supply of skilled petrochemical engineers. Consumer demand for products derived from petrochemicals, such as plastics and synthetic materials, can impact the overall demand for petrochemical engineers. Market trends and shifts in consumer preferences can drive changes in production processes and, consequently, the demand for skilled engineers.

2.11 Other country contributing to migration

According to Van Rooyen (2000), approximately 10% of emigrants list the state of the South African economy as a reason for leaving the country. They feel that taxes are too high, their savings are being eroded by inflation, and the falling currency could result in them not being able to leave the country in future. The relatively high interest rates in comparison with most developed countries were also a cause of concern.

Van Rooyen (2000) found that 19% of emigrants give declining standards of public education and healthcare as major reasons for wanting to leave. Many children in schools had not received textbooks in 1999 or 2000, while teachers' salaries consumed almost 100% of the education budget, leaving little money for equipment and books. Those with children in private schools saw massive increases in fees as state subsidies were cut by 65% between 1995 and 1998. Education is thus considered to be a major contributor to the skills shortage and to emigration. Van Rooyen also revealed that 10% of participants cite corruption and an inefficient

government and civil service as contributing to emigration. Van Rooyen did not distinguish between the responses of participants from various professions. It was also conducted amongst those who had emigrated and not potential emigrants.

The United Nations Development Index rated 174 countries in terms of their standards of living, life expectancy and educational attainment in 2006 United Nations, Human Development Report (2006). Canada was rated first for the previous seven years, with the United States of America fourth, New Zealand ninth, the United Kingdom fourteenth and Australia fifteenth. South Africa was rated ninety-eighth.

This study will compare potential emigration destinations chosen by survey respondents with the findings of the United Nations report. The increasing cost of living may be cited as a reason for wanting to emigrate. However, Johannesburg has been ranked as the eighth cheapest city in the world for expatriates, according to the most recent Cost of Living Standards Survey from Mercer Human Resource Consulting Klein, (2008).

Moscow is the most expensive city, followed by London, while Asuncion in Paraguay is ranked as the least expensive city for the fifth year running. Mercer's annual Cost of Living Survey covers 143 cities across six continents and measures the comparative cost of over 200 items in each location, including housing, transport, food, clothing, household goods and entertainment. In addition to country-related factors discussed above which contribute to emigration, there are also several employment-related factors which could contribute to emigration. These are discussed below.

In addition to country-related factors discussed above which contribute to emigration, there are also a few employment-related factors which could contribute to emigration. These are discussed below.

a. Employment Equity Act, 1998

The main purpose of affirmative action is to correct the injustices resulting from the apartheid era South Africa. Employment Equity Act, (1998). This is to be achieved through preferential appointments of previously disadvantaged individuals. However, this could create dissatisfaction amongst those who are not from the designated group as their career advancement opportunities are perceived to be limited by the Employment Equity Act (Booysen, 2005).

b. Salary levels of engineers in South Africa

The South African Institution of Civil Engineering SAICE, (2019) says that the country is losing an alarming number of engineers and other high-level skills – and the economy is likely to suffer for it. The group, which has around 12,000 registered members, said that it has seen hundreds of engineers leave the country over the last three years, largely through emigration. SAICE reports that South Africa has excellent, experienced engineers both locally and internationally and urged the government to take action to attract them back to the country. The engineering sector in South Africa is extremely lucrative, particularly for those fortunate enough to land a government job in that field.

c. The current state of the engineering industry within South Africa

The South African Petrochemicals Industry plays a critical role in the South African economy. According to CHIETA the industry's contribution is approximately a quarter of South Africa's manufacturing production and it produces significant outputs that are used in almost all other economic sectors of industry. It is therefore clear that the petrochemicals industry plays a vital role in the South African economy. The industry contracted during the 2008/2009 recession and although it recovered in the subsequent two years, growth has been somewhat stifled again in the economic downturn to 2018. The industry is highly dependent on imports, which makes it vulnerable to global economic changes such as competition from rapidly growing chemical producers like China and India, and the exchange rate fluctuations.

In 2022, the domestic economic outlook for the next few years appears to be somewhat sluggish due to various factors such as the volatile currency, the impact of Covid 19 Pandemic, the constrained global economy, and the uncertain regulatory environment which may affect production processes and export and import prices.

According to CHIETA the Petroleum Subsector is affected by uncertainty regarding legislation such as tariffs, health and safety, waste management and other current and pending environmental legislation, while the fluctuating crude oil prices are putting companies in this sub sector under financial pressure. It should be noted that crude oil prices have slumped due to the current geo-political climate that has resulted in international trade relations uncertainty. Consequently, oil producers' have been attempting to stabilize the market. Industrial growth potential of the sector in South and Southern Africa remains undisputed partly due to Africa's economy of scale. Skills development must continue to build the competencies and capacity to unlock this potential.

The Sector Skills Plan compiled by the CHIETA reflects the 2019 Workplace Skills Plan and the Annual Training Report data. The report indicates that there were increases in the petrochemical industry's estimated employment from 2015 to 2019.

In 2018 there was a significant decline of just under 9000 employees from 169 181 in 2017 to 160 308 in 2018, however a strong recovery of just over 11 000 to 171 376 employees in 2019 as discussed in the Sector Skills Plan. The 2018 drop in employment corresponds with the sluggish economic performance seen in the sector, and the recovery may be due to business realignment as a response to economic pressures. There is a myriad of factors that impact on the performance of the industry and on the demand for skills in the sector. Some of these factors tend, however, to increase the demand for high-level and specialised skills. The industry is dependent on professional and technical skills which are in short supply locally and globally. The dependence of industry on these skills makes it more

susceptible to occupational shortages because of the long lead times in the training of high-level and specialised skills.

Regarding the requirements of the Employment Equity Act, that is, racial equity in employment in the industry, White people dominate managerial and professional occupations, followed by the African people. African women are particularly under-represented in the managerial and professional occupations. Transformation therefore remains an important objective for the sector and is a transversal theme that this sector is grappling with, just as other economic sectors are. This also poses a concern if Black engineers are emigrating to international countries where there are employment equity targets that must be met to address the issues of transformation. The industry is highly regulated, and organisations must contend with a host of local and, in many cases, international legislative and regulatory requirements. Regulations are also ever-changing, and organisations must keep up to remain compliant.

The South African Government is actively involved in the chemicals industry through the Industrial Policy Action Plan (IPAP) and various other national strategies and plans, such as Operation Phakisa, the Special Infrastructure Project, and the White Paper for Post School Education and Training. The government also attempts to stimulate economic and employment growth in the chemicals industry, as expressed in the national strategies and plans. The government is also a key player in the industry through various state-owned enterprises such as PetroSA and NECSA. If the national strategies and plans bear fruit, the sector will certainly experience growth in employment. However, the actual effect of government initiatives as well as new developments such as the mooted shale gas exploration will only become evident in the next few years. At the same time, these initiatives and developments are dependent on the availability of skills, and the CHIETA, together with other role players, needs to continue to ensure a steady flow of people with the right skills to take up positions in current and new enterprises.

It is critical to note that the Sector Skills Plan identifies four issues that are pertinent in the industry and that underpin skills planning for the period 2020-2025. The first

is the need for a more robust and refined skills information and planning system. The second is the need for long-term planning for the provision of professionals and scientists with specialised skills needed for the sector.

The capacity of the Technical and Vocational Education and Training (TVET) colleges and the quality and relevance of their educational offerings are other issues that the sector has been contending with. In this regard, CHIETA has developed a tried and tested public-private partnership model and uses this as best practice in the imparting of industry-relevant training and workplace opportunities to learners, in collaboration with industry. Furthermore, CHIETA has been conducting studies into identifying institutional challenges faced by TVET colleges in the implementation of Work Integrated Learning (WIL); such studies will add great value in improving the TVET system and increase the pool base of the skills required by industry.

The next issue that the SSP identifies as pertinent to industry for the 2020-2025 period is Recognition of Prior Learning and the availability of articulation pathways for qualifications between various levels at public institutions.

CHIETA indicates that the institution has put more emphasis on the recognition of prior learning; however, there needs to be institutional buy-in, particularly with regard to articulation pathways for qualifications, intra- and inter-institutions. In addition, the institution states that there is a need to enhance approaches in conducting Recognition of Prior Learning such that candidates that have requisite technical skills but are not able to write are afforded opportunities for assessment through other means such as oral assessments.

According to the Engineering Council of South Africa (ECSA) 2021 Annual Report, in the 2019/2020 financial year, the number of Registered Persons reported stood at 55 733. During the 2020/2021 financial year, a total of 3 181 new registrations were added to the register, bringing the total of the register to 56 509. The Engineering Council of South Africa is a statutory body established in terms of the Engineering Profession Act, 46 of 2000, with a mandate to regulate the engineering

profession to protect the public, health and safety and work environment against unsound engineering practices. ECSA has undertaken a research study on candidate retention strategies. This research study was undertaken to determine how to retain candidates already registered with ECSA and ways to encourage engineering graduates to register as candidates.

ECSA further indicates that there is a need for a strategy as more registered candidates cancel their candidacy registration before they can attain professional registration status. The study identified the reasons why graduates do not register and why already registered candidates deregister. The recommendations from the study on how to retain engineering candidates and see them through their professional registration are as follows: The ECSA Academies model should be implemented as soon as possible and promoted nationwide. The Road to Registration presentations should be presented online as often as practically possible and shared on all ECSA online platforms. Funding is currently accessible from the SETAs; internship programmes for engineering candidates should be encouraged. Mentorship programmes should be revised and made purposeful, not incidental. Employers should allow for time in their professional billable hours for the mentoring of candidates. Supervisors need special training on how to formally mentor candidates. However, the retention strategy recommendations do not address the engineers currently in the industry on how they could be retained from emigration intentions and engineers that have already emigrated.

In summary, there is no single cause of the skills shortage in the petrochemicals sector. Some skills are being lost to an ageing workforce; some are moving to other sectors and industries; some are simply failing to keep up with the changing technologies. As petrochemical industries rise to the challenge of cleaning up the industry at Scope 1, 2 and 3 levels of emissions and environmental impact, cleaner technologies will create a demand for alternative engineering skills.

d. Affirmative action

The main purpose of affirmative action is to correct the injustices resulting from the apartheid era (South Africa. Employment Equity Act, 1998). This is to be achieved through preferential appointments of previously disadvantaged individuals. However, this could create dissatisfaction amongst those who are not from the designated 33 group, as their career advancement opportunities are perceived to be limited by the Employment Equity Act (Booysen, 2005).

The following observations were made amongst white males interviewed by Booysen (2005):

a) *White males are demotivated; they just perform to maintain their jobs; they are reluctant to show initiative as it is not going to be rewarded.*
b) *The careers of white males are on hold or limited. The careers of top achievers are limited but not terminated.*
c) *There is no job security for younger white males who are not yet established in a career.*

According to Copans (2008), there are severe skills shortages within South African municipalities. A study conducted by Lawless found that 79 of the country's 231 local municipalities do not have civil engineers, technologists, or technicians. Styan, (2008) This is partly due to affirmative action where skilled and experienced engineers were displaced to make way for the appointment of previously disadvantaged individuals. Copans, (2008). Engineers who remained were faced with a challenge in that, in many cases, their newly appointed superiors were not from a technical background. According to Creighton (1990), one of the most difficult tasks faced by managers today is the way they must provide direction to the highly skilled workers that they supervise. In most cases, technical staff members like to perform their work in a self-directed manner and are far more likely to feel motivated when working under the supervision of another person with similar training whose technical abilities they respect rather than under the supervision of a manager to whom they cannot relate. Creighton (1990).

Engineers in municipalities who feel dissatisfied with their management are likely to have a higher propensity to emigrate. A study by Van Rooyen in 2000 found that affirmative action was only a minor contributor to emigration, as only 10% of prospective emigrants cite it as a reason for wanting to emigrate. The implementation of affirmative action for positions requiring the incumbent to be a registered professional engineer offers additional challenges if one considers that 34 over 89% of registered professional engineers in South Africa are white males (Bwalya, 2008). Table 2.7 illustrates the professional engineers by race and gender, where white males form the largest percentage in terms of representation at 89.1%. Females in the sector are under-represented.

Table 2.7: Professional engineers by race and gender

Race	Gender	Percentage
Asian	Male	3.3%
	Female	0.3%
Black	Male	4.4%
	Female	0.2%
Coloured	Male	0.7%
	Female	0.0%
White	Male	89.1%
	Female	2.0%

Source: Bwalya (2008)

2.11.1 The migration of South African Black engineers

Another dynamic on migration is African/Black engineers. They are emigrating from South Africa for various reasons, influenced by a combination of push and pull factors. These factors can be categorised into economic, social, political, and professional aspects, each contributing to the decision-making process of engineers considering

emigration (Crush & Tevera, 2010). The economic factors are attributed to limited career opportunities. African/Black engineers in South Africa face limited career advancement opportunities due to factors such as slow economic growth, limited job openings in their specialisation, and competition in the job market. There are also salary disparities and compensation packages within the country and between South Africa and other countries, particularly those in the Western world.

The currency depreciation can erode the purchasing power of engineers' salaries, making emigration to countries with stronger currencies more attractive (Hugo& Hugo, 2012).

Concerns about the quality of life in South Africa, including issues such as crime, healthcare access, education, and infrastructure, may drive engineers to seek better living conditions and social amenities in other countries. Family considerations are also crucial, and engineers may consider emigration to provide better opportunities for their families, including access to quality education, healthcare, and a safer environment.

As far as the political factors are concerned, the South African political stability is a challenge. Political instability, uncertainty, and concerns about governance and corruption in South Africa may prompt engineers to seek countries with more stable political environments and better governance. (Tengeh & Zikhali, 2012).

The affirmative action policies also play a role to a certain extent. While the Employment Equity Act in South Africa aims to address historical injustices and promote equity in the workplace, some Black African engineers may perceive limitations or challenges in career advancement opportunities due to affirmative action policies.

Professional factors pertain to skills recognition and African Black engineers may perceive better opportunities for skills recognition, career advancement, and professional development in countries with more established engineering industries and recognition of foreign qualifications. Moreover, the issues pertaining to research and innovation provide access to research opportunities, innovation hubs, and

advanced technology in other countries, which may attract engineers seeking to enhance their skills and contribute to cutting-edge projects.

While the EEA aims to promote equity and redress historical inequalities in the workplace, the emigration of skilled professionals can pose challenges to its implementation (South African Department of Labour, n1998). The loss of skilled engineers through emigration may hinder the achievement of demographic representativeness and diversity targets set by the EEA. On the other hand, the departure of African/Black engineers may reflect underlying structural issues in the labour market, such as limited career advancement opportunities and wage disparities, which the EEA seeks to address.

2.11.2 The South African Government Responses

The South African government has implemented various initiatives and policies to address challenges such as political instability, corruption, and crime to create a more attractive environment for skilled professionals. Additionally, there have been policies focused on promoting skills development and retention. In addressing political instability, corruption, and crime, the government has aimed to improve political stability through democratic processes, adherence to the rule of law, and initiatives to address political challenges and conflicts Kahn, (2018).

The establishment of institutions coordinates anti-corruption efforts across various sectors. The South African Police Service (SAPS) has undertaken various crime prevention strategies, including community policing initiatives, increased visibility, and collaboration with other law enforcement agencies.

On policies for skills development and retention, there is the National Skills Development Strategy (NSDS), which is a key policy framework aimed at addressing skills development needs in South Africa. It focuses on creating a skilled and capable workforce to enhance the country's competitiveness. The Sector Education and Training Authorities (SETAs) play a crucial role in implementing the NSDS by facilitating skills development in specific sectors. They work with employers and training providers to identify skills needs and develop relevant training programs (Mbiyozo, 2018).

The Skills Development Levies Act mandates employers to contribute to a skills development fund, which is then used to finance training initiatives and programmes. The government has identified a Critical Skills List, which outlines professions and skills that are deemed essential for the country's development. This list influences immigration policies, making it easier for individuals with these critical skills to work and reside in South Africa (Bhorat, Mayet & Visser, 2021).

Skilled emigration from South Africa is a multifaceted issue with economic, political, and social dimensions. Addressing the root causes requires a comprehensive approach that involves not only government intervention but also the private sector and societal collaboration. Balancing the need for skilled individuals to contribute to global knowledge networks with the imperative to retain talent domestically is crucial for the sustained development of South Africa.

2.12 Other country-related contributing factors

According to Van Rooyen (2000), approximately 10% of emigrants list the state of the South African economy as a reason for leaving the country. They feel that taxes are too high, their savings are being eroded by inflation, and the falling currency could result in them not being able to leave the country in the future.The relatively high interest rates in comparison with most developed countries were also a cause of concern. Van Rooyen (2000) found that 19% of emigrants give declining standards of public education and healthcare as major reasons for wanting to leave. Many children in schools had not received adequate resources in the years 1999 and 2000. On the other hand, teachers' salaries consumed almost 100% of the education budget, leaving little money for equipment and books. Those with children in private schools saw massive increases in fees as state subsidies were cut by 65% between 1995 and 1998. Education is thus considered to be a major contributor to the skills shortage and to emigration. Van Rooyen (2000) also revealed that 10% of participants cite corruption and an inefficient government and civil service as contributing to emigration.

The United Nations Development Index rated 174 countries in terms of their standards of living, life expectancy and educational attainment in 2006. Canada was rated first for the previous seven years, with the United States of America fourth, New Zealand

ninth, the United Kingdom fourteenth and Australia fifteenth in the United Nations. Human Development Report, (2006). South Africa was rated ninety-eighth. Some professionals use this index to inform their decision making on destination countries to consider.

2.13 The future implications of skilled migration the sending countries

The implications of skilled emigration in South Africa are profound and have an influence on the country's economic, social, and developmental trajectories. Skilled migration presents both challenges and opportunities for South Africa. These are discussed briefly. Crush & Pendleton (2014) argued that the migration of skilled workers aggravates existing skills shortages in critical sectors within South Africa, such as in healthcare, engineering, and technology. This increasing skills gap helps to slow down economic development. On the other hand, Bezuidenhout & Joubert (2009) asserted that South Africa invests heavily in educating professionals, but all the benefits are lost when they emigrate to other countries. In addition, Padarath & Chamberlain (2007) suggested that the emigration of doctors and nurses hampers healthcare delivery, especially in underserved areas in South Africa. Adepoju (2018) strongly argued that the departure of skilled professionals weakens institutional capacity and innovation. This brings the country down in terms of competitiveness and service delivery.

However, emigration does not bring challenges only to the country of origin but offers opportunities too. Ratha & Shaw (2017) were of the view that skilled emigrants such as engineers often send remittances back home, which can support local economies. This was supported by Meyer & Brown (2011), who suggested that skilled migrants abroad can foster international trade, investment, and knowledge transfer. Similarly, Kahn (2018) believed some skilled migrants return to their home countries with enhanced skills and global exposure, benefiting the local economy. Once more, skilled emigrants can act as intermediaries for international collaboration Kahn, 2018; Crush, (2011).

Furthermore, studying the emigration phenomenon from South Africa concerning skilled labour and its implications for Sustainable Development's seven pillars

necessitates a comprehensive and interdisciplinary approach. Below are potential areas for future research, accompanied by detailed discussions on their impacts across Sustainable Development's seven pillars, which are briefly discussed below. There is a need to examine the remittance to South Africa's economic development and whether they sufficiently counterbalance the loss of skilled labour. This analysis involves understanding the magnitude of remittances, their distribution across economic sectors, and their overall contribution to GDP growth (Ratha & Shaw, 2017).

There would be a need to investigate the demographic shifts resulting from skilled emigration and their repercussions on social cohesion. Emigration may lead to brain drain effects, particularly impacting education and healthcare systems. This research can explore how demographic changes affect social services, community structures, and intergenerational relations. This will also include the cultural adaptation that will explore the cultural ramifications of emigration on South African society, encompassing issues of identity, diversity, and community resilience. Understanding how emigration shapes cultural norms, values, and practices is essential for fostering inclusive societies and addressing potential social tensions.

Furthermore, the c. Environmental Pillar, exploring resource management and sustainability, would analyse the environmental implications of skilled labour emigration, particularly its influence on resource management practices and sustainability initiatives within South Africa. Emigration may affect environmental policies, land use patterns, and conservation efforts, necessitating a nuanced understanding of its ecological footprint.

With the political pillar there is a need for further policy assessment that would evaluate the efficacy of existing policies aimed at mitigating brain drain and retaining skilled labour. Additionally, propose alternative policy measures to address emigration challenges while promoting sustainable development goals. This involves assessing policy coherence, implementation strategies, and stakeholder engagement processes. On the other hand, the global governance perspective would have to investigate the role of international agreements and global governance mechanisms in regulating the movement of skilled labour and its implications for South Africa's political landscape.

This research can explore avenues for enhancing policy coordination, knowledge sharing, and diplomatic cooperation to mitigate brain drain pressures.

With regard to the cultural pillar, particularly on knowledge exchange or transfer and innovation, there would be a need to assess how emigration influences knowledge transfer, innovation, and technological advancement within South Africa. This includes examining the potential for diaspora engagement in development initiatives, collaborative research projects, and technology diffusion programmes. Cultural diplomacy would aim to explore opportunities to leverage emigration as a catalyst for cultural exchange and cross-border collaboration. Promoting cultural diplomacy and soft power initiatives can foster mutual understanding, enhance global partnerships, and promote sustainable development goals.

There is a need to investigate the impact of skilled emigration on healthcare access and delivery, particularly in rural and underserved areas. Propose strategies for addressing healthcare disparities, improving educational opportunities, and supporting emigrant families in navigating educational systems abroad.

The digital engagement will have to ensue and explore the role of digital technologies and online platforms in facilitating connections between emigrants and their home communities. Assess the potential for digital tools to foster innovation, entrepreneurship, and skills development initiatives, thereby contributing to sustainable development objectives. Lastly, there must be investigation mechanisms for promoting skills transfer and capacity-building initiatives between emigrants and local stakeholders. This includes exploring collaborative training programmes, knowledge exchange networks, and mentorship opportunities in emerging sectors critical for sustainable development, such as renewable energy and digital technology.

By addressing these research areas, scholars and researchers can gain deeper insights into the complex interplay between emigration, skilled professionals, and Sustainable Development's seven pillars, thereby informing evidence-based policy interventions and fostering holistic approaches to global migration challenges.

2.14 Retention Strategies and Implications

To retain existing engineers in South Africa, the factors causing them to consider emigration should be addressed. To increase the number of engineers in the country, more emphasis should be placed on mathematics and science at school, thereby increasing the number of candidates who qualify for admission to engineering courses. It also needs to be ensured that universities have the capacity to train the increased number of engineers required on an ongoing basis.

A study by Mattes and Mniki (2007) revealed a range of possible government strategies to address emigration.Some of these include the requirement to perform national service in return for education, such as the Department of Health currently requires from medical students, which could be extended to any number of years of service. Other measures suggested included making nationals pay tax on income earned outside of the country, severely limiting the amount of money that could be taken overseas, not allowing foreign passports to be held by nationals and entering into agreements with foreign governments to limit the immigration of skilled nationals into those countries.

Retention has become a centre of attraction within the human resources environment, and it has been noted that millennials are more likely to move jobs than more mature employees.

The more valuable the employee, where an individual has specialist skills or has developed strong customer relationships and stakeholder management as an example, the more damaging the resignation, especially if they are lost to a competitor and the competitor is abroad (Siwela & Van der Bank, 2021).

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Many employers are understaffed and are struggling to find the resources needed to recover from the pandemic. However, it is important to retain top talent, especially under adverse conditions, for the survival and success of the business.

In the UK, job vacancies soared to an all-time high in 2021, with more than one million job openings available for the first time since records began. The coronavirus pandemic triggered a radical shift in employee behaviour, prompting some 640 000

UK employees to leave their jobs in 2021 as per the UK Office of National Statistics (2021).

According to several research studies, one of the keys to retaining talent is to offer flexible working arrangements, with 73% of employees preferring hybrid over traditional office-based working (Edelman, 2022). However, many leaders have indicated that they will enforce a return to pre-pandemic working terms and norms. The Edelman study uncovered a concerning disconnect between leaders and the employees, with 61% of leaders arguing that they are successful while 38% of employees blame the pandemic for their struggles.

According to Nel (2003), in a fluid and shifting global job market, talent is a commodity to be treasured. Nel (2003) further states that employee talent determines which companies are successful and which are not.However, he argues that retention of talented workers is one of the most important challenges facing businesses these days.Michaels, Handfield & Axelrod (2001) state that the talent of employees is the key factor that differentiates a company from its competitors.

2.14.1 Competitive remuneration

Offering competitive remuneration packages to skilled personnel can attract and retain talent in the petrochemical sector in South Africa. Competitive remuneration is indeed an important retention strategy in the petrochemical sector. Offering attractive compensation packages can help companies attract and retain top talent, as well as motivate and incentivise employees to perform at their best (Castles, de Haas & Miller 2020).

Petrochemical companies rely on skilled professionals, engineers, scientists, and technicians to drive innovation, maintain operational efficiency, and ensure safety and compliance. By offering competitive remuneration packages, companies can incentivise employees to stay with the organisation, reducing turnover and maintaining a stable workforce.

2.14.2 Career development opportunities

The creation of career progression opportunities can provide a better sense of job security and fulfilment, leading to a higher staff retention rate. In the petrochemical sector, career development opportunities can be a powerful retention strategy to attract and retain top talent. By providing employees with avenues for growth, learning, and advancement within the organisation, companies can create a more engaged and committed workforce. The following aspects are essential in retaining skilled workforces in the petrochemical sector.

a) Training and Development Programs

It is essential for organisations to invest in training and development programs which allow employees to enhance their skills and knowledge, enabling them to take on new responsibilities and advance their careers within the organisation. A study by Elnaga and Imran (2013) found that training and development opportunities positively impact employee satisfaction and retention in the petrochemical industry.

b) Mentoring and Coaching

It is essential for organisations to deploy mentoring and coaching programs which can facilitate the transfer of knowledge and expertise from experienced professionals to younger or less experienced employees. This can contribute to their career growth and development. According to a study by Al-Zawahreh and Al-Madi (2012), mentoring programs positively affect employee retention in the petrochemical sector.

c) Internal Job Postings

Promoting internal job postings and transfers allows employees to explore different roles and career paths within the organisation. This provides them with a sense of advancement and growth opportunities, reducing the likelihood of seeking opportunities outside the company. Research by Qayyum and Niazi

(2017) highlights the significance of internal mobility for employee retention in the petrochemical industry.

d) Succession Planning

Establishing a robust succession planning process ensures that employees are aware of potential career advancement opportunities within the organisation. This strategy provides them with a long-term career roadmap, enhancing their commitment and loyalty. A study by Naik, Barua, and Choudhury (2016) emphasises the role of succession planning in retaining employees in the petrochemical sector.

Performance-Based Recognition and Rewards: recognizing and rewarding high-performing employees with promotions, salary increases, or additional benefits can incentivize career progression within the petrochemical industry. This approach not only acknowledges individual contributions but also motivates others to strive for similar growth opportunities. Research by Azizi, Hojjat, and Hosseinzadeh (2017) supports the positive impact of performance-based recognition on employee retention in the petrochemical sector.

Mentorship and coaching programs offered to employees can help them to develop their skills, further their career growth, and remain engaged with the company (Bakker & Demerit, 2018). Mentorship and coaching programs can be effective retention strategies in the petrochemical sector. These programs provide valuable support and guidance to employees, fostering their professional development and increasing their engagement and loyalty to the organisation. Here are some key points and references related to mentorship and coaching programs as retention strategies in the petrochemical sector.

Enhanced employee engagement contributes to increased employee engagement, job satisfaction, and motivation, as suggested by Garvey, Stokes & Megginson (2014).Through one-on-one interactions, mentors and coaches can provide personalised guidance and support tailored to individual employees' needs, fostering a sense of belonging and commitment to the organisation. Employee engagement can

lead to higher staff retention rates. Employers can invest in employee engagement strategies, such as team-building exercises, training and development programmes, and reward and recognition initiatives. Employee engagement is a crucial factor in improving employee retention in the petrochemical sector. When employees are engaged and motivated, they are more likely to stay with the organization, leading to higher retention rates and reduced turnover costs (Garvey, Stokes & Megginson, 2014). When companies actively engage with their employees, providing regular updates on organizational performance, market trends, and future plans, it helps alleviate concerns and promotes a sense of security Saks, (2017).

Professional development in mentorship and coaching programmes offers employees opportunities to enhance their skills, knowledge, and career growth. Furthermore, Saks (2017) suggested that mentors and coaches can provide valuable insights, share their experiences, and guide mentees/coachees towards achieving their professional goals. This investment in employees' development can significantly improve their job satisfaction and retention.

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Knowledge transfer in the petrochemical sector: mentorship programs facilitate the transfer of critical industry knowledge and expertise from experienced employees to the newer generation. This knowledge transfer helps maintain institutional knowledge and ensures a skilled workforce, mitigating the risk of talent gaps due to retirements or turnover.

Retention of high-potential employees in mentorship and coaching programs can be particularly effective in retaining high-potential employees by providing them with opportunities for growth, challenging assignments, and guidance from senior professionals. These programs help foster a sense of investment in their careers and increase their commitment to the organisation. Implementing mentorship and coaching programs requires careful planning, clear program objectives, and matching mentors/coaches with mentees/coachees based on their goals, skills, and expertise. Regular evaluation and feedback mechanisms should be established to monitor the effectiveness of these programs in achieving their retention goals in the petrochemical sector Grant, (2014).

According to a study by Albdour and Altarawneh (2019), job satisfaction significantly predicts employee retention in the petrochemical sector. It was found that stronger organisational commitment fosters a sense of commitment towards the organisation. Committed employees are more likely to remain loyal and stay with the company for an extended period. A research study by Petrou, Demerouti, and Schaufeli (2018) found a positive relationship between organizational commitment and employee retention in the petrochemical industry.

Enhanced employee well-being, where engagement initiatives that focus on employee well-being, such as work-life balance programmes, health and wellness initiatives, and employee assistance programmes, can contribute to higher retention rates. Research by Duraisamy and Kaliappan (2021) highlighted the positive impact of well-being practices on employee retention in the petrochemical sector. Increased employee empowerment, providing opportunities for employees and involvement in decision-making processes, can enhance engagement levels and subsequently improve retention. According to the study by Nasurdin and Aziz (2019), empowering leadership positively influences employee retention in the petrochemical industry.

Effective communication and feedback in opening and having a transparent communication channel, along with regular feedback mechanisms, play a crucial role in engaging employees and building a positive work environment. A research study by Albdour et al. (2020) emphasised the importance of effective communication and feedback in improving employee retention in the petrochemical sector.

Professional development opportunities and career growth opportunities are an effective strategy to engage and retain talent in the petrochemical sector. Research conducted by Alotaibi (2021) found that professional development programs positively impact employee retention in the petrochemical industry.

Guaranteeing job security in the petrochemical sector contributes to employees' peace of mind and stability, ultimately solidifying their standing within the organisation. Employing strategies such as offering extended contracts, facilitating training programmes, and creating internal growth opportunities enhances staff retention. Scholarly evidence emphasises the pivotal role of job security in retaining personnel within the petrochemical industry (Alotaibi, 2021). When employees feel that the work

environment is secure, their commitment to the organisation increases, leading to heightened productivity and lower turnover rates.

The stability of the industry provides a sense of assurance to employees, reducing their concerns about layoffs and company downsizing during challenging times (Bhattacharya, 2017). The petrochemical sector is subject to stringent regulations and safety measures due to the potentially hazardous nature of the work. Companies that prioritize compliance and invest in maintaining high safety standards tend to create a more secure work environment, increasing employee confidence and job security (Mannan, 2018).

Petrochemical companies that invest in long-term projects and capital-intensive initiatives showcase their commitment to future growth and sustainability. Such investments indicate stability, which fosters job security and reduces employee turnover Sui, (2020). Companies that prioritize employee training and skill development ensure that their workforce remains equipped with up-to-date knowledge and expertise. This commitment to enhancing employee capabilities contributes to job security by increasing employability within the organization Grossman et al., (2019).

2.15 Case Studies on talent retention

There are case studies that South African industries can from countries such as Norway. Norway is a is a major player in the petrochemical sector and has implemented comprehensive talent retention strategies. These strategies include attractive compensation, strong social welfare, and a focus on work-life balance. Norway's petrochemical sector offers competitive salaries and benefits, attracting and retaining top talent. Where in South Africa there might be an opportunity to evaluate and enhance compensation packages to remain competitive in the global market.

Norway prioritizes social welfare, providing a high quality of life and a safety net for employees. South Africa might consider implementing or improving social welfare programs to enhance employee well-being within the sector. Work-life balance is a cornerstone of Norway's work culture, promoting employee satisfaction. In South

Africa the sector might consider to further fostering a culture that values and supports work-life balance to improve employee morale and retention.

On the other hand, in Singapore, the Skills Future Initiative promotes continuous learning, emphasising the importance of upskilling to meet industry demands. In South Africa a similar approach can be implemented to promote initiatives to ensure a skilled and adaptable workforce in the petrochemical sector. Skills Future fosters a culture of continuous learning, encouraging employees to stay relevant in a rapidly changing industry. In South Africa there might be a need to develop programs that instil a continuous learning mind-set, enhancing the adaptability of the workforce.

The initiative involves collaboration with industries to align training programs with actual industry needs. There might be an opportunity for South Africa to strengthen partnerships between educational institutions and the petrochemical industry to ensure that skill development programs meet industry requirements. South Africa can benchmark against global leaders like Norway to understand competitive compensation structures and social welfare programs and conduct industry-wide surveys to identify global benchmarks and adjust compensation and welfare policies accordingly.

Both cases emphasise the need for tailored retention strategies that address the unique needs of the workforce. Both cases involve active government support for talent development and retention. Advocate for government support and policies that incentivise skill development and retention strategies within the South African petrochemical sector.

Singapore's Skills Future Initiative reflects a long-term vision for continuous learning and adaptability. South Africa needs to develop a long-term vision for the South African petrochemical sector that includes sustained investment in skills development and retention strategies. Singapore's collaboration with industries ensures that educational programs align with industry needs. It would be ideal to strengthen ties between petrochemical companies and educational institutions in South Africa to co-create programs that address industry-specific skill gaps. Furthermore, Singapore's Skills

Future Initiative that demonstrates the importance of proactive skill development programmes, is relevant for the South African case. The initiative encourages continuous learning and upskilling to meet the evolving needs of industries.

The South African petrochemical industry can learn from Norway's emphasis on compensation and work-life balance, as well as Singapore's proactive skill development initiatives. By combining these approaches and tailoring them to the unique context of South Africa, the industry can enhance talent retention, foster a culture of continuous learning, and position itself for long-term success in a competitive global landscape.

Recent Trends and Global Migration Dynamics

Recent trends show that migration is becoming increasingly complex and interconnected. Key contemporary issues include:

Climate Migration

Environmental changes such as rising sea levels, droughts, and natural disasters have led to an emerging category of “climate migrants”, people who are forced to leave their homes due to environmental degradation (McLeman, 2014).

Refugee and Forced Migration

Political instability, conflicts, and human rights violations continue to drive large-scale forced migration, particularly from regions like the Middle East, Sub-Saharan Africa, and parts of Asia. The global refugee crisis has prompted international debates about asylum policies, border security, and humanitarian obligations (Crisp, 2003).

The Role of Technology and Globalization

Advances in communication technology and the ease of international travel have made migration more accessible. Migrants can maintain stronger connections with their home countries, and the movement of people is increasingly intertwined with global economic systems Castles et al., (2014).

The study of emigration and migration remains a vital area of research in understanding human mobility. Both processes are influenced by a combination of individual, social, economic, and political factors.

While emigration typically focuses on the departure from a specific country, migration encompasses a broader spectrum of movements, including the dynamics between sending and receiving nations. Future research must continue to explore the impacts of migration on societies, economies, and cultures, particularly in the context of global challenges such as climate change and geopolitical conflicts.

The conceptual model

Emigration of professionals from their home countries to other countries abroad in pursuit of ‘greener pastures’ has been happening for quite some time now. There are several studies that have been carried out to have a clear understanding of the drivers of emigration of professionals. Many researchers have developed and operationalised several frameworks on emigration of professionals. However, a widely recognised framework that has been developed to have a better understanding of the factors driving engineers to emigrate from South Africa is the Push-Pull Model of migration by Lee (1966). This model classifies the drivers of emigration into 'push' factors, which prompt individuals to leave their home country, and 'pull' factors, which attract them to a new destination country. The Push-Pull Model demonstrates the relationship between emigration (as the dependent variable) and six independent variables that include push economic factors, push social factors, push political factors, pull economic factors, pull social factors and pull political factors (Ambroziak & Schwabe, 2019).

The current study applies the Push-Pull Model (shown in **Figure 2.1**) to assess the determinants of emigration among South African engineers in the petrochemical industry. This model emphasises that economic, social and political factors are the main driving factors behind the emigration of professionals. The argument is that the significant economic disparity between developed and developing countries is one of the main factors that push migrants from poor countries to migrate to much more developed countries abroad (Oltman and Renshon, 2017). Additionally, economic factors in advanced economies, such the demand for labour, attract or pull

professionals looking for better job prospects, higher wages, career development and improved living standards (Nejad & Young, (2016).

The model articulates that social factors such as poverty, lack of employment opportunities, education and housing push professionals to migrate to other countries abroad (Carbajal& de Miguel Calvo, 2021). It also explains that social push factors are based on the human desire to achieve a better quality of life. On the other hand, professionals are attracted to emigrating to countries that offer better social care, such as better healthcare, are non-discriminatory, and have access to welfare state benefits, among other things.

The model also demonstrates that political push factors such as conflicts, corruption, poor governance, human rights abuse, bad governance and terrorism push individual professionals to migrate to regions with safe political environments (Hadj Abdou, 2020). Contrary to this, safety and security, political freedom, democracy, and human civil rights are political factors that attract professionals to work in countries that offer political stability.

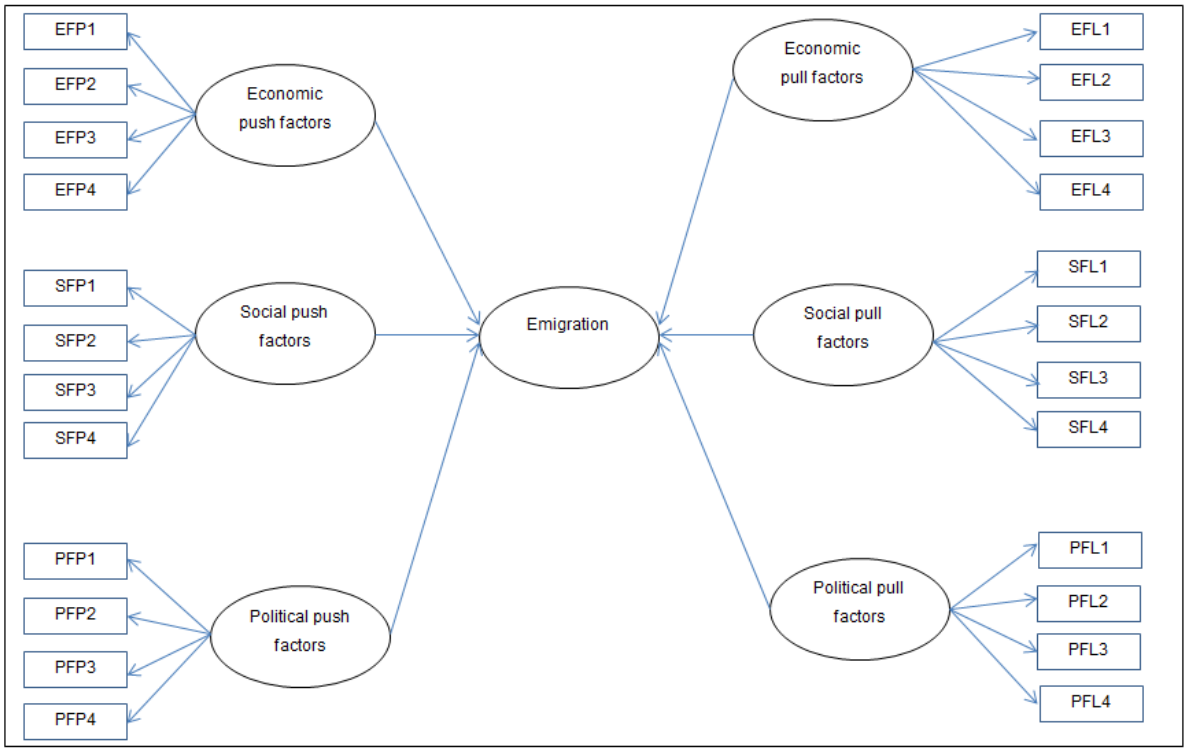


Figure 2. 1: Conceptual model (adapted from Lee, 1966)

2.16 Chapter summary

The review of literature revealed that accurate statistics regarding emigration numbers are not available. The limited information which is available indicates that the United Kingdom was the most popular destination chosen by South African emigrants by a substantial margin, followed by Australia and the rest of Africa. Evidence suggests that many engineers have recently emigrated or are currently considering emigration. This section also examined several country- and work-related factors described in the literature as being drivers for emigration. The duration of stay and factors which could influence this were investigated. This revealed that most emigrants intended to return to South Africa at some point during their lifetimes.

This chapter has synthesised the existing literature of the petrochemicals sector by interrogating how skilled personnel's aspirations, qualifications, and international skills requirements shaped their needs and desires for migration from South Africa to other countries. Patterns and practices associated with emigrating for work opportunities in other countries were covered. This chapter comprises the literature responses. The highlights of the determinants that cause the South African engineers in the petrochemicals sector to emigrate to international countries and the associated retention strategies to address concerns of engineers within this sector were explored.

CHAPTER 3

3 CHAPTER 3 Theoretical framework

3.1 Introduction

This chapter explains the theories which frame the entire study. The first part of this chapter explains the related theories which frame the entire study. It attempts to situate the research within established migration theories. The chapter outlines these set theories, providing a foundation for understanding the dynamics of skilled migration within the South African petrochemicals sector. It outlines some of the models developed by scholars of migration studies which discuss the academic study of human migration. It will constitute the thread that runs through the entire research, from the beginning until the conclusions. The inclusion of historical-structural theory and dual labour market theory has provided potential to broaden the scope of the discussion, with the aim of providing theoretical context for the empirical data that follows in this study. The conceptual framework for this research will be aimed at the importance of an in-depth and detailed analysis of the above-mentioned concepts. Furthermore, the conceptual framework will be unpacked in the literature review.

The use of migration theories in the study attempts to simultaneously convey the deepest values of the researchers in the field and provide a clearly articulated signpost, perspective, or lens for how the study will process new knowledge.

This research unpacks the key concepts that were used in conducting the study and identifies the relationships between these concepts that are related to the determinant for skilled professionals to emigrate from the petrochemicals sector that leads to potential brain drain within the sector.

Moreover, it is important to note that skilled emigration from South Africa is not solely driven by social capital. Economic factors, such as better job prospects, higher wages, and opportunities for professional growth, are significant determinants of skilled migration. Global economic trends and the demand for specific skills in destination

countries also exert a strong influence on the decision to emigrate, often overshadowing the role of social capital.

The research questions provided in chapter 1 focus on different aspects of the petrochemicals sector, including future developmental implications, determinants for skilled professionals to emigrate, retention strategies for organisations, and the nature of skilled professionals' emigration. To address these questions, a combination of theoretical frameworks is utilised to guide this study.

This chapter offers a high-level discussion of the interplay between historical-structural theory, dual labour market theory, and critical race theory, contextualised within South Africa's petrochemicals sector, while also addressing their limitations and grounding the analysis in contemporary scholarship.

3.2 Conceptual Framework

The conceptual framework for this study will be the main outcome or the objective of the literature review process and will have the following six key subcomponents or areas of focus: research setting or context analysis this will help to understand the physical research setting and context. Exploring emigration research setting or context analysis will look at the examination of the physical, social, economic, and cultural environment in which the process of emigration takes place. This analysis involves studying the geographical aspects of the location from which people are emigrating, such as the specific countries, regions, or specific areas within the country. It's crucial to examine the social and economic conditions in the emigration setting. This includes looking at employment opportunities, wage levels, poverty rates, and the availability of social services.

These factors often play a significant role in people's decisions to emigrate. Understanding the political and legal environment is crucial. Laws and policies related to immigration and emigration, as well as political stability, can impact the decision-making process of potential emigrants. This research will also explore the cultural and social aspects of the emigration setting. Cultural ties and social connections can influence emigration decisions and experiences. Historical events and factors, such as conflicts, wars, or economic shifts, can have a long-lasting impact on emigration

patterns. Analysing historical context will assist in providing the understanding as to why certain populations within South Africa may have a history of emigration.

Examining the availability of infrastructure and services like healthcare, education, and transportation is important. Lack of access to these services can be a push factor for emigration. Understanding the roles of family and community networks in the emigration setting is vital. These networks often provide support, information, and resources to individuals considering emigration. By conducting thorough emigration research setting or context analysis, through this research there are possibilities of gaining insights into the complex web of factors that drive and influence emigration patterns. This understanding is essential for possible interventions in developing effective policies and strategies related to emigration, as well as for addressing the needs of emigrants and their impact on both the origin and destination countries.

The conceptual framework of this study will be to delve deeper into the analysis of the research problem, with the aim of comprehending, refining, and justifying the research problem, opportunity, or question that the research seeks to investigate. Will also perform an assessment of the existing knowledge gap by reviewing previous and current efforts in similar research endeavours. It is worth taking into consideration that this study is grounded in classical and contemporary emigration theories to examine the determinants of skilled personnel emigration and inform effective retention strategies within the South African petrochemical sector. A sound theoretical framework is essential to ensure conceptual clarity, guide the formulation of research questions, and provide a structured lens for data interpretation. The following theories form the foundation of this research: the **push-pull theory, human capital theory,** and **world systems theory.**

Push-Pull Theory

Originally developed by Lee (1966), the push-pull theory explains migration as a result of factors that drive individuals away from their home country (push factors) and those that attract them to a new destination (pull factors). In the context of South Africa's petrochemical industry, **push factors** may include political instability, high crime rates,

limited career advancement, and poor public services, while **pull factors** could involve better remuneration, professional growth opportunities, and higher living standards abroad.

This theory is critical for identifying the motivational duality in migration decisions and aligns directly with anecdotal and empirical evidence from skilled South African professionals who seek improved socioeconomic conditions overseas.

Human Capital Theory

Human Capital Theory, developed by Becker (1964), views individuals as rational actors who invest in their skills and education to maximise returns on their human capital. Migration is considered a strategic decision to enhance personal and economic outcomes. Skilled workers in the petrochemical sector, having invested heavily in technical qualifications and professional expertise, often assess emigration as a means to achieve better financial rewards, career stability, and global exposure.

This theory highlights the individual-level cost-benefit analysis involved in emigration decisions and underscores the importance of retention incentives such as competitive remuneration, training, and leadership pathways within the South African industry.

World Systems Theory

Wallerstein's (1974) World Systems Theory provides a macro-level perspective, suggesting that emigration is driven by the global economic system, wherein wealthier nations attract labour from peripheral economies through systemic imbalances. For South Africa, part of the semi-periphery, emigration of skilled personnel to core countries like the UK, USA, and Australia reflects the structural inequalities embedded in global labour markets.

While this theory is broader in scope, it contextualises skilled migration within historical and global economic relationships, offering insight into long-term policy considerations and international collaboration for talent retention.

Comparative Analysis and Integration of Theories

These three theories provide complementary insights:

- **Push-pull and human capital theories** focus on individual motivations but differ in scope:Push-Pull highlights environmental factors, while human capital centres on rational economic decisions.

- **World Systems Theory** contrasts both by offering a structural explanation of migration flows beyond individual control.

By integrating micro- and macro-level perspectives, this study develops a **multi-dimensional theoretical framework** that captures the complexity of skilled personnel emigration. It allows for both qualitative and quantitative exploration of drivers, enablers, and barriers to retention.

Justification for Selected Theories

Among the theories reviewed, **push-pull and human capital theories** are most applicable to this research due to their practical alignment with the sector-specific dynamics of the South African petrochemical industry. They enable the identification of both policy-responsive push factors (e.g., working conditions, governance) and individual-level motivators (e.g., return on education investment). **World Systems Theory**, while less central, adds valuable contextual depth and reinforces the need for structural reforms and global competitiveness.

This theoretical framework forms the analytical bedrock for understanding skilled migration and guides the development of targeted, evidence-based retention strategies. By employing a triangulated theoretical approach, the study ensures a robust and nuanced understanding of the emigration phenomenon, tailored to the specific realities of South Africa's petrochemical sector.

Key Theories on Emigration

Examining key emigration theories is essential to understanding the underlying drivers of skilled personnel migration in South Africa’s petrochemical sector. Theories such as *Push-Pull*, *Human Capital*, and *Dual Labour Market* offer valuable frameworks to interpret the socio-economic and institutional factors influencing emigration decisions.

By comparing and contrasting these theories, researchers can better align them with the unique emigration determinants in the sector, such as global demand for petrochemical skills, local economic volatility, and limited career growth.

Furthermore, this theoretical grounding enhances the development of effective retention strategies. For instance, understanding the "pull" of global opportunities helps organisations shape competitive remuneration and development programmes, while insight into "push" factors such as domestic instability or lack of innovation informs policy-level reforms. Ultimately, this comparative theoretical analysis provides a critical lens for designing context-specific interventions to retain skilled talent and mitigate long-term brain drain in this strategically important industry.

Key Theories on Migration

Understanding key migration theories is essential for critically analysing the emigration patterns of skilled professionals and informing effective retention strategies within South Africa's petrochemical sector. Classical theories such as push-pull theory, neoclassical economic theory, and world systems theory help unpack the economic, social, and political factors influencing skilled personnel to seek opportunities abroad. Contemporary perspectives, including the New Economics of Labour Migration and Brain Drain/Gain frameworks, further provide insights into household decisions, global inequalities, and the dual impact of emigration on sending and receiving countries.

By comparing and contrasting these theories, policymakers and sector leaders gain a multi-layered understanding of emigration determinants such as wage differentials, perceived career advancement, political stability, and quality of life, which are particularly relevant in South Africa's context of inequality and skills shortages. This theoretical grounding also supports the development of targeted retention strategies, including improved working conditions, competitive remuneration, career mobility, and supportive socio-political environments.

Incorporating these frameworks ensures a robust, evidence-based approach to addressing the strategic challenge of retaining critical talent in a globally competitive petrochemical industry.

Push-Pull Theory

One of the foundational models in migration studies, this theory posits that migration occurs because of a combination of push factors (conditions that drive people away from their country) and pull factors (conditions that attract people to a new country or area). Lee, (1966).

Dual Labour Market Theory

This theory explains migration through the lens of labour market segmentation in receiving countries. Migrants are often drawn to low-wage, low-skill jobs that native workers typically avoid. These jobs are essential for the functioning of the economy, particularly in developed countries Piore, (1979).

Cumulative Causation Theory

According to this theory, migration patterns tend to perpetuate themselves once they start. As more people migrate, they create conditions (such as established networks, reduced migration costs, and increased social acceptance) that make further migration more likely (Massey et al., 1998).

World Systems Theory

This theory posits that emigration is linked to the broader dynamics of global capitalism, where peripheral countries (often poorer) send migrants to core countries (richer, industrialised nations). The migratory flow is thus part of a larger economic system of exploitation and resource allocation Wallerstein, (1974).

Social Networks Theory

Migrants are often not isolated actors; rather, their decisions are shaped by social networks, such as family members, friends, or ethnic communities, who have already emigrated (Massey et al., 1993). These networks provide information, support, and encouragement to potential emigrants, facilitating the emigration process.

Traditional emigration theories

There are several traditional theories on the migration of people. This section discusses a few notable theories on the migration of people.

Understanding traditional emigration theories such as Push-Pull Theory, Human Capital Theory, and World Systems Theory is essential in contextualising the emigration of skilled personnel from South Africa's petrochemical sector. These theories provide foundational insight into the factors influencing migration decisions, including economic opportunities, political stability, career advancement, and quality of life.

By comparing and contrasting these theories with current emigration determinants such as crime, political uncertainty, limited professional growth, and global demand for petrochemical expertise policy-makers and sector leaders can more accurately diagnose root causes and tailor effective retention strategies. For example, while Push-Pull Theory highlights external incentives and disincentives, Human Capital Theory emphasises the investment-return calculation professionals make regarding emigration.

Critically analysing the alignment and limitations of these theories within the South African context enables the development of targeted interventions, such as improved work conditions, competitive compensation, and talent development pipelines. Ultimately, integrating theory with current sector dynamics supports a more evidence-based approach to curbing the loss of skilled professionals.

Historical-Structural Theory

This theory frames migration because of systemic global inequalities, emphasising how socio-economic disparities between developed and developing regions create migration flows. It underscores the role of colonial histories, economic dependency, and structural adjustments in shaping migration patterns (Mohammad, 2017). This theory highlights the historical processes and long-standing structures that determine emigration trends rather than viewing migration as solely an individual choice. It considers factors such as colonial histories, economic inequalities, and structural violence, which have created patterns of migration over time.

Historical-structural theory links emigration to colonial histories and how colonial powers established economic, social, and political systems that disconnected other groups of the society who were left with no choice but to seek greener pastures abroad (Sassen, 1998). For instance, in South Africa, the lingering effects of apartheid have entrenched economic disparities, influencing emigration trends among skilled professionals like engineers in the petrochemical sector.

One common critique of the historical-structural theory is that it focuses on macro-level factors such as colonialism, economic systems, and political structures and downplays factors on an individual level (Vertovec, 2007). Critics argue that this theory leads to a deterministic view of migration, where individuals are regarded as passive subjects that are shaped by historical forces, at the expense of personal aspirations and motivations (King, 2002). Vertovec (2007) argues that historical-structural theory focuses too much on structural issues such as long-standing economic and political structures and disregards other important issues such as personal or family connections, cultural ties, or local context-specific factors.

Dual Labour Market Theory

This theory describes emigration through labour market dynamics and considers both sending and receiving countries. According to Piore (2009), Dual Labour Market Theory suggests that there are two distinct sectors in modern economies, and these include the primary sector (which compriseshigh-skill, well-paid, stable jobs) and the secondary sector (which consists of low-skill, poorly paid, often insecure jobs). The Dual Labour Market Theory postulates that labour shortages in the secondary sector in developed countries create opportunities for migrant workers, which drives emigration from less developed countries.

Dual labour market theory combines both push and pull factors. It explains that emigration is often motivated by lack of opportunities in the primary sector of the sending country (e.g., high unemployment, underemployment, or poor working conditions). On the other hand, the pull factor is the demand for labour in the secondary sector of the receiving countries (Castles & Miller, 2009).

Critics argue that Dual Labour Market Theory excessively simplifies the complexities of labour markets in both sending and receiving countries. It does not fully take into consideration the multifaceted nature of migration, such as the role of family ties, social networks, and political factors that also play significant roles in emigration patterns (Castles & Miller, 2009). Furthermore, this theory deliberately focuses on low-skilled migration to fill secondary labour market jobs, and it underplays the growing trend of skilled migration to developed countries (Sassen, 2006).

Intersection and Complementarity

Migration is a complex phenomenon that is influenced by various factors such as economic, social, political, and historical dynamics. Instead of relying on a single theory, researchers commonly use intersection and complementarity theory to integrate multiple migration theories for a more comprehensive understanding of emigration (De Haas, 2010).

Intersection and complementarity in emigration research highlight the importance of integrating multiple theoretical perspectives. Instead of viewing migration through a single lens, researchers combine several theories to capture the complexity of migration dynamics, including economic, historical, social, and political factors (Portes, 1995). Complementarity in this theory suggests that different theories explain different aspects of emigration rather than competing against each other (Massey et al., 1993).

For example, this theory considers Push-Pull Theory, which explains why people emigrate (e.g., poverty, conflict, better opportunities). Complementarity theory also considers historical-structural theory, which provides context on how colonialism and capitalism shape migration trends. It also involves transnationalism, which explains how migrants maintain social and economic connections between their home and host countries (De Haas, 2010). Dual labour market theory complements this by addressing the meso- and micro-level dynamics within organisations. For example, Black African engineers might face racialised organisational barriers in the petrochemicals sector that limit upward mobility, reinforcing their emigration decisions. These theories intersect in examining how global inequalities, organisational behaviour, and individual agency converge to shape migration.

The push-pull theory

"Push-pull factors" are the reasons that push or attract people to a particular country of choice. "Push" factors are the negative aspects (for example, crime, violence, and wars) that drive people to emigrate to other countries often abroad. According to Mattes and Richmond (2002), "pull" factors are the positive aspects that encourage people to emigrate to seek a better life (better working and financial opportunities)). According to this theory, emigration is driven by push factors push factors that may include low salaries, scarce employment opportunities, political unrest, and lack of infrastructure (Sassen, 2006). On the other hand, “pull” factors are attractive conditions in the destination country, such as high prospects of employment, higher salaries and political stability. Besides the “push” and “pull” factors, there are potential obstacles which influence the decision of a would-be emigrant. These obstacles may include expenses involved in relocating to another country and migration laws (Mattes and Richmond, 2003).

3.3 Theoretical Framework and Migration Determinants

Using Lee’s Push-Pull Theory (1966) as a theoretical framework, this study explores the socio-economic and personal factors driving the emigration of petrochemical engineers. Push factors such as stagnant earnings, limited career advancement, and socio-political instability are frequently cited as underlying causes. According to Lee’s theory, the interaction between these push factors and the pull of overseas opportunities (e.g., higher remuneration, advanced career paths, and better living standards) creates a powerful incentive for migration (Castelli, 2018; Khalid & Urbański, 2021). These economic and social push factors have been observed across various fields, including medical and engineering sectors (Brink, 2012; Aguila et al., 2012).

Lass & Steenkamp (2019) highlight that South African engineers, like many skilled professionals, are influenced by political instability, economic factors and crime, while global competition for petrochemical skilled workers further encourages migration. It can be argued that emigration is much more complex and is influenced by several primary factors, such as the economic, political and social conditions of countries.

However, it is important to understand these drivers clearly so that effective retention strategies can be developed.

3.3.1 The Economic Theory

The economic theory is employed to understand the future developmental implications of human flight in the petrochemicals sector. This framework can analyse the economic impact of emigration on the sector, including potential labour shortages, skill gaps, and effects on productivity and innovation.

The economic theory provides a framework for understanding skilled migration by examining the economic factors that influence individuals' decisions to migrate (Wong & Ngin, 2021). While this approach offers several advantages in analysing skilled migration, it also has certain limitations. The advantages and disadvantages of the economic theory in relation to skilled migration were explored; the advantages assume that individuals make rational decisions based on a cost-benefit analysis (Piper, 2023). It suggests that individuals weigh the potential economic gains against the costs and risks associated with migration. This perspective helps explain why skilled professionals may choose to migrate if they perceive better economic opportunities abroad.

The economic theory focuses on labour market dynamics and the supply and demand of skilled labour. It helps analyse the impact of skilled migration on both the sending and receiving countries' economies. By examining factors such as wage differentials, skill shortages, and productivity gains, economic theory provides insights into how skilled migration affects labour markets.

Economic theory allows for an examination of the developmental implications of skilled migration. It helps identify the potential benefits for sending countries, such as remittances, brain circulation, and knowledge transfer. Additionally, it explores how skilled migration can contribute to the economic growth and innovation of receiving countries. On the other hand, the disadvantages suggest that the economic theory primarily focuses on economic factors and may overlook other social, cultural, and political aspects that influence skilled migration. It may neglect non-economic

motivations, such as quality of life, political stability, family reunification, or career advancement opportunities, which are crucial factors in migration decisions (Rogan & Reynolds, 2022).

The economic theory assumes individuals' decisions are solely driven by maximizing economic benefits. However, migration decisions are complex and multifaceted. Skilled professionals may consider a range of factors beyond wages, such as lifestyle, social networks, cultural affinity, and personal aspirations. Economic theory oversimplifies the decision-making process by reducing it to purely economic considerations (Portes, 1995).

It is critical to also note that the economic theory heavily relies on quantitative data and statistical analysis to understand skilled migration patterns. However, obtaining accurate and comprehensive data on skilled migration can be challenging in South Africa. Data limitations may lead to incomplete or biased analyses, overlooking the nuanced aspects of skilled migration experiences and motivations (Massey et al., 1993).

In addition, the economic theory's focus on economic gains can overshadow ethical considerations related to skilled migration. It may overlook the potential negative consequences, such as brain drain, loss of human capital, and exacerbation of inequalities between sending and receiving countries. Ethical concerns, such as social justice, equity, and fair distribution of benefits, should be considered alongside economic considerations.

The economic theory provides valuable insights into skilled migration by examining economic factors and labour market dynamics. It helps understand the rational decision-making process and the potential economic benefits for sending and receiving countries. However, it has limitations in its narrow focus on economic factors, oversimplification of migration decisions, data limitations, and the neglect of ethical considerations. To gain a comprehensive understanding of skilled migration, it is essential to consider a broader range of factors beyond the economic lens (Piper, 2023).

3.3.2 Neoclassical Economics

Macro-theory is probably the best-known approach for presenting migration. It developed a theoretical model explaining internal labour migration in the face of economic development (Corry, 1996; Harris and Todaro, 1970). According to the theory's assumptions, the main cause of labour migration is differences in wages between a sending country and a receiving country. In other words, wage differential elimination will end the migration of workers, and migrants will not migrate if such differentials do not exist.

Labour migration is influenced by labour market mechanisms. It means that other kinds of markets (insurance market, capital market) do not have an important effect on the flows of workers. The labour migration can be controlled by the government through regulating labour markets in both the sending and receiving countries (D. S. Massey, 2005).

Neoclassical economics arose in response to a macroeconomic model. This theory assumes that individuals are rational and migrate because, having calculated costs and benefits, they conclude that they receive a positive net return from movement. In other words, migrants estimate the cost and the benefit of moving and migrate to that country where expected net returns are greater than in the country of origin (Borjas, 1990). Migrants estimate net returns in each future period by taking the observed earnings and multiplying them by the probability of obtaining a job in the destination country to obtain 'expected destination earnings'. The policies that affect expected earnings in sending and receiving countries can influence the size of migration flows (Massey, 2005).

The New Economics of Migration is a theoretical model that has arisen in response to the neoclassical theory (Stark and Bloom, 1985). According to that model, families, households and other culturally defined units of production and consumption are those who count in analysis for migration research (not individuals). A wage differential is not a necessary condition for deciding about migration to other countries. Migration

does not necessarily stop when differences in wages disappear. Conviction of migration rightness will exist if other markets in the country of origin, such as the insurance market, capital market, and consumer credit market, are absent or imperfect. Governments can change the size of migration flows through regulating labour markets and, in case they do not exist or are imperfect, all markets mentioned above.

3.3.3 Human Capital Theory

This theory explores how individuals' investment in education, skills, and experience influences their decisions to migrate. It can help identify factors such as better job prospects, higher wages, career advancement opportunities, or better working conditions that may drive skilled professionals to emigrate (Borjas, 1987). The human capital theory posits that individuals migrate to improve their economic opportunities and to increase their earning potential. This theory suggests that migration is a rational decision-making process driven by economic factors, such as wage differentials between countries. Human capital theory also emphasises the importance of education and skills in facilitating successful migration and economic integration (Borjas, 1987).

Human capital theory is a widely accepted framework that suggests that individuals' skills, knowledge, and education contribute to their productivity and economic success. It argues that investments in education and training enhance a person's human capital, leading to higher wages and economic growth for individuals and societies (Chetty, 2019). However, when evaluating the theory against skilled emigration determinants in the South African context, several critical points arise. South Africa has been experiencing a significant brain drain, with highly skilled individuals emigrating to other countries. This emigration negatively impacts the country's human capital base. Human capital theory assumes that individuals seek opportunities that maximise their potential earnings (Mohammad, 2017). In the case of South Africa, economic and social factors often drive skilled individuals to emigrate, such as better job prospects, higher wages, and improved living conditions in other

countries. This contradicts the theory's assumption that individuals will invest in their human capital to benefit their home country.

South Africa's history of apartheid has resulted in inequalities in access to education and opportunities (Spaull, 2013). While human capital theory assumes equal access to education and training, the legacy of apartheid has left many disadvantaged communities with limited access to quality education. This inequality perpetuates a cycle of limited human capital development and inhibits economic growth. Consequently, the theory's assumptions about the availability and equality of educational opportunities do not hold true in the South African context.

It is also important to note that skilled emigration from South Africa is not solely driven by economic factors. Social and political considerations also play a significant role. Issues such as crime, political instability, and social unrest can drive skilled individuals to seek safety and stability elsewhere. Human capital theory tends to overlook these non-economic factors, assuming that individuals make migration decisions based solely on maximizing their economic outcomes (Seekings & Nattrass, 2015).

Another challenge in applying human capital theory to the South African context is the issue of skill mismatch. The theory assumes that individuals' skills align with the demands of the labour market. However, South Africa faces a significant problem of skill mismatch, where the skills possessed by individuals do not match the needs of the economy. This leads to underemployment or unemployment for many skilled individuals, creating a disincentive to invest in human capital development.

Human capital theory often neglects the broader social and structural factors that influence the accumulation of human capital. In the South African context, social reproduction processes, such as racial and gender inequalities, can hinder individuals' ability to invest in their human capital. Discrimination and limited opportunities for marginalised groups result in a systemic disadvantage that cannot be solely addressed by individual investment in education and training.

When critically evaluating the human capital theory against skilled emigration determinants in the South African context, the theory has limitations. The theory assumes equal access to education, neglects social and political factors, overlooks skill mismatch, and fails to consider the historical legacy of inequality. Understanding the complexities of skilled emigration in South Africa requires a broader analysis that incorporates social, economic, and political factors beyond the scope of human capital theory.

3.3.4 Social capital theory

It is a theoretical model explaining migration by presenting a concept of migrant networks. According to this approach, migration expands until network connections are wide enough that all people who wish to migrate to that country can do so without difficulties (Fine, 2008). The correlations between wage differentials or employment rates and migration flow hardly exist. Controlling migration in the light of this approach is very difficult, as migrants' networks are created outside the country and occur irrespective of policies pursued (Castles and Miller, 2009).

The social capital theory provides valuable insights into the decision-making process behind skilled emigration; its application in the South African context requires careful consideration. Social capital alone cannot fully explain the complex phenomenon of skilled emigration from South Africa, as it interacts with a multitude of factors, including historical inequalities, push and pull factors, economic considerations, and global trends. A comprehensive understanding of skilled emigration in South Africa necessitates an integrated analysis that incorporates multiple theoretical frameworks and acknowledges the diverse determinants at play.

The social capital theory emphasises the role of social networks in facilitating migration. This theory suggests that individuals rely on their social connections to obtain information, resources, and support when migrating to a new location. Social capital theory also highlights the importance of social integration in facilitating successful migration and integration (Portes, 1998). The social capital theory and skilled emigration determinants are two important concepts when analysing the phenomenon of skilled emigration in the South African context.

The social capital theory suggests that social networks and relationships play a crucial role in influencing individual decisions, including the decision to migrate. It argues that individuals with higher levels of social capital, which includes social connections, trust, and access to resources, are more likely to migrate because they can rely on their social networks to facilitate the migration process and provide support in the destination country (Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997).

When applying this theory to skilled emigration determinants in South Africa, several key points emerge. Firstly, it is important to recognise that South Africa has a complex history of social divisions and inequalities, which have influenced the formation of social networks and the distribution of social capital. The legacy of apartheid has left lasting effects on the social fabric of the country, with certain communities having limited access to social capital due to historical disadvantages.

Secondly, the brain drain phenomenon in South Africa is influenced by various push and pull factors. Push factors include high levels of crime, political instability, inadequate infrastructure, limited job opportunities, and low salaries in some sectors. These push factors contribute to the decision of skilled individuals to seek better prospects abroad, irrespective of their social capital (Fukuyama, 1995). The social capital theory may be less applicable when individuals face overwhelming challenges and limitations within their home country,

Furthermore, the impact of social capital on skilled emigration in South Africa is not uniform across different demographic groups. Marginalised communities, such as those in rural areas or townships, often have limited access to social networks and resources, which hinders their ability to migrate. In these cases, individual decisions to emigrate are shaped by other factors, such as economic motivations and aspirations for a better quality of life.

3.3.5 The Job Embeddedness Theory

Job Embeddedness Theory is a valuable framework for understanding the factors that influence employees' decisions to stay or leave an organisation. Developed by Mitchell, Holtom, Lee, Sablynski & Erez (2001), the theory posits that employees'

connection to their jobs, communities, and organisations influences their decisions about turnover. A critical analysis of this theory reveals both strengths and limitations.

Job Embeddedness Theory offers a comprehensive perspective by considering not only job-related factors but also community and organisational aspects. This holistic approach recognises that employees' decisions are influenced by a combination of professional and personal factors. Research has shown that job embeddedness is a significant predictor of employee turnover intentions and actual turnover (Crossley, Bennett, Jex & Burnfield, 2007). By focusing on the broader context of employees' lives, the theory captures elements that traditional turnover models might overlook. The emphasis on creating a positive work environment, fostering a sense of belonging, and providing opportunities for career advancement aligns with practical retention strategies. Organisations can use the insights from this theory to design interventions that enhance job embeddedness and reduce turnover.

In contrast, the Job Embeddedness Theory may have limited generalisability across different industries and cultural contexts. Factors influencing job embeddedness may vary, and the theory's effectiveness might be contingent on the specific characteristics of the organisational and societal context (Holtom & Inderrieden, 2006).

The theory may not fully account for the dynamic nature of the employment relationship. Employees' embeddedness can change over time due to evolving personal circumstances, organisational changes, or shifts in job satisfaction, challenging the theory's ability to provide a static and universally applicable framework (Jiang, Liu, McKay, Lee & Mitchell, 2012). Job Embeddedness Theory is a valuable framework that contributes to the understanding of employee turnover by emphasising the interconnectedness of job, community, and organisational factors. While it has practical implications for retention strategies, its limitations highlight the need for ongoing research and refinement. Organisations should consider the unique characteristics of their workforce and context when applying this theory to enhance its effectiveness in mitigating skilled personnel emigration.

3.3.6 Herzberg’s two-factor theory of motivation

The two-factor theory (also known as Herzberg's motivation-hygiene theory and dual-factor theory) states that there are positive factors in the workplace that cause job satisfaction, while a separate set of factors cause dissatisfaction, all of which act independently of each other. Herzberg's research found that all variables that make people feel positive or negative about their work can be grouped into one of two categories, namely motivators and hygiene factors (Robbins, Odendaal & Roodt, 2003). Herzberg relates more intrinsic factors, such as achievement, recognition, work content, career advancement, responsibility and the like, to job satisfaction. On the other hand, extrinsic factors such as status, security, remuneration, supervision and the like are related to job dissatisfaction. According to Herzberg, removing dissatisfying aspects (hygiene factors) from a work environment will not necessarily constitute job satisfaction. Herzberg maintains that job satisfaction is a function of challenging, stimulating activities or work content, to which he refers to as motivators (Mullins, 2016).

The presence of hygiene factors will not lead to a state of job satisfaction but rather to a state of no dissatisfaction. Hygiene factors on their own can therefore not motivate employees. To do that, the determinants and motivators must also exist. The opposite is also true. For motivators to operate as such, the hygiene factors must be present.

3.3.7 The expectancy theory of Victor Vroom

Victor Vroom's expectancy theory is a theory focused on motivation. According to Vroom (1964), work effort depends on the perception that an individual's effort will result in a desired outcome. To enhance the performance-outcome link, managers should use systems that tie rewards very closely to performance.

Managers also need to ensure that the rewards provided are deserved and wanted by the recipients. To improve the effort-performance link, managers should engage in training to improve their capabilities and improve their belief that added effort will in fact lead to better performance (Porter & Lawler, 2005). Vroom's (1964) expectancy theory, which falls into the category of process theories, considers the whole work

environment and argues that individuals are motivated to work when they anticipate achieving what they expect from their jobs. Individuals who feel that no matter how hard they work, they will not reach the desired performance level are unlikely to be motivated (Open University, 2003).

The critics argue that this theory assumes that people make logical calculations about effort, performance, and rewards, but emotions and biases also affect motivation (Porter & Lawler, 2005). It is difficult to quantify expectancy, instrumentality, and valence, making practical application challenging (Graham & Weiner, 1996). The model assumes individualistic motivation (self-interest), which may not apply to collectivist cultures where group success is valued more than personal rewards (Hofstede, 1980).

3.3.8 The equity theory

Equity theory focuses on establishing whether the distribution of resources is fair to both relational partners. Equity is determined by comparing the ratio of contributions (or costs) and benefits (or rewards) for each person. This theory seeks to maintain equity between the inputs that they bring to a job and the outcomes that they receive from it against the perceived inputs and outcomes of others (Adams, 1963).

According to Equity Theory, to maximise individuals' rewards, there is a tendency to create systems where resources can be fairly divided amongst members of a group or workers. Inequalities in relationships will cause those within them to be unhappy to a degree proportional to the amount of inequality (Greenberg, 1990). The belief is that people value fair treatment, which causes them to be motivated to keep the fairness maintained within the relationships of their co-workers and the organisation. The structure of equity in the workplace is based on the ratio of inputs to outcomes. Inputs are the contributions made by the employee for the organisation.

Equity theory proposes that the individual still balances inputs and outcomes, efforts and rewards, but does this in comparison to others (Robbins, 1998). Depending on the outcome of this comparison, they become either motivated if they perceive themselves as being awarded equitably or even over-rewarded, or demotivated if they

perceive inequity or under-reward. Trevor (2001) found that the effect of job satisfaction on turnover is moderated by and has a positive correlation with education, cognitive ability and occupation-specific training (Hofstede, 1980). This suggests that more mobile employees with high educational levels, high cognitive ability and high occupation-specific training tend not to be concerned with or affected by an economic landscape. These arguments suggest that a link exists between motivation, job satisfaction and retention. Engineers who feel that they will not be able to attain sufficient levels of motivation or job satisfaction through employment in South Africa may decide to consider emigration.

Equity theory remains a powerful framework for understanding workplace motivation. Employees are driven by fair treatment and react when they perceive inequality in rewards. Employers can use this theory to create fair compensation structures, improve employee satisfaction, and reduce workplace conflicts. However, this theory has been criticised as saying that employees have different views on what is "fair", making it hard to apply universally (Greenberg, 1990). In addition, some employees focus on personal growth rather than comparisons with others (Carrell & Dittrich, 2001).

3.3.9 Transnationalism Theory

Transnationalism theory examines how migration and globalisation create connections between home and host countries, allowing migrants to maintain social, economic, political, and cultural ties across national borders. The theory challenges traditional views of migration as a one-way process of assimilation, emphasising that migrants remain engaged in their home countries while integrating into new societies (Glick Schiller, Basch, & Szanton Blanc, 1992).

With the transnationalism theory, migrants develop dual or hybrid identities, belonging to both home and host countries and maintain strong social and economic networks across borders (Faist, 2000). There are several other aspects where migrants maintain a strong presence. They engage in cross-border economic activities, such as trade, remittances, and entrepreneurship, and participate in home-country politics through

voting, lobbying, and activism (Levitt & de la Dehesa, 2003). Additionally, migrants share and exchange cultural traditions, shaping both home and host societies.

This theory is criticised forits overemphasis on connectivity when it is possible that some migrants lose contact with their home countries due to economic or social factors (Portes, 1999). Not all migrants engage in transnational activities—class, legal status, and opportunities matter (Faist, 2000), and while migrants participate in home-country politics, their influence is often restricted (Levitt & de la Dehesa, 2003).

3.3.10 Critical Race Theory

The Critical Race Theory offers a critical perspective on migration, highlighting the intersectionality of race, class, and gender in shaping the experiences and outcomes of migration. This theoretical framework suggests that migration is not solely driven by individual decision-making but is also influenced by systemic inequalities and power structures that perpetuate marginalisation and discrimination (Crenshaw et al., 1995).

Critical Race Theory (CRT) is a theoretical framework that seeks to examine and challenge the ways in which race and racism operate in society (Bell, 1995). It emerged as a response to the limitations of traditional legal frameworks in addressing systemic racial inequalities. However, evaluating the application of CRT against skilled emigration determinants in the South African context requires an understanding of both CRT and the factors influencing skilled emigration in South Africa.

CRT emphasises the intersectionality of race with other social categories such as class and gender. It argues that racism is not merely a result of individual prejudice but is deeply embedded in social structures and institutions (Cole, 2009). CRT also highlights the concept of white privilege and the perpetuation of racial hierarchies.

When examining skilled emigration determinants in South Africa, several factors come into play. These include economic opportunities, political stability, quality of life, crime rates, and racial dynamics. Skilled individuals may choose to emigrate due to limited

employment prospects, political instability, high crime rates, and perceptions of racial discrimination.

In evaluating CRT against skilled emigration determinants in South Africa, it is important to consider its strengths and limitations by first looking at analysing power structures. CRT provides a valuable lens for understanding the power dynamics and structural racism that may contribute to skilled emigration. It encourages critical examination of institutional practices and policies that perpetuate racial disparities (Crenshaw, 1989; Crenshaw, 1991).

In addition, with regard to intersectionality, CRT recognises that race intersects with other social identities. This perspective acknowledges that skilled emigration determinants are influenced not only by racial factors but also by socioeconomic status, education, and other intersecting dimensions (Delgado & Stefancic, 2017). Then the overemphasis on race shows that one limitation of CRT is its exclusive focus on race, which may overlook other important factors contributing to skilled emigration. While race is undoubtedly a significant aspect, skilled individuals may also consider economic opportunities, political stability, and quality of life when making decisions to emigrate (Heriot, 2008).

CRT sometimes emphasises structural determinism, potentially overlooking the agency and individual decision-making of skilled emigrants. It is essential to acknowledge that individuals have complex motivations for leaving their home country, and not all decisions can be solely attributed to racial factors.

The applicability of CRT to the South African context should be critically examined. South Africa has a unique history of apartheid and post-apartheid transformation, which may require nuanced analyses that go beyond the U.S.-specific CRT framework. CRT offers valuable insights into understanding the structural and institutional factors contributing to racial disparities. While it can be applied to analyse skilled emigration determinants in South Africa, it is important to recognise its limitations and consider other factors influencing emigration decisions. A

comprehensive examination should include economic opportunities, political stability, quality of life, and crime rates, along with the racial dynamics that CRT emphasises.

3.4 Appropriate framework for the study

The emigration of skilled professionals, particularly engineers, from South Africa has raised concerns about brain drain and its impact on national development. While traditional migration theories such as Human Capital Theory and Push-Pull Theory provide insights, they do not fully capture the complexities of the South African context. This study proposes the Contextual Skilled Emigration Theory (CSET), integrating economic, political, historical, and psychological push and pull factors to explain and address the exodus of engineers from South Africa.

By integrating historical-structural theory, dual labour market theory, and critical race theory, this framework provides a robust basis for analysing emigration in South Africa's petrochemicals sector. Each theory contributes unique insights, and their intersections enrich the analysis by highlighting the interplay of structural constraints, organisational dynamics, and racial inequalities. Expanding on these theories' limitations and grounding the discussion in contemporary studies ensures the framework is both critical and relevant. Comparative examples from global industries further validate the chosen approach, offering actionable insights for addressing retention challenges in South Africa's complex socio-political landscape. Therefore, a South African-specific migration theory blends economic, social, and political factors while addressing global pull factors and local push factors.

Integrating historical-structural theory, dual labour market theory, and critical race theory creates a robust framework for understanding emigration in South Africa's petrochemicals sector. While historical-structural theory explains systemic inequalities, dual labour market theory contextualises organisational dynamics, and CRT provides insights into racialised experiences. However, the limitations of these theories necessitate a nuanced approach that incorporates contemporary scholarship and comparative analyses to ensure a comprehensive understanding of the phenomenon.

3.5 Conclusion

The chapter has dealt with the theoretical framework. As far as the context of emigration determinants and retention strategies for skilled personnel in the South African petrochemical sector is concerned, several critical theories have been applied. In relation to pull and push factors and emigration determinants, this theory suggests that individuals are pushed away from their home country (push factors) and pulled toward the destination country (pull factors). In the petrochemical sector, push factors might include political instability, economic challenges, and safety concerns in South Africa. Pull factors could be better career opportunities, higher salaries, and improved quality of life in other countries. Yet, on the other hand, as far as retention strategies are concerned, understanding and addressing both push and pull factors is crucial. Implementing strategies that mitigate push factors (e.g., improving working conditions, addressing safety concerns) and enhance pull factors (e.g., competitive compensation, professional development opportunities) can contribute to talent retention.

Having explored the Human Capital Theory, a deeper focus was explored in this chapter and indicates that, as far as determinants are concerned, this theory focuses on the idea that individuals migrate to maximise their lifetime earnings. Skilled personnel in the petrochemical sector may be attracted to countries offering higher wages, better career prospects, and a more favourable working environment, and to retain skilled personnel, companies should invest in their human capital. This involves providing training and development opportunities, creating a conducive work environment, and offering competitive salaries and benefits.

In addition, social capital theory indicates that social networks play a crucial role in migration decisions. If skilled professionals in the petrochemical sector have connections in other countries, they may be more inclined to emigrate. This could be influenced by family ties, friends, or professional networks. Building a strong sense of community and fostering social connections within the workplace can contribute to employee retention. Companies can also establish mentorship programs and networking events to strengthen social ties among employees.

In job embeddedness theory, this theory emphasises the links employees have to their jobs, communities, and organisations. If skilled personnel feel disconnected or disengaged, they may be more likely to consider emigration. Increasing job embeddedness involves creating a positive work environment, promoting a sense of belonging, and offering opportunities for career advancement within the organisation. This can make it more difficult for skilled professionals to justify leaving for opportunities elsewhere.

Implementing a comprehensive approach that considers these theories can help the South African petrochemical sector address emigration determinants and develop effective retention strategies for skilled personnel.

4 CHAPTER 4 - RESEARCH METHODOLOGY

4.1 Introduction

This section discusses the research methodology that was employed in this study. It shows how the study was conducted to address the determinants of emigration of skilled professionals from South Africa's petrochemicals sector as well as the possible retention strategies that organisations within the petrochemicals sector can adopt to retain some of the engineers. Consequently, comprehending the developmental capacities of migrants necessitates the utilisation of methodologies capable of elucidating both the structural influences shaping migrant behaviour and the ways in which migrants, as autonomous actors, navigate these influences to address challenges and seize opportunities. In this section, methodological approaches that are applied in the study are discussed.

4.2 Research paradigm

A research paradigm is a fundamental framework that guides how a research study is conducted. A research paradigm consists of beliefs, assumptions and methodologies that influence how researchers approach their studies (Campbell, 2007). A research paradigm defines ontology (the nature of reality), epistemology (how knowledge is acquired) and methodology (how research is conducted).

Creswell & Plano Clark (2017) suggested that mixed methods research operates on a pluralistic ontology, accepting that reality is both objective (measurable through quantitative data) and subjective (interpretable through qualitative insights). On the other hand, epistemology embraces methodological pluralism, recognising that knowledge can be acquired through both empirical measurements and interpretive understanding.

4.2.1 Common Types of Research Paradigms

There are fundamentally five types of research paradigms that are used in academic research. This includes positivism, interpretivism (anti-positivism), post-positivism,

critical theory and pragmatism. The research paradigms are characterised in **Table 4.1.**

Positivism is one of the foundational research paradigms that focus on objectivity, empirical evidence, and the use of quantitative methods to uncover universal laws (Neuman, W. L. (2014). While it has been criticised for its limitations in addressing subjective and contextual aspects of human behaviour, it remains a dominant paradigm in scientific research due to its rigour and replicability.

Interpretivism emerged as a key response to the limitations of positivism, particularly its inability to account for the subjective and contextual aspects of human behaviour. It provides rich, detailed insights into human behaviour and social phenomena, capturing the complexity of lived experiences (Denzin & Lincoln, 2011). Interpretivist research is flexible and adaptive, allowing researchers to explore emerging themes and insights as they arise. Interpretivist research paradigms are often criticised for their limited generalisability, as findings are typically context-specific and not easily transferable to other settings (Bryman, 2012). However, interpretivism is still a valuable research paradigm for understanding the subjective meanings and social contexts that shape human behaviour. While it has limitations, such as lack of generalisability and potential subjectivity, it provides rich, nuanced insights that are essential for exploring complex social phenomena.

Post-positivism emerged as a response to the critiques of traditional positivism, particularly its failure to account for the complexity and subjectivity of social phenomena. Post-positivism combines the rigour of quantitative methods with the depth of qualitative methods, providing a more comprehensive understanding of research problems (Tashakkori & Teddlie, 2010). Additionally, post-positivism allows researchers to adapt their methods to the specific needs of their research questions, making it a versatile paradigm. However, the integration of multiple methods and perspectives can make post-positivist research more complex and time-consuming. Post-positivism does not provide a clear, step-by-step framework for conducting research, which can be challenging for researchers (Bryman, 2012).

Critical theory is a powerful research paradigm that seeks to unearth and challenge the underlying power structures and ideologies that perpetuate inequality and

oppression (Agger, 2011). By emphasising social justice, reflexivity, and transformative change, critical theory provides a valuable framework for researchers committed to creating a more equitable and just society. Critics argue that critical theory can be overly pessimistic, focusing on oppression and domination without offering practical solutions (Hammersley, 2013). Furthermore, critical theory is often criticised for being abstract and difficult to apply in practical research settings.

The pragmatic paradigm is a research philosophy that prioritizes practical outcomes and problem-solving over abstract theoretical debates. It is rooted in the philosophical tradition of pragmatism, which emphasises the practical consequences of ideas and actions. In research, pragmatism focuses on addressing real-world problems by using the most appropriate methods, whether qualitative, quantitative, or mixed methods (Bryman, 2012). This paradigm is particularly well-suited for applied research, where the goal is to produce actionable insights and solutions (Creswell & Plano Clark, 2017). This research paradigm encourages the use of multiple methods, including both qualitative and quantitative approaches, to address research questions effectively. Pragmatism rejects the dualisms of objectivity/subjectivity and quantitative/qualitative, viewing them as complementary rather than opposing.

Critics argue that pragmatism lacks the philosophical depth of other paradigms, as it prioritizes practical outcomes over theoretical rigour (Hammersley, 2013). It is also argued that pragmatism's focus on practical outcomes may lead to the neglect of theoretical contributions and broader intellectual debates. The pragmatic paradigm is a practical and flexible research philosophy that prioritizes problem-solving and actionable outcomes. By emphasising methodological pluralism and contextual sensitivity, pragmatism provides a valuable framework for addressing complex real-world problems. While it has its limitations, its focus on practical relevance and integration of diverse methods makes it a powerful approach for applied research.

A summary of common types of research paradigms and their characteristics is shown in Table 4.1.

Paradigm	Positivism	Post-Positivism	Interpretivism	Critical Theory	Pragmatism
Ontology	Reality is objective and independent of human perception.	Reality exists but is imperfectly understood.	Reality is subjective and socially constructed.	Reality is shaped by power structures and social forces.	Reality is dynamic and context-dependent.
Epistemology	Knowledge is acquired through observation and measurement	Knowledge is influenced by context and biases but can be refined.	Knowledge is gained through experience and interaction.	Knowledge is gained by questioning existing power dynamics	Knowledge is practical and problem-solving orientated.
Methodology	Uses quantitative methods	Mixed method	Uses qualitative methods	Uses qualitative and action research	Uses mixed methods based on the research question.

Table 4. 1: Common types of research paradigms and their characteristics

The pragmatism research paradigm is used in this study, as it is the best-suited research paradigm for a mixed-methods approach (Patton, 2012). Pragmatism is selected for use in this study, as it is a flexible, practical, and problem-centred paradigm that prioritizes the research question over rigid adherence to a specific methodology. It allows researchers to combine qualitative and quantitative methods in a way that best addresses the research problem, making it ideal for mixed methods research (Johnson & Onwuegbuzie, 2014). In addition, pragmatism emphasises solving real-world problems rather than adhering to a specific philosophical stance. This aligns with the mixed methods approach, which seeks to address complex research questions by using the most appropriate methods (Creswell & Plano Clark, 2017). Pragmatism allows researchers to use both qualitative and quantitative methods without being constrained by the philosophical assumptions of positivism (quantitative) or interpretivism (qualitative). Furthermore, pragmatism rejects the binary opposition between positivism and constructivism, instead advocating for the

use of methods that best address the research objectives. It focuses on actionable outcomes, emphasising practical significance over theoretical purity.

4.3 Research design

This study employed a mixed-methods research design, integrating both quantitative and qualitative approaches to provide a comprehensive understanding of the emigration trends of Black/African engineers in South Africa's petrochemicals sector. This approach combines the breadth of quantitative data with the depth of qualitative insights, enabling a holistic exploration of migration patterns, motivations, and systemic influences. Creswell (2014) suggested that although quantitative methods may overlook contextual nuances, while qualitative methods lack generalisability, mixed methods address these limitations by combining the strengths of both approaches. Furthermore, a mixed method was preferred in this study, as it allowed for triangulation, where findings from a quantitative method were cross-validated with findings from qualitative. This enhanced the credibility and validity of the findings of the study (Bryman, 2006).

There are many mixed-methods research designs that can be applied in a research study. However, to simplify researchers' design choices, several typologies have been developed (Creswell, 1994; Creswell, 2002; Creswell, Plano Clark, Guttmann and Hanson, 2003).

These typologies differ in their levels of complexity. However, most mixed-method designs utilise the time orientation dimension as their base. Time orientation refers to whether the qualitative and quantitative phases of the study occur at approximately the same point in time such that they are independent of one another (i.e., concurrent) or whether these two components occur one after the other such that the latter phase is dependent, to some degree, on the former phase (i.e., sequential).

Mixed methods research enables researchers to capture a more comprehensive understanding of migration phenomena by integrating both quantitative and qualitative data collection and analysis techniques. This approach acknowledges the complexity and richness of migration experiences, allowing researchers to explore diverse perspectives, contexts, and meanings associated with migration processes.

Furthermore, it facilitates triangulation, where findings from different methods are compared to enhance the validity and reliability of research outcomes.

A mixed methods approach, predominantly involving a blend of questionnaire surveys and interviews or focus groups, has emerged as a prominent technique in migration research since the early 1990s (Bryman, 2006; Graham, 1999; Rossman and Wilson, 1994). Employing a mixed methods approach entails utilising two or more methodologies to "address a research question at the same stage in the research process, in the same place, and with the same research subjects" (Phillip, 1998: 264). This study applied a concurrent mixed method. In this instance both quantitative and qualitative data were collected simultaneously and then integrated to provide a comprehensive understanding of the causes of emigration of engineers from South Africa. Simultaneous collection of both qualitative and quantitative data allowed researchers to cross-validate and compare results, boosting the study's reliability and trustworthiness.

While the combination of qualitative and quantitative methods has been characterised as an 'impossible mixture' or 'uneasy alliance', research has shown that integrating these two approaches offers numerous advantages (Bryman, 2006; Graham, 1999; Johnstone, 2004; McKendrick, 1999; Rossman and Wilson, 1994). These advantages include triangulation or corroboration, elaboration, development (where results from one method shape subsequent strategies of another method), and initiation (where results from one study foster new lines of thinking and challenge the original conceptual framework) (Greene et al., 1989; Rossman and Wilson, 1994).

Therefore, a mixed methods approach offers various benefits, ranging from enhancing research design to validating research findings. As detailed in the subsequent chapter, this thesis adopted a mixed-methods approach, consisting of a quantitative approach followed by an in-depth qualitative approach to explore the experiences of South African engineers emigrating from their home country.

This mixed-methods approach provides a robust framework for exploring the emigration of Black/African engineers in South Africa's petrochemicals sector. By combining quantitative breadth with qualitative depth, the study captures both

systemic trends and individual experiences. Addressing limitations and emphasising ethical rigour further strengthens the credibility and validity of the findings, offering actionable insights into migration dynamics and retention strategies.

4.4 Research strategy

The research strategy presents how the researcher proposes to carry out the research under investigation (Creswell, 2018). There are several research strategies that can be applied in a research study. Some of these strategies include surveys, archival research, case studies, ethnography, action research studies, grounded theory and experimental research. The current study on the investigation of the patterns, drivers, and implications of skilled professionals' emigration from South Africa's petrochemical sector was based on a combination of a survey and case study research strategies.

A survey strategy was used in this study, as it generally allows a researcher to collect data from many participants relatively quickly and efficiently; it is less expensive to administer and can be distributed online or in person, reducing costs associated with extensive travel (Neuman, 2014). While surveys offer several advantages, they also have limitations, which include potential biases (e.g., response bias, sampling bias) and the possibility of superficial data if the instrument design is not well crafted (Patton, 2012).

Furthermore, the survey strategy was combined with a case study approach to have a detailed examination of context-specific data of the patterns, drivers, and implications of skilled professionals' emigration from South Africa's petrochemical sector. Therefore, a case study has the capacity to generate deep, contextual, and practical insights into the drivers of emigration of engineers in South Africa, particularly from the petrochemical sector. However, case studies have limitations such as concerns with the ability to generalise findings to a larger population and have high levels of subjectivity, as the researcher's bias can significantly influence how data is interpreted (Creswell, 2014).

4.5 Population and Sampling

4.5.1 Target population

According to Creswell (2018), a target population in research refers to the entire group of individuals, organisations, or objects that a study aims to investigate and draw conclusions about. It is the broader group from which a sample is selected for data collection and analysis. It is emphasised that the population units must align with the study's goals (Creswell & Creswell, 2018) and that the members of the target population share common traits relevant to the research (Bryman, 2016; Babbie, 2020).

Since this study used a mixed-method approach, which consisted of two parts, the quantitative and the qualitative approaches. For the quantitative component of the study, the target population elements consisted of engineers that have left the country and have localized, engineers that are on short-term contracts, engineers that are expatriates, engineers that have repatriated, and engineers that have an intention to emigrate. These engineers were sourced from the database of various engineering institutions which included Omnia Group PTY Ltd, the Engineering Council of South Africa (ECSA), the South African Institute of Chemical Engineers (SAICHE), the South African Petroleum Industries Authorities, the Institute of Municipal Engineers of South Africa (IMESA), National Energy Regulator of South Africa (NERSA), South African Petroleum Industry Association (SAPIA) including the six of South Africa's leading petroleum refining and marketing companies affiliated with SAPIA namely, BP (SA) (PTY) LTD, Caltex Oil (SA) (PTY) LTD, Engen Petroleum LTD, Shell (SA) (PTY) LTD, Sasol Limited, Total (SA) (PTY) LTD and the Institute of Chemical and Metallurgical Engineers (ICME) and South African Institution of Civil Engineering (SAICE). Only engineers who were in the petrochemical industry and who have spent a minimum of 2 years working in this industry were considered. In this case, the total population of the study was estimated at 415 professional engineers.

4.5.2 Sample and sampling technique

For the quantitative part of the study, a sample was considered instead of the entire population of size 415. A sample is useful, as it is effective in terms of cost and time. A properly chosen sample reduces errors compared to attempting to gather data from an entire population, which may lead to incomplete or unreliable responses (Fowler, 2014). Furthermore, collecting, processing, and analysing data from a large population can be overwhelming (Saunders et al., 2019).

There are several methods that are used to calculate the sample size from a known population. Creswell & Creswell (2018) argued that for a population of less than 1000, a credible sample size that can replicate population characteristics should be 30% of the population size. However, Bryman (2016) argued that a sample size depends on the field or discipline, the level of confidence, the margin of error and the anticipated response rate. Therefore, the researcher used a margin of error of 5 per cent and a confidence level of 95 per cent, and it was established that a sample of at least 200 experts from a population of 415 was required to replicate population characteristics.

The stratified random sampling technique was used to select participants from various employee databases of their respective institutions listed above. The stratified random sampling technique ensured that the population was subdivided into smaller groups across age, gender, race and experience levels. This helped to reduce sample bias and hence improve accuracy.

However, it was believed that a population of 415 professional engineers was not too large, and hence all the population elements (of 415) were invited to participate in this exercise on emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector. To participate in this study, professional engineers were expected to have at least five years of experience in the petrochemical industry, willingness to participate in the study and direct involvement in areas related to the research focus. Participants' recruitment involved reaching out to industry associations, professional networks, and specific organisations known for their prominence in the petrochemicals field. Invitations were sent via email, supplemented by follow-up phone calls.

Several challenges arose during this exercise to gather data from participants. It was challenging to gain access to individuals due to their busy schedules and issues with confidentiality, privacy and organisational gatekeeping. To mitigate these challenges, the researcher used professional networks and industry events as levers to establish credibility and secure participation.

For the qualitative part of the mixed method, a total of 24 participants were used. This was comprised of 12 human capital professionals who provided their insights on the retention strategies to reduce migration of professional engineers. Another 12 interviewees were sector experts who were well versed with the emigration of professional engineers from South Africa. The focus in the qualitative approach was not on having more participants but on in-depth thoughts from everyone on the subject matter under investigation. This is adequate given that in general about 8 to 20 people are considered sufficient to reach saturation points to gather adequate data from participants of interviews (Yin, 2014).

4.6 Data collection methods

This study pursued a mixed-method approach to investigate the patterns, drivers, and implications of skilled professionals' emigration from South Africa's petrochemical sector. For the quantitative data, a structured survey questionnaire was used to gather opinions of participants who included experts and engineers in the petrochemical sector. The opinions of participants were rated using a 5-point Likert scale ranging from not effective to very effective. This structured questionnaire was administered online using Google Forms. This platform was preferred, as its use did not cost the researcher anything (except having data or a Wi-Fi connection). The platform was also convenient for participants, as they were able to complete it in their own time. The Google Form also provided basic descriptive statistics, which went a long way for supporting data analysis.

An interview guide was used to gather the qualitative data of the study. The aim was to gather opinions of experts and engineers on the drivers and implications of skilled professionals' emigration from South Africa's petrochemical sector. A structured interview guide was developed based on the relevant literature and targeted sector experts and human capital executives who were selected purposely to provide rich, relevant insights into the emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector. This target audience of sector experts and human capital executives were deemed to have the knowledge and experience on issues pertaining to issues under investigation. The structured interview guide was preferred in this study, as it is flexible and allowed the interviewer to obtain a great amount of information.

Prior to conducting the interviews, the researcher obtained ethical approval from the university, and informed consent, confidentiality, and the right to withdraw at any time were guiding principles for the data collection exercise. The researcher had to build a rapport with participants to elicit honest and detailed responses. Scheduling and logistical challenges arose, especially in securing participation from harder-to-reach individuals. The researcher had to be patient with potential interviewees and was flexible to accommodate their tight work schedules. Interviews were mainly conducted online using the Microsoft Teams platform. However, it should be stressed that some of the interviews were done face-to-face, whereupon a recorder was used to record the sessions. The interviewer also jotted down some important points that were emerging during these sessions. Some of the interviews were done online using the Google Meet platform. The record option on this platform was utilised to record interview sessions. The interviewer also took some notes, which were also an important source of information for qualitative data gathering.

4.7 Data analysis

Given that this study was a mixed-method approach, both qualitative and quantitative analysis methods were used. The details of relevant analysis techniques that were in the study follow in the subsequent subsections.

4.7.1 Quantitative analysis

The data that was gathered using the questionnaire survey was analysed using quantitative techniques. Demographic characteristics of the respondents (which included the age, gender, race, education, and experience in years of the migrants) were analysed using frequencies, percentages, and visualisation using tables and graphs.

An exploratory factor analysis was applied to uncover the underlying structure of a large set of variables (Yin, 2014). Exploratory factor analysis reduces the number of variables, establishes associations between variables and evaluates the construct validity of scales. Kaiser-Meyer-Olkin (KMO) was used as part of the preliminary analysis to determine whether EFA was appropriate for use with the data that was gathered in this study. The KMO measure of sampling adequacy shows the percentage of variance that is explained by variables that are considered or measured in a study. Generally, a KMO value of greater than 0.5 is required for a satisfactory factor analysis to proceed, and Bartlett's test of sphericity must be significant if EFA is appropriate for use with the collected data (Bryman and Bell, 2015).

Principal component analysis was applied to determine the number of underlying factors in the data using total variance explained by components as well as a scree plot. Eigenvalues were used to measure the amount of variance explained by each component of the factor. Mehmedinovic (2017) asserts that eigenvalues larger than 1 demonstrate the criticality of the underlying factor component and explain a significant variance.

Principal Component Analysis (PCA) and a suppression factor of 0.4 as suggested by Fornell & Larcker (2017) were used to extract underlying factors in the dataset. This meant that items with factors of less than 0.4 were deemed not critical, as suggested by Fornell & Larcker (2017). The underlying factors that were extracted were named appropriately in line with emigration concepts and theories.

4.7.2 Qualitative analysis

The researcher read transcripts of each interviewee several times to gain a deep understanding of the issues that were raised by interviewees. Notes for interesting or significant ideas were jotted down, and potential patterns or recurring concepts were highlighted. The emerging data was broken down into smaller segments, and descriptive codes were assigned to each segment that captured its essence. Related codes were grouped together to form potential themes. The researcher had to look for patterns, relationships, and connections between codes. Emerging themes were refined to ensure these were distinct and meaningful. The researcher also ensured that themes were coherent, consistent, and supported by the data. It was also ensured that the themes generated were meaningful and directly addressed the research questions.

4.8 Validity and Reliability

The quantitative part of a mixed-method approach focused on validity and reliability of the data, while the qualitative part dealt with trustworthiness that is discussed later. Validity and reliability of the data are essential facets of a research study. These facets challenge the researcher to think about reputational issues of the data source and how the data is gathered and analysed. Reliability and validity of the instrument are very important, as these fundamental research elements can be used to mitigate risk associated with measurement problems in a research study.

Validity refers to the relevance of the data and measures used and the accuracy of the results, as well as the generalisability of the findings to the population (Creswell, 2014). There are two types of validity that are commonly used. There is an internal and external form of validity. External validity measures the degree of the generalisability of the findings to the population, while internal validity concerns itself with validating if the instrument is measuring what it intends to measure (Creswell, 2018).

On the other hand, reliability measures the consistency of a measurement and is commonly measured using Cronbach's alpha coefficient (Leedy and Ormrod, 2016). Furthermore, in quantitative research studies, reliability measures the extent to which

the sample of a study used gives an accurate representation of the target population. Leedy and Ormrod (2016) recommended that Cronbach's alpha values of at least 0.7 are acceptable, and this means that the instrument can give consistent results in repeated use. On the other hand, Cronbach's alpha values of less than 0.7 are poor and unacceptable. However, Malhotra (2009) recommended a lower threshold alpha value of at least 0.6 as an acceptable level of internal consistency. Malhotra (2008) further indicated that Cronbach's alpha values of less than 0.6 are considered poor and unacceptable.

There are measures that were taken to ensure that high validity and reliability are achievable. Some of these measures that were taken were as follows.

a. The research instrument was designed based on published literature.
b. Research instrument was piloted to ensure appropriateness to the study objectives, completeness of the instrument to cover all the research questions as well as accuracy of the findings
c. Due to the general subjective nature of opinions, the participants were requested to be very objective when completing the questionnaire.
d. There was a need to have a well-defined data collection methodology. This methodology should be applied consistently during the data gathering process
e. The data-gathering instrument was arguably very easy to read and was devoid of any ambiguities

4.9 Trustworthiness and Authenticity

It is very important in qualitative studies that the data is trustworthy and authentic. This helps to ensure that the findings are accurate, credible and can be depended on. There are certain measures that must be undertaken to ensure that the trustworthiness and authenticity of this study are upheld. These measures were instituted on the defining elements of trustworthiness which included credibility, dependability, conformability, transferability, and authenticity. The details of the measures that will be taken to ensure trustworthiness and authenticity of this study are as follows.

Table 4.2 :Measures undertaken to ensure trustworthiness and authenticity

Element	Measures
Credibility (assurance of the research process)	Assuring participants of confidentiality of their participation
	Encourage participants to express themselves freely by providing unbiased opinions backed by facts
	Piloting interview guide prior to the rollout of interviews
	use of several analysis methods such as thematic and content analyses
	Triangulating qualitative data with quantitative
	Training of researcher to ensure professional conduct during engagements with participants
Dependability (consistency in findings)	Pilot instrument prior to administering it to participants
	Anonymity will be observed through not using any form of identifiers
	Data quality checks will be done
	adhere to research practices
	The supervisor will quality check the outcome.
Conformability (bias reduction)	Several data collection and analysis methods will be used for triangulation of findings
Transferability (application of study to similar context)	Provide detailed background of the study
Authenticity	Engage and treat participants fairly
	Appropriate briefing is required prior to interviews
	An audit trail of interview carried out should be retained

4.10 Ethical consideration

The researcher adhered to several ethical principles to foster trust, credibility and respect in the research process of the study. The following ethical considerations were amplified.

i. Approval from Ethics Committees

The researcher first got an approval from the Ethics Committees from Wits University. This meant that the committee was satisfied with the compliance of the study with ethical standards.

ii. Informed Consent

The researcher ensured that participants were fully informed about the study's purpose, procedures, risks and benefits. The participants were made aware that taking part in this exercise was voluntary without coercion and were also free to leave as and when they felt so.

iii. Confidentiality

The researcher made sure that participants' personal information was protected and that associated data was anonymised. The data obtained in the study was securely stored to prevent unauthorised access.

iv. Debriefing

The researcher provided a clear explanation of the study's purpose and outcomes as well as its benefits.

v. Minimizing Harm

The researcher made it a point that the study did not expose participants to physical, psychological or social harm. Instead, the researcher gave priority to participants' safety and well-being.

vi. Integrity

The researcher ensured that this study was conducted honestly, transparently, and without fabrication, falsification, or misrepresentation of data.

4.11 Conclusion

This chapter has explained the research methodology employed in this study, delineating the systematic approach undertaken to address the following research questions: (i) What factors act as determinants compelling skilled professionals to emigrate from the petrochemicals sector? (ii) What characterises the landscape of emigration among skilled professionals in the petrochemicals sector? (iii) What retention strategies can organisations within the petrochemicals sector potentially adopt to preserve a subset of engineers, and how can skilled engineers be effectively retained? (iv) What are the prospective implications pertaining to skills development for petrochemical engineers within the petrochemicals sector?

The use of a mixed-method research methodology is particularly important in a study examining emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector for the following reasons: Qualitative methods, such as interviews, has provided a deep understanding of the subjective experiences and motivations behind emigration. This was crucial for grasping the nuanced factors influencing skilled professionals to leave the petrochemical sector. Quantitative methods, such as surveys or statistical analyses, allow for the collection of numerical data to measure the effectiveness of various retention strategies. This complements the qualitative insights by providing a broader perspective on the prevalence and impact of different strategies.

The use of both qualitative and quantitative data allows for triangulation, where findings from one method are corroborated or complemented by findings from the other. This enhanced the overall validity and reliability of the study by reducing the risk of bias and ensuring a more robust interpretation of results. In addition, combining qualitative and quantitative approaches enabled the researcher to gain a holistic perspective on the emigration determinants and retention strategies. It helped in capturing the complexity and diversity of factors involved, ensuring that the study does not oversimplify the multifaceted nature of skilled personnel decisions. It is critical to

note that qualitative methods were well-suited for capturing the contextual nuances and cultural aspects that have influenced emigration decisions and retention strategies in the South African petrochemical sector.

Understanding the unique context was crucial for developing targeted and effective recommendations. The mixed-method approach facilitates a more comprehensive analysis of policy implications. By integrating qualitative insights into the quantitative findings, the researcher is providing policymakers with a richer understanding of the challenges and opportunities related to emigration and retention in the petrochemical sector. The emigration determinants and retention strategies are dynamic and can change over time. A mixed-method approach allowed for a longitudinal exploration, combining the strengths of qualitative exploration for in-depth insights with quantitative analysis to identify trends and patterns over time. The combination of methods helped enhance the overall validity and reliability of the study. Qualitative data has provided a rich understanding of individual experiences, while quantitative data has contributed statistical significance, leading to more robust and trustworthy research outcomes.

The mixed methods design, underpinned by a pragmatic philosophical foundation, allowed for a comprehensive exploration of the research problem. The quantitative surveys provided a broad overview of trends and relationships, while the qualitative interviews offered depth and contextual richness. Together, these methods not only complemented each other but also enriched the overall validity and applicability of the study's findings, showcasing the value of methodological integration in addressing complex research questions.

Therefore, a mixed methods approach offers various benefits, ranging from enhancing research design to validating research findings. As detailed in the subsequent chapter, this thesis adopts a mixed-methods approach, consisting of a questionnaire survey followed by in-depth qualitative interviews, to explore the experiences of South African engineers emigrating from their home country. It will be demonstrated how this approach strengthens the research design and enhances the quality of the research findings. This chapter concludes by synthesising the key arguments presented herein that guide the thesis.

5 CHAPTER 5 - PRESENTATION, ANALYSIS, AND DISCUSSION OF FINDINGS

5.1 Introduction

The previous chapter covered appropriate research methods that were applied in this study to investigate the patterns, drivers, and implications of skilled professionals' emigration from South Africa's petrochemical sector, specifically focusing on the challenges faced by Black/African engineers. This chapter is devoted to the presentation, analysis and discussion of the findings of the study.

The chapter is broken into two parts. The first part of the chapter presents quantitative analysis of data obtained from the survey questionnaire, while the second part presents qualitative analysis whose data was obtained from the interviews. Both quantitative and qualitative analyses of data are presented to provide answers to the main research questions of the study on the central determinants of emigration and retention strategies of skilled personnel in the South African petrochemical sector.

The chapter also presents discussions where the findings of the study (from both quantitative and qualitative analysis) are compared with literature to identify any departure points as well as provide explanations of such gaps. The results in this chapter form a basis for the next chapter that deals with the conclusions, recommendations and scope of further research.

5.2 The aim of the research study

It is important to recap the main research questions of the study, as it allows the chapter to flow as guided by the study questions in chapter 1. To guide the study in analysing the data and generating appropriate conclusions, the following research questions were used.

a. What is the profile of skilled professionals emigrating from SA, particularly from the petrochemicals sector?
b. What characterises the levels and trends of emigration of professional engineers from SA, particularly from the petrochemical sector?
c. What are the determinants of skilled professionals emigrating from SA, particularly from the petrochemicals sector?
d. What are the future developmental implications of human flight and the exodus on skills and overall development of the petrochemical sector in SA?
e. What are the possible retention strategies that organisations within the petrochemicals sector in SA can adopt to retain some of the engineers?

5.3 Quantitative analysis of data

This first part of the chapter presents a quantitative analysis of data which was obtained from the questionnaire. This section covers demographic characteristics of respondents, response rate, reliability analysis, descriptive statistics of the data and inferential statistics (correlation and regression analyses) to test relationships between the constructs.

5.3.1 Response rate

The response rate of the study is shown in Table 5.1. It is shown that 415 questionnaires were distributed to the targeted audience using an email facility. Out of this total, 153 questionnaires were completed in full and returned. Based on this information, a response rate of 36.9%, as demonstrated in Table 5.1, was achieved. This is an acceptable response rate given that online surveys with a response rate as high as 30% are considered reasonably high (Park & Tsuchiya, 2021).

Table 5. 1: Response rate of the study

Country	Emailed	Returned	Return Rate (%)
South Africa	101	32	31.7%
Australia	40	29	72.5%
UAE	83	41	49.4%
UK	80	6	7.5%
USA	20	12	60.0%
Canada	30	11	36.7%

New Zealand	30	11	36.7%
Other Africa	15	7	46.7%
Other Europe	5	0	0.0%
Other Asia	3	1	33.3%
Other	8	3	37.5%
Total	**415**	**153**	**36.9%**

5.3.2 Reliability analysis

The reliability of the instrument was measured using Cronbach's alpha. Cronbach's alpha values of 0.7 and above indicate that the internal consistency is good, while Cronbach's alpha values of less than 0.7 indicate poor internal consistency that is not acceptable in a research study (DeVellis, 2017; Hair, Black, Babin & Anderson, 2019).

Table 5.2 indicates that all the constructs that were measured in this study had Cronbach's alpha values that were more than the 0.7 cutoff value. The scales for country-related factors, future implications, repatriation, criticality ratings and emigration reasons recorded high Cronbach's alpha values that were above 879.0%, which indicates a very good level of internal consistency. An overall Cronbach's alpha of 85.4% was achieved in this study. This is a very good level of internal consistency, which is above the 0.7 standard cutoff point.

Table 5. 2: Measuring reliability of instruments using Cronbach's Alpha

Construct	No. of items	Cronbach's Alpha (%)
Country-Related Factors, CRF	16	90.3
Retention of Chemical Engineers, RCE	29	79.3
Mitigation Strategies, MSE	5	78.6
Future implications, FI	13	88.6
Intention to emigrate, IMG	12	88.9
Repatriation, R	10	89.9
Criticality ratings, CR	15	87.6
Work-related factors, WRF	11	80.2
Emigration reasons, ER	16	90.9
Determinants, D	11	79
Overall	**138**	**85.4**

It should be noted that there were initially 10 items in the Mitigation Strategies (MSE1 to MSE10) construct. However, the internal consistency of this construct was initially lower than the 0.7 threshold. Therefore, the 10 items in Mitigation Strategies were analysed with deleted items activated. It was concluded that 5 items were not adding value to the improvement of the internal consistency of the Mitigation Strategies construct and were disregarded, as these were weakly related to the overall scale and may not have been measuring the same construct. The remaining 5 items that were strongly related to the overall scale and were important for its reliability are shown in **Table 5.3.**

Table 5. 3: Reliability of Mitigation Strategies with items deleted

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
MSE1	13.06	2.890	.670	.715
MSE3	13.06	2.890	.670	.715
MSE4	13.34	2.730	.492	.779
MSE8	13.35	2.772	.585	.738
MSE10	13.51	3.165	.450	.780

Similarly, the internal consistency of work-related factors (WRF) was analysed with deleted items. It was concluded that 5 items were weakly associated with the overall work-related factors scale and may not have been measuring the same construct. These items were disregarded, leaving 11 items as shown in Table 5.4. Therefore, all the items that were disregarded were also not considered in the subsequent analysis.

Table 5. 4: Reliability of Work-related factors with items deleted

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
WRF1	24.01	19.817	.268	.802
WRF4	23.77	19.947	.252	.803
WRF5	23.88	18.860	.493	.786
WRF7	24.29	17.802	.359	.800
WRF8	24.02	18.134	.426	.790
WRF9	23.99	17.433	.523	.779
WRF12	24.20	16.854	.519	.780
WRF13	24.03	16.143	.690	.759
WRF14	23.95	17.892	.516	.781
WRF15	24.07	16.024	.633	.765
WRF16	24.09	18.079	.393	.794

5.3.3 Demographic Characteristics of respondents

Firstly, the demographic characteristics of the respondents are analysed using frequencies and percentages. Six demographic characteristics of the respondents were evaluated, which included the age, gender, race, education, and experience in years of the migrants. The results of the demographic characteristics are presented and discussed in Table 5.5.

Table 5. 5: Demographic information of respondents

N = 105			
Variable	**Category**	**Frequency**	**Percentage %**
Gender	Female	27	25
	Male	78	74
Race	White	37	35
	African	34	32
	Asian	25	23
	Coloured	9	8
Education	BSc/BCom	40	38
	Honours	21	20
	Postgrad	28	26
	Masters/MBA	14	13

	PhD	2	1.9
Age	25-30 years	18	17.1
	31-40 years	24	22.9
	41-50 years	35	33.3
	51-60 years	20	19.0
	60+ years	8	7.6
Experience (years)	Less than 5 years	55	52.4
	5-10 years	36	34.3
	10-15 years	9	8.5
	15+ years	5	4.8

The overwhelming majority of respondents, as depicted in Table 5.5 are male, accounting for 74% of the total. This statistic underscores the gender disparity within the engineering profession in South Africa. Although there has been a notable increase in the representation of women in engineering over the past two decades, the proportion of emigrant female South African engineers remains low at 25%.

The gender distribution outlined above closely mirrors the data obtained from the Engineering Council of South Africa (ECSA), which indicates that most engineers working in South Africa are male, accounting for 71.2% of the workforce (ECSA, 2022). This aligns well with the ECSA Report (2022), which reveals that there is a higher proportion of white engineers (55%) compared to Black engineers (40.3%) of South African origin, with nearly 13.6% being of Asian descent and about 6.8% of these being from the coloured community.

A significant portion of respondents, over 65%, are below the age of 50. However, this demographic distribution varies by race, with 35.2% of white engineers and 32.3% of Black engineers falling within this age bracket. This age discrepancy can be attributed to the historical legacy of apartheid in South Africa, where Black individuals had limited access to education until the post-apartheid era began in 1994. Consequently, Black engineers have a more recent history of migration compared to their white counterparts.

In terms of racial composition, the survey found that a slight majority (35.2%) of respondents were white, while Black engineers accounted for 32.3% of the total

respondents. Additionally, 23.8% identified as Indian/Asian and 8.5% as Coloured. It is important to note that the underrepresentation of Black engineers in the sample can be attributed to their lower participation rates in the survey.

It is illustrated that the majority (38%) of the respondents were in possession of Bachelor of Science degrees or Bachelor of Commerce degrees, while 46% of the respondents confirmed that they were in possession of either a postgraduate degree or an honors degree. About 14.9% of the respondents confirmed that they were in possession of at least a master's degree. Based on Table 5.5, it is shown that 52.4% of the respondents had less than 5 years of experience in engineering, while 34.3% confirmed that they were having an experience of between 5 and 10 years in engineering. This statistic confirms that more of the young engineers in South Africa are emigrating to work abroad for various reasons.

5.3.4 Determination of factor structure using exploratory factor analysis

The original data of the study had no structure and consisted of a very large set of variables, some of which were not critical. Therefore, an exploratory factor analysis was applied to uncover the underlying structure of a large set of variables (Yin, 2014). Exploratory factor analysis reduces the number of variables, establishes associations between variables, and evaluates the construct validity of scales.

Kaiser-Meyer-Olkin (KMO) was used as part of the preliminary analysis to determine whether EFA was appropriate for use with the data that was gathered in this study. The KMO measure of sampling adequacy shows the percentage of variance that is explained by variables that are considered or measured in a study. As a rule of thumb, a KMO value of greater than 0.5 is required for a satisfactory factor analysis to proceed, and Bartlett's test of sphericity must be significant if EFA is appropriate for use with the collected data (Bryman and Bell, 2015).

Table 5.6 shows that the Bartlett's test in this study was significant ($p < 0.01$) and the value of KMO was above the 0.5 threshold (at 0.747). This is a demonstration that there is a strong relationship among variables considered in this study. Alternatively, this means that there are few underlying factors that can be identified in this study.

These are significant factors that can be extracted from the data of the study, which makes analysis and understanding of the dataset easier and less complex.

Table 5. 6: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.747
Bartlett's Test of Sphericity	Approx. Chi-Square	2.457E3
	df	136
	Sig.	.000

5.3.5 Determination of underlying factors using factor analysis

Principal component analysis was also used to determine the number of underlying factors using total variance explained by components as well as a scree plot. Eigenvalues are used to measure the amount of variance explained by each component of the factor. Mehmedinovic (2017) asserts that eigenvalues larger than 1 demonstrate the criticality of the underlying factor component and explain a significant variance.

A scree plot was also used to determine the number of underlying factors that can be extracted from the data of the study. The number of factors that can be extracted from the data corresponds to the point of inflection that is determined from the plot. The scree plot is a useful reference on the number of components that can be extracted from a dataset; however, it should be noted that it is not particularly accurate.

A total of only 6 underlying factors were extracted from the dataset, as shown in Table 5.7. These factor components extracted had Eigen values that were greater than 1 and explained a significant cumulative variance of 85.34 percent of the data.

Table 5. 7: Determination of the number of factors using total variance explained by components

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.113	24.194	24.194	4.113	24.194	24.194	3.189	18.759	18.759
2	3.705	21.795	45.989	3.705	21.795	45.989	2.810	16.528	35.287
3	2.448	14.399	60.388	2.448	14.399	60.388	2.391	14.067	49.354
4	1.771	10.420	70.807	1.771	10.420	70.807	2.151	12.652	62.006
5	1.276	7.504	78.312	1.276	7.504	78.312	2.136	12.567	74.573
6	1.195	7.030	85.342	1.195	7.030	85.342	1,831	10.768	85.342
7	.940	5.527	90.868						
8	.528	3.107	93.976						
9	.319	1.878	95.854						
10	.242	1.421	97.275						
11	.212	1.247	98.522						
12	.123	.726	99.248						
13	.074	.435	99.683						
14	.038	.226	99.909						
15	.009	.051	99.960						
16	.006	.035	99.996						
17	.001	.004	100.000						

The number of factors that can be extracted from the data of the study was also determined by a scree plot as shown in Figure 5.1. The point of inflexion is at 6, which means that a total of 6 underlying factors were extracted from the dataset of the study.

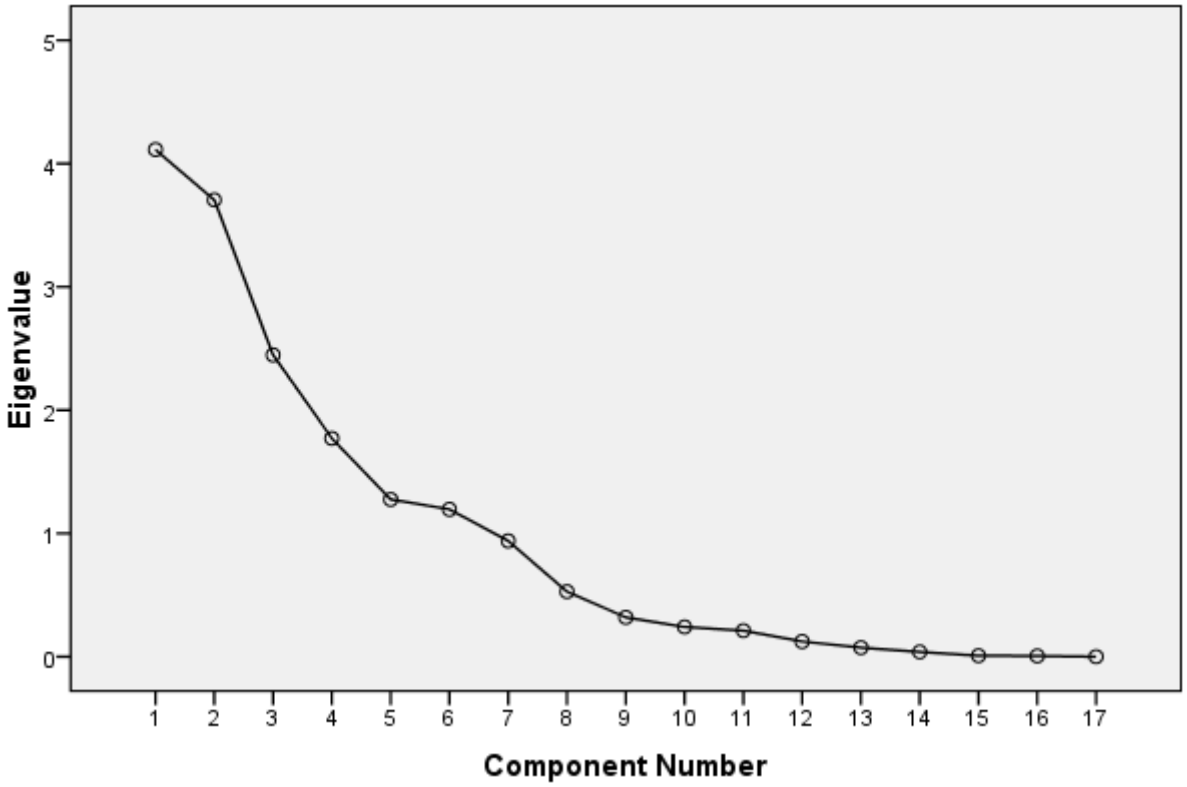


Figure 5. 1: Determination of the number of factors using a scree plot

5.3.6 Identifying and naming underlying factors

The 6 underlying factors that were extracted in this study included pull and push factors under economic, political, and social dimensions, as shown in Table 5.8. Therefore, the list of the 6 underlying factors that were extracted in this study included pull economic factors, pull political factors, pull social factors, push economic factors, push political factors, and push social factors. These factors were generated using Principal Component Analysis (PCA) and a suppression factor of 0.4 as suggested by Fornell & Larcker (2017). This means that attributes or items with factors that are less than 0.4 are deemed not critical.

The 6 underlying factors that were extracted in this study are shown in Table 5.8. Items that were associated with pull economic factors had high loading factors that were all greater than 0.7. This means that all the measurement items were contributing significantly to defining the pull economic factors latent construct. A composite reliability of 92% was recorded for the Pull Economic Factors latent construct. This indicates high and favorable internal consistency reliability. On the other hand, Average Variance Extracted (AVE) assesses whether a set of indicators effectively represents a latent construct. An AVE value of 0.50 or higher indicates adequate convergent validity, meaning that at least 50% of the variance in the observed variables is explained by the underlying construct (Hair, Black, Babin & Anderson, 2019). A high AVE for Pull Economic Factors of 66% was recorded, and this means that 66% of the variance in the observed variables was explained by the underlying construct.

The items or elements for Push Social Factors recorded high loading factors that were ≥ 0.68, indicating that the observed variables (item indicators) strongly correlated with the underlying Push Social Factor construct. The Push Social Factors construct recorded a high and favorable composite reliability of 89%, indicating high internal consistency and a high AVE of 61%. However, the Push Economic Factors item indicators recorded high loading factors that were ≥ 0.7 and a high composite reliability of 89%. This demonstrated high internal consistency and high convergent validity of the construct.

The items for Pull Social Factors recorded high loading factors that were ≥ 0.7, demonstrating that the observed variables (item indicators) strongly correlated with the underlying Pull Social Factor construct. Furthermore, the Pull Social Factor construct recorded a high and favorable composite reliability of 90%, indicating high internal consistency and a high AVE of 66%. Similarly, Push Political Factor items recorded high loading factors that were ≥ 0.7, demonstrating strong association with this underlying construct. The push political factor recorded high and favorable

composite reliability and AVE values of 90% and 75%, respectively. This demonstrated the high internal consistency and convergent validity of the construct.

Finally, Pull Political Factor items recorded high loading factors that were ≥ 0.7, indicating that the observed variables (item indicators) strongly correlated with this construct. Furthermore, the Pull Social Factor construct recorded a high and favorable composite reliability of 88%, indicating high internal consistency and a high AVE of 60%. This means that pull economic factors, pull political factors, pull social factors, push economic factors, push political factors, and push social factors were significant drivers of emigration of engineers from South Africa.

Table 5. 8: Reliability and validity of underlying constructs using loading factors, CR, and AVE

Variable	Measured items	Factor Loadings	CR	AVE
Pull Economic Factors	Remuneration, IMG4	0.742	0.92	0.66
	Stable economics, R2	0.770		
	Career Development, R8	0.870		
	Best opportunities, R13	0.845		
	Prospects of work promotion, RE7	0.714		
	Meaningful work, RCE5	0.930		
Push Social Factors	Safety and Security, D6	0.710	0.89	0.61
	Service delivery, D8	0.880		
	Health care, D9	0.880		
	Corruption, D12	0.730		
	Education, D13	0.689		
Push Economic Factors	Level of taxation, D10	0.841	0.88	0.71
	Weak currency, D14	0.896		
	Unemployment, D11	0.793		
	Loss in value of pension, RCE19	0.460		
Pull Social Factors	Living conditions. IMG5	0.790	0.90	0.66
	Lifestyle, R5	0.770		
	Flexible working, RCE11	0.840		
	Health care facilities, CRF 9	0.810		
	Safety and Security, R9	0.835		
Push Political Factors	Political uncertainty, D5	0.890	0.90	0.75
	Nationalism, RCE15	0.810		
	Government Confidence, CRF7	0.890		
Pull Political Factors	International prospects, D15	0.740	0.88	0.60
	Inclusivity and participation, FI15	0.810		

5.3.7 Descriptive statistics of the data

This part presents a descriptive analysis of data on the emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector. It should be noted that variables that have been identified as non-critical or not adding any value (from factor analysis and reliability analysis) have been excluded in all the analyses in this study.

The descriptive analysis for this study is based on a 5-point Likert scale, which ranged from not at all to. A value of 1 was associated with not at all, (2) less likely, (3) likely, (4) more likely, and (5) definitely. Based on this scale, mean scores of between 1 and 2.4 were an indication of adverse perceptions, while mean scores of between 2.5 and 3.4 were indicative of moderate perceptions. However, mean scores of at least 3.5 were indicative of favorable opinions.

Standard deviation and coefficient of variation (CV) were used to indicate the extent of dispersion of the views of participants from the mean values. The higher the standard deviation and coefficient of variation, the larger the extent of inconsistency among the participants. Typically, a coefficient of variation of less than 10% indicates a high level of agreement among participants, while 10% to 19% indicates a moderate level of agreement. However, a coefficient of variation that is at least 20%indicates a high level of inconsistency among the participants (Shechtman, 2019).

i. Pull Economic Factors

Table 5.9 shows the influence of pull economic factors motivating petrochemical engineers to emigrate from South Africa. Participants confirmed that they are motivated by better remuneration, better career development, and better opportunities to emigrate to other countries abroad. The above-mentioned attributes recorded high and favorable mean scores of 3.5, 3.6, and 4.3, respectively (as well as a median and mode of 4), when compared to a maximum possible score of 5 (as shown in Table 5.9). However, participants suggested that a stable economic environment and perceived meaningful work abroad have a moderate influence on

their intention to emigrate. A stable economic environment and perceived meaningful work recorded moderate mean scores of 3.3 each. On the other hand, participants believed they are not motivated by prospects of work promotion abroad. This recorded a low and adverse mean score of 2.4 when compared to a maximum possible score of 5.

These findings are supported by Mbiyozo (2018), who argued that South Africa has also seen significant emigration of young people in recent years, which has been influenced by better job opportunities. The findings are also supported by Portes's (1995) intersection and complementarity theory, which argued that though emigration is complex, it is motivated by economic, historical, social, and political dynamics. Therefore, if there are differences in opportunities for a better life between South Africa and other countries abroad, professionals will emigrate for a better quality of life.

Table 5.9: Influence of Pull Economic Factors to motivate engineers to emigrate

Attribute	Mean	Median	Mode	Std. Deviation	%CV
Remuneration, IMG4	3.5	4	4	0.761	21.6
Stable economics, R2	3.3	3	3	0.886	27.3
Career Development, R8	3.6	4	4	1.232	34.7
Best opportunities, R13	4.3	4	4	0.683	16.0
Prospects of work promotion, RE7	2.4	2	2	0.502	20.9
Meaningful work, RCE5	3.3	3	2	1.191	36.0

ii. Push Social Factors

Table 5.10 shows the influence of push social factors to motivate engineers to emigrate. Participants confirmed that they were pushed by adverse safety and security, service delivery, health care, and high corruption in South Africa. The above attributes recorded high mean scores of between 3.5 and 3.6 (as well as a median and mode of 4), confirming that the above dire conditions in safety and security, service delivery, health care, and corruption attributes are pushing engineers to move

from South Africa. However, participants were of the view that the quality of the education in South Africa has a moderate influence on pushing engineers to emigrate.

These findings are supported by push-pull theory, which argued that people, especially professionals, emigrate due to various reasons some of which include better quality of life, which can embrace healthcare, safety, and security, as well as other basic services that include education (De Haas, 2010).

Table 5.10: Influence of Push Social Factors to motivate engineers to emigrate

Attribute	Mean	Median	Mode	Std. Deviation	%CV
Safety and Security, D6	3.5	3	3	0.500	14.5
Service delivery, D8	3.6	4	4	0.646	18.0
Health care, D9	3.6	4	4	0.486	13.4
Corruption, D12	3.5	4	4	0.501	14.2
Education, D13	3.0	3	3	0.312	10.4

iii. Push Economic Factors

Table 5.11 shows the influence of push economic factors to drive engineers to emigrate. Participants were of the view that engineers are pushed to emigrate from South Africa by the potential loss in value of their pensions. This attribute recorded a high mean score of 4.5 compared to a maximum possible score of 5. However, it is shown that the level of taxation, weak currency, and unemployment rate all have a moderate influence on the intention to emigrate. The above-mentioned attributes recorded moderate mean scores of between 3.0 and 3.1 (as well as modest modes of 3).

The findings here generally contradict the economic theory, which argued that people migrate from one country to the other due to economic reasons such as a better

economic environment, which is defined in terms of the strength of currencies, taxation, and better economic opportunities (Wong & Ngin, 2021). However, in this study, level of taxation, weak currency, and unemployment were not strong push factors to motivate engineers to emigrate from South Africa.

Table 5.11: Influence Push Economic Factors to motivate engineers to emigrate

Attribute	Mean	Median	Mode	Std. Deviation	%CV
Level of taxation, D10	3.0	3	3	0.642	21.2
Weak currency, D14	3.0	3	3	0.128	4.3
Unemployment, D11	3.1	3	3	0.628	20.3
Loss in value of pension, RCE19	4.5	4	4	0.502	11.2

iv. Pull Social Factors

Table 5.12 shows the influence of pull social factors to motivate engineers to emigrate from South Africa. Participants confirmed that they are motivated by only flexible working conditions abroad. The above-mentioned attribute recorded high and favorable mean scores of 4.1 as well as a median of 4 and a mode of 5. However, participants confirmed that they were not encouraged by health care facilities, safety and security, and living conditions that exist abroad. Health care facilities and safety and security recorded low and adverse mean scores of 1.6 and 2.3, respectively.

These findings are in contrast with Fukuyama's (1995) postulate, which argued that push factors such as high levels of crime, inadequate infrastructure, particularly in health and education, and living conditions push professionals to emigrate to other countries abroad irrespective of their social capital.

Table 5.12: Influence of Pull Social Factors to motivate engineers to emigrate

Attribute	Mean	Median	Mode	Std. Deviation	%CV
Living conditions. IMG5	3.1	3	4	0.956	30.8

Lifestyle, R5	3.2	3	2	1.136	35.9
Flexible working, RCE11	4.1	4	5	1.049	25.5
Health care facilities, CRF 9	1.6	2	2	0.539	32.9
Safety and Security, R9	2.3	2	2	0.470	20.3

v. Push Political Factors

Table 5.13 shows the influence of push political factors to stimulate engineers to emigrate from South Africa. Participants confirmed that they are pushed to emigrate by nationalism and political uncertainty that exists in South Africa. Nationalism recorded high mean scores of 4.2 as well as a median of 4 and a mode of 5, while political uncertainty recorded a high mean score of 3.5. However, participants confirmed that they were not pushed by government confidence in South Africa, as this recorded a low and adverse mean score of 1.8 (as well as a median and mode of 2).

These findings are well supported by theory, which argued that political unrest, poor governance, geopolitical uncertainties, and trade wars often drive professionals to emigrate to other countries abroad (Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997; OEC World, 2021). It was also stressed that professionals migrate to countries that are perceived as friendly and politically stable. This is since stable countries tend to have stronger economies with more job opportunities, higher salaries, and better career growth prospects (OEC World, 2021).

Table 5.13: Influence of Push Political Factors to motivate engineers to emigrate

Attribute	Mean	Median	Mode	Std. Deviation	%CV
Political uncertainty, D5	3.5	4	4	0.675	19.8
Nationalism, RCE15	4.2	4	5	0.852	20.3
Government Confidence, CRF7	1.8	2	2	0.491	27.9

vi. Pull Political Factors

Table 5.14 shows the influence of pull political factors to motivate engineers to emigrate. Participants confirmed that they are motivated by international prospects and inclusivity and participation to emigrate to other countries abroad. The above-mentioned attributes recorded high and favorable mean scores of 3.5 each (as well as median and mode of 4) when compared to a maximum possible score of 5.

These findings are consistent with the theory that postulated that a political climate that upholds individual rights, including freedom of speech, inclusivity, and participation, offers political stability, opportunity, and a high quality of life (ILO, 2015; World Bank, 2020). These political factors, among others, play a crucial role in influencing professionals' decisions to migrate.

Table 5. 9: Influence of Push Political Factors to motivate engineers to emigrate

Attribute	Mean	Median	Mode	Std. Deviation	%CV
International prospects, D15	3.5	4	4	0.681	19.5
Inclusivity and participation, FI15	3.5	4	4	1.185	34.2

5.3.8 Investigation of relationships between categorical variables

Chi-square test was used to examine relationships between categorical variables, such as age, gender, ethnicity, and emigration, as shown in Table 5.15. It is observed that the association between emigration and age was significant ($p < 0.05$). This means that emigration depends on the age of the engineers who participated in this study. More young engineering professionals are emigrating to countries abroad as compared to senior engineering personnel. The Cramer's V coefficient was moderate but negative, indicating that the emigration rate decreases with an increase in the age of the engineering professionals. Young South African engineers tend to emigrate at

higher rates than their older counterparts due to a confluence of factors related to career expectations, mobility, and the local professional environment.

Young engineers, being at the beginning of their careers, are more likely to leave when faced with systemic issues that lead to stagnation or underemployment. This phenomenon contributes significantly to brain drain in South Africa, where a country loses its emerging talent to countries with more robust institutional frameworks and opportunities (Docquier & Rapoport, 2012). However, it is observed that the associations between emigration and gender and emigration and ethnicity were not significant ($p > 0.05$). This means that emigration does not depend on gender and ethnicity.

Table 5.15: Examination of relationships between categorical variables using chi-square

Variables	Chi-square value	df	Cramer's V coeff	Sig.
Emigration age*	63.861	63	-0.45	*
Emigration * Gender	0.507	3	0.069	NS
Emigration*Ethnicity	10.841	9	0.186	NS

5.3.9 Evaluation of the study hypotheses

Table 5.16 shows the comparison of emigration intention across age (youth, middle-aged, and old engineers). It is observed that there is a significant difference between the young and the middle-aged engineers ($p < 0.05$) on the intention to emigrate. Given that the young and the middle-aged engineers recorded mean scores of 4.4 and 3.6, respectively, on emigration. It means that the young engineers are more likely to emigrate to countries abroad when compared to the middle-aged engineers. There is also a significant difference between the young and the old engineers ($p < 0.05$) on the intention to emigrate. However, there is no difference between the

middle-aged engineers and the old engineers. The middle-aged and old engineers recorded mean scores of 3.6 and 3.5.

Table 5.16: Comparison of emigration intention across age

(I) Age2	(J) Age2	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Youth	Middle age	.131	.161	.043	-.26	.52
	Old	.094	.183	.032	-.35	.54
Middle age	Youth	-.131	.161	.043	-.52	.26
	Old	-.037	.171	.735	-.45	.38
Old	Youth	-.094	.183	.032	-.54	.35
	Middle age	.037	.171	.735	-.38	.45

One of the main goals of this research was to evaluate the study hypotheses, which were formulated in chapter 1. The hypotheses were formulated to evaluate which among push and pull factors significantly influenced the emigration of engineers from South Africa. The hypotheses were analyzed with reference to multiple linear regression. In this case, the dependent variable was emigration, while the independent variables were push political factor, push social factor, push economic factor, pull political factor, pull social factor, and pull economic factor.

The results indicated that R-squared was 0.635, while the adjusted R-squared was 0.631, which demonstrated that 63.1% of the variation in emigration was explained by the push and pull factors in the model. The Analysis of Variance (ANOVA) results indicated that there was a significant effect of pull and push factors on emigrations ($F(6, 98) = 21.915$, $p < 0.05$). The results of the individual effect for pull and push factors are summarized in Table 5.17. The detailed evaluation of hypotheses is based on Table 5.15 and follows in the next subsections.

Table 5.17: Effect of push and pull factors on emigration of engineers using regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.305	1.597		2.069	.041
	Political Pull	.285	.152	.216	1,882	.063
	Political Push	-.266	.195	-.150	-1.363	.176
	Social Pull	.464	.235	.241	2.973	.037
	Economic Push	.297	.338	.102	3.879	.038
	Social Push	-.412	.218	-.192	-1.886	.062
	Economic Pull	.164	.295	.464	5.562	.024

Hypothesis statement 1

(H0): Economic factors are NOT significant push factors for emigration of engineers from South Africa.

(H1): Economic factors are significant push factors for emigration of engineers from South Africa.

Since the p-value of the coefficient of the economic push factor in Table 5.15 is less than 0.05 ($p < 0.05$), the null hypothesis, H_0, is rejected. Hence, it can be concluded that there is statistical evidence to suggest that Economic push factors significantly influence the emigration of engineers from South Africa. Based on the regression analysis in Table 5.15, it is indicated that emigration of engineers was positively and significantly influenced by the economic push factor ($\beta = 0.102$, $p < 0.05$), supporting Hypothesis 1 (H1).

Hypothesis statement 2

(H0): Social factors are NOT significant push factors for emigration of engineers from South Africa.

(H2): Social factors are significant push factors for emigration of engineers from South Africa.

Given that the p-value of the coefficient of the social push factor in Table 5.16 is more than 0.05 ($p > 0.05$), the null hypothesis, H_0, is NOT rejected. Hence, it can be concluded that there is NO statistical evidence to suggest that the social push factor significantly influences the emigration of engineers from South Africa.

Hypothesis statement 3

(H0): Political factors are NOT significant push factors for emigration of engineers from South Africa.

(H3): Political factors are significant push factors for emigration of engineers from South Africa.

Since the p-value of the coefficient of the political push factor in Table 5.16 is more than 0.05 ($p > 0.05$), the null hypothesis, H_0, is NOT rejected. Hence, it can be concluded that there is NO statistical evidence to suggest that the political push factor significantly influences the emigration of engineers from South Africa.

Hypothesis statement 4

(H0): Economic factors are NOT significant pull factors encouraging emigration of engineers from South Africa.

(H4): Economic factors are significant pull factors encouraging emigration of engineers from South Africa.

Since the p-value of the coefficient of the economic pull factor in Table 5.16 is less than 0.05 ($p < 0.05$), the null hypothesis, H_0, is rejected. Hence, it can be concluded that there is statistical evidence to suggest that the economic pull factor significantly

influences the emigration of engineers from South Africa. Based on the regression analysis in Table 5.15, it is indicated that emigration of engineers was positively and significantly influenced by the economic pull factor ($\beta = 0.464$, $p < 0.05$), supporting Hypothesis 4 (H4).

Hypothesis statement 5

(H0): Social factors are NOT significant pull factors encouraging emigration of engineers from South Africa.

(H5): Social factors are significant pull factors encouraging emigration of engineers from South Africa.

Since the p-value of the coefficient of the social pull factor in Table 5.16 is less than 0.05 ($p < 0.05$), the null hypothesis, H_0, is rejected. Hence, it can be concluded that there is statistical evidence to suggest that the social pull factor significantly influences the emigration of engineers from South Africa. Based on the regression analysis in Table 5.15, it is indicated that emigration of engineers was positively and significantly influenced by the social pull factor ($\beta = 0.241$, $p < 0.05$), supporting Hypothesis 5 (H45).

Hypothesis statement 6

(H0): Political factors are NOT significant pull factors encouraging emigration of engineers from South Africa.

(H6): Political factors are NOT significant pull factors encouraging emigration of engineers from South Africa.

Since the p-value of the coefficient of the political pull factor in Table 5.16 is more than 0.05 ($p > 0.05$), the null hypothesis, H_0, is NOT rejected. Hence, it can be concluded that there is NO statistical evidence to suggest that the political pull factor significantly influences the emigration of engineers from South Africa.

From the findings above, it is interesting to observe that pull factors have a greater influence on emigration than push factors. The reason for this observation is that two out of three pull factors (social pull and economic pull) were found to be significant as compared to only one push factor (social push). Therefore, this means that migration is a result of being attracted to a foreign country compared to being forced out of South Africa. Within this factor, aspects such as hope for better quality of life, better remuneration, better employment opportunities, a more stable economic environment, better career development, improved safety, and hope for better healthcare attract people to foreign countries resulting in emigration.

5.4 Qualitative analysis of the study

This second part of the chapter presents a qualitative analysis of data that was obtained from the interviews. The qualitative data collected through interviews provide critical insights into the lived experiences of interviewees on the drivers that influence the emigration of petrochemical industry engineers from South Africa. This investigation is based on the lived experiences of engineers from South Africa on the determinants or causes of emigration using thematic narrative analysis. The themes in this case were generated based on inductive (from the interview data) as well as deductive (based on the literature covered in chapter 2). The thematic narrative analysis is organized according to the themes developed.

5.4.1 Theme 1: Racial Dynamics and Structural Barriers

This theme was subdivided into two subthemes, which included Workplace Inequities and Perceived Discrimination and Tokenism and Career Stagnation. The discussion on these two subthemes follows below.

Sub-Theme 1: Workplace Inequities and Perceived Discrimination

Critical Race Theory by Bell (1992) suggested that inequities and perceived discrimination at the workplace, such as racism, are deeply embedded in some social institutions. This has an adverse influence on job opportunities and professional advancement for professionals. Furthermore, this theory suggested that professionals from marginalized racial groups may emigrate to escape these systemic barriers.

The above theories can be linked to many of the interviewees' sentiments, who felt that Black/African engineers, particularly younger professionals, face systemic barriers at the workplace in South Africa, which push them to make the decision to leave the country for better opportunities abroad. The interviewees showed that Black engineers in South Africa frequently face workplace discrimination and exclusion from key projects or leadership roles. For example, a 35-year-old Black male engineer narrated as below.

"Even after years of service, I feel like I'm always justifying my place. Promotions seem reserved for others who are seen as 'better fits,' even when we have the same qualifications."

This serves to demonstrate how institutional cultures, shaped by legacy power structures, fail to effectively accommodate diversity in South Africa.

Sub-Theme 2: Tokenism and Career Stagnation

Tokenism theory has demonstrated that when certain groups of people are highly underrepresented in an organization, they are subjected to heightened stereotyping, isolation, and intensified performance pressures (Kanter, 2007). This uncomfortable environment often leads to feelings of marginalization, reduced self-efficacy, and limited access to career-enhancing opportunities. For professional engineers experiencing tokenism, the cumulative adverse effects of isolation and lack of progression at the workplace can contribute to dissatisfaction and the decision to emigrate in search of more inclusive environments that support career growth.

Tokenism theory is closely supported by the glass ceiling theory, which underlined the existence of invisible barriers that prevent underrepresented or minority professionals from advancing to higher levels at the workplace (Cotter, Hermsen,

Ovadia & Vanneman, 2001). The glass ceiling theory emphasizes that despite having the qualifications and capabilities, minority professionals can encounter systematic obstacles, including biased promotion practices and exclusion from key networks, which result in career stagnation.

The above theories can be linked to the life story of many young Black engineers interviewed in this study who expressed that while organizations hire them to meet Employment Equity (EE) targets, they often feel unsupported in their career progression. A 28-year-old Black female engineer narrated as follows.

"It feels like we are hired to tick boxes, but when it comes to opportunities for growth or international assignments, we are overlooked."

Such frustrations contribute to emigration, as these professionals seek environments where their capabilities and performances are valued. These professional engineers will also move in search of organisational environments that have “no glass ceiling” and promote individuals on merit.

5.4.2 Theme 2: Gender and Intersectionality

Intersectionality theory posits that multiple forms of social classification that can include gender, race, class, and other identity markers intersect to create unique experiences of hindrances and discrimination (Crenshaw, 1989). When applied to professional emigration, this theory helps explain how, for instance, women from marginalized racial or socioeconomic groups face compounded barriers (e.g., limited career advancement, workplace discrimination, and inadequate support networks) in their home countries. These overlapping hindrances can prompt professionals to seek opportunities abroad where the structural constraints are less pronounced.

The above theory can be linked to the life story of many Black female engineers interviewed in the study who face compounded challenges due to the intersection of race and gender. Women interviewed revealed that they face hostile work

environments at their respective workplaces. Women reported microaggressions, gender bias, and a lack of mentorship in male-dominated teams. For instance, a 32-year-old female engineer narrated as below.

"Women are often underrepresented in most of our meetings. You find that there is only one woman at a time in a meeting, and your ideas are dismissed unless repeated by a male colleague. This constant battle is exhausting."

Furthermore, the women in their early 30s who were interviewed mentioned the lack of flexible working conditions as a reason for leaving. Many were emigrating to countries offering better work-life balance and inclusive work cultures.

5.4.3 Theme 3: Early Professional Career Growth

Human capital theory postulates that professionals make long-term investments in their education and skills with the expectation of good future returns, which can include higher wages and better career growth (Becker, 1964). For young career professionals, migration may be viewed as an investment decision. They may be driven to work in other countries abroad due to lack of career growth and poor returns on their human capital investments.

Several young engineers who were interviewed in the study have personal stories that have relevance to the Human Capital Theory. Younger engineers interviewed reported dissatisfaction with the lack of structured career paths in their organizations. For example, a 29-year-old narrated his experiences at the workplace as follows.

"After five years in the industry, I still feel stuck. There’s no clear plan for my growth, and the idea of staying here feels like a career dead end."

Push-Pull Model of Migration by Lee (1966) explains emigration because of “push” factors (e.g., limited career opportunities and slow professional growth in the home

country) and “pull” factors (like better employment prospects, mentoring, and faster career advancement in the destination country). For young professionals at the start of their careers, push factors might include underdeveloped labor markets or insufficient professional networks, while pull factors may include dynamic industries, higher salaries, and structured career development programs abroad.

Many young engineers who were interviewed in the study have personal stories that have relevance to the Push-Pull Model above. Many young engineers interviewed in the study mentioned the appeal of global mobility and higher salaries abroad as some of the main factors attracting them to work abroad. For example, one young engineer narrated as follows.

"Companies in Europe and the Middle East are actively recruiting us. They offer double the salary, better projects, and no glass ceiling."

This serves to justify that young engineers from South Africa are attracted to work abroad, as organizations in those countries offer better remuneration, better opportunities for career progression, and better conditions of service.

5.4.4 Theme 4: Political and Economic Instability

The classic push-pull model explains that push factors and pull factors generally drive professional people to make decisions to leave their home countries to work abroad, which offers better opportunities and general conditions of work (Lee, 1966). The push factors can include political instability, poor conditions of employment, adverse external factors, limited career opportunities, and slow professional growth in the home country. On the other hand, pull factors can include better employment prospects, mentoring and coaching, better salaries, and faster career advancement in the destination country.

The above theory can be linked to the life story of many engineers interviewed in this study who expressed that they are forced to leave South Africa due to adverse

conditions such as load-shedding, political corruption, and economic stagnation. A 40-year-old engineer narrated as follows.

"When power outages affect my work, and I see no real political will to fix things, I wonder if there's a future here for my family and career."

One senior engineer submitted that a lack of investment in the petrochemical industry, which is now characterized by decaying infrastructure, is one of the reasons pushing engineers to leave the country. He also suggested many engineers are now aware that countries abroad are offering better rewards and exciting careers. He narrated as follows.

"Without new projects or innovation, we are stuck maintaining out-dated facilities. International markets are more exciting and rewarding."

5.4.5 Theme 5: Globalization and Increased Mobility

Globalization theory examines the increasing interconnectedness and interdependence of countries through business networks, trade, technology, finance, and cultural exchange programs. This framework posits that as global markets integrate, obstacles to mobility, such as geographic and informational restrictions, are diminished (Sassen, 1998). For professionals, this means that opportunities are no longer confined to their home countries; instead, they can pursue careers in dynamic, globally prestigious, and connected markets where advanced technology, innovation, better pay, better conditions of employment, and robust professional networks are available.

The above theory can be linked to the life story of many engineers interviewed in the study who submitted that globalization has amplified emigration by creating seamless access to international opportunities. Engineers reported that nowadays with technology and globalization, it is easy to get in touch with an international organization when seeking employment. For instance, there are several platforms

where international organizations advertise for engineering jobs. For instance, a 33-year-old engineer submitted his opinion on this as follows.

"I get LinkedIn messages weekly from companies in Canada, Australia, and the UAE. They offer better pay, and I don’t have to deal with the systemic issues here."

Other interviewees expressed that it is prestigious working for international organizations abroad. Furthermore, interviewees reported that there is prestige in working on globally recognized projects as well. They felt that organizations in South Africa underutilize their potential compared to their international counterparts.

5.4.6 Institutional Architecture and Retention Challenges

Institutional theory posits that the formal and informal structures, such as rules, laws, regulations, norms, and cultural practices, that shape a society’s economic and social interactions significantly influence individual behavior (North, 1990; Scott, 1995; Williamson, 2000). When the institutional architecture in each country is weak or inefficient, it may fail to provide a supportive environment for professional development and career advancement. This can lead to retention challenges, as professionals seek environments with more robust institutional support and governance.

The institutional theory above can be linked to the life story of many engineers interviewed in the study who reported that the weakness of structural architecture in South African institutions is one of the main factors pushing engineers to seek greener pastures abroad. Engineers pointed out that retention strategies for engineers are either weak or nonexistent in most organizations in South Africa. For instance, a 38-year-old engineer explained in brief as follows.

"Retention strategies feel reactive rather than proactive. They only care when someone resigns, not before."

Black engineers expressed that mentorship and developmental programs in most organizations in South Africa are very weak. A 30-year-old engineer reported on this as follows.

"We need people to guide us, especially in a sector this complex. Without that, you feel lost and undervalued."

5.5 Conclusion

The quantitative and qualitative parts of the study revealed a multifaceted emigration trend driven by systemic barriers, workplace discrimination, political instability, and global opportunities. Key insights show that Black/African engineers, particularly young and female professionals, are disproportionately impacted by institutional inequities, driving them to emigrate. Institutional shortcomings are clearly illustrated in most organizations in South Arica as these often fail to address workplace discrimination, career stagnation, and lack of inclusivity, contributing to dissatisfaction and turnover. It was also revealed that attractive global opportunities, better pay, and meritocratic environments further exacerbate skilled emigration.

These findings underscore the urgent need for tailored retention strategies, including mentorship programs, inclusive policies, and targeted career development initiatives. Organizations must also address systemic barriers and align with global best practices to retain their talent and foster resilience within South Africa’s petrochemical industry.

6 Chapter 6 Policy Implications in South Africa for emigration and the impact on Petrochemicals Sector

6.1 Introduction

The thesis has demonstrated that South Africa is losing several of its engineers to more developed countries. It has also been shown that there are a variety of determinants for skilled professionals to emigrate from the petrochemicals sector. This reality makes it imperative for the country to adopt measures to reduce the impacts of the movements on the country's engineering delivery system. The study has several implications for both policy and practice on the gender inequality illustrated by the Department in the presidency. There are several policy measures that could be adopted by the sector for managing the loss of skilled professionals. Three policies have been identified from literature. Primarily, policies can be implemented to discourage the petrochemicals sector professionals from leaving South Africa.

This chapter reviews South Africa's experiences with respect to managing engineering migration as well as assessing the feasibility of the diaspora option.The chapter uses data collected from the in-depth interviews with the industry experts in South Africa, human resources practitioners in the petrochemicals sector, survey respondents, and document review.

6.2 Review of current policies and industry strategies

South Africa has recognized the challenge of brain drain and has implemented various policies and initiatives to address the emigration of skilled professionals, including engineers. A review of current policies and strategies aimed at reducing the brain drain of the engineers was conducted during interviews with the industry experts, human resources practitioners, and the engineers, respectively. These key informant interviews showed that the main method of reducing engineering migration from South Africa is through skills development, industry-meaningful retention strategies, economic incentives, research and innovation investment,

collaboration with the private sector, reviewing of the migration policies and international collaboration and partnerships for the qualified engineers.Here are some general policies and strategies that South Africa has historically employed to reduce brain drain.

The emigration of skilled professionals from South Africa's petrochemicals sector continues to be a pressing concern, with significant implications for the industry's sustainability and the nation's economic health. Recent studies and first-hand accounts shed light on the dynamics of this "brain drain" and offer insights into potential strategies for "brain gain."

6.3 Current Trends in Emigration and Workplace Dynamics

Recent data indicates that approximately 10,000 South Africans emigrate annually, with half being professionals (Cowling, 2022). This outflow represents a substantial loss of human capital, estimated to cost the country billions. In the petrochemicals sector, both Black and White engineers express dissatisfaction with workplace dynamics. Many Black engineers feel that policies like B-BBEE and the Employment Equity Act are superficially implemented, leading to perceptions of tokenism rather than genuine empowerment. A mid-level Black engineer remarked, "I've worked hard to get here, but it feels like the policies are just a checkbox exercise. I don't see real development opportunities—just tokenism."

On the other hand, white engineers think that BBEE and the Employment Equity Act are barriers to their career progression, leading to feelings of exclusion. A senior White engineer noted, "I understand the need for redress, but it feels like there's no room for people like me to grow. It's disheartening to be passed over because I don't fit the profile." It was apparent in the study that local challenges, including economic instability and concerns about safety, motivate professionals to seek opportunities abroad. While the government has developed and implemented some policies, these are not adequate to restrain engineering professionals from emigrating.

The emigration of skilled professionals from South Africa's petrochemicals sector is a multifaceted issue influenced by policy implementation, workplace dynamics, and broader economic factors. Addressing these challenges requires a holistic approach that includes effective policy execution, improved working conditions, and strategies to enhance economic stability. By implementing these recommendations, South Africa can work towards retaining its skilled workforce and potentially attracting talent back to the country.

6.4 Skills Development and Retention Initiatives

South Africa has focused on improving skills development programs to enhance the capabilities of its workforce. This includes investing in education, vocational training, and professional development opportunities to make the country more attractive for skilled professionals. Debates on skills development and retention of skilled labor in South Africa have revolved around various key issues. These debates often touch upon policy effectiveness, education and training systems, economic incentives, and the overall strategy for addressing skills shortages. Debates exist around the effectiveness of skills development programs in addressing the country's skills gaps. Some argue that there is a need for more targeted and industry-specific training programs to ensure that skills acquired align with market demand. Ndebele-Murisa, M. R. (2016).

Participant Expert 001 reported as follows.

“There is an ongoing debate about the alignment of the education system, including higher education and vocational training, with the needs of industries. Ensuring that education and training programs equip individuals with the skills demanded by the labour market is crucial for retaining skilled professionals.”

According to Bunting (2017), ongoing discussions center on the synchronization of the education system, encompassing both higher education and vocational training, with the requirements of industries. It is imperative to guarantee that

educational and training initiatives provide individuals with the skills required by the labour market, as this plays a critical role in retaining skilled professionals. South Africa faces competition with other countries for skilled workers. The global mobility of professionals raises questions about how the country can attract and retain talent in the face of international opportunities. Crush, J., & Williams, V. (2015).

The impact of migration policies, including visa regulations and work permit processes, on the retention of skilled labour is a subject of debate. Striking a balance between attracting international talent and retaining local skills is crucial. Landau, L. B., and Segatti, A. (2017). Further debates also center on how to address inequalities in access to education and skills development. Ensuring that historically disadvantaged groups have equal opportunities for skill acquisition is a key concern. Reddy, V. (2019). The role of the private sector in skills development and its collaboration with the public sector is another area of debate. Balancing the contributions of both sectors is essential for effective skills development (Altman & Esterhuizen, 2017)

6.5 Economic Incentives

The South African government has implemented economic incentives to encourage professionals to stay in the country. This may include tax incentives, financial support, and other benefits to make working and living in South Africa more appealing. The South African government has employed tax incentives to retain skilled professionals. These incentives may include tax breaks or reductions for certain categories of professionals or for individuals working in specific sectors deemed critical for the country's development. These tax incentives aim to improve the overall financial attractiveness of staying in South Africa. South African Revenue Service (SARS).

Financial support programs may include government grants, subsidies, or low-interest loans for professionals in specific industries or occupations. These programs are designed to support career development, entrepreneurship, and investment in targeted sectors, contributing to overall job satisfaction and economic

stability (Department of Trade, Industry, and Competition, 2021). Some economic incentives are tailored to specific sectors facing skills shortages. For instance, professionals in critical sectors such as healthcare, information technology, engineering, and science may benefit from targeted support, including financial incentives and career development programs. The government has established Special Economic Zones (SEZs) to attract investment, create employment opportunities, and enhance economic development. SEZs often come with specific incentives, including tax benefits and infrastructure support, to encourage professionals and businesses to operate within these designated zones. Incentives for research and development activities can attract professionals engaged in innovation and technological advancements. These incentives may include tax credits or deductions for companies and individuals involved in R&D projects.

6.6 Research and Innovation Investment

Policies aimed at boosting research and innovation can attract and retain skilled professionals, including engineers. Investment in research institutions, technology parks, and innovation hubs creates an environment that fosters intellectual growth and career opportunities. The National Research and Development Strategy (NRDS) is a comprehensive policy framework that guides research and development activities in South Africa. It emphasizes the importance of innovation, knowledge creation, and technology transfer to drive economic development and address societal challenges. The Technology Innovation Agency (TIA) plays a crucial role in implementing the National Research and Development Strategy. It supports research and development initiatives, facilitates technology transfer, and invests in projects that have the potential for commercialization.

South Africa has established innovation hubs and technology parks as part of its efforts to create conducive environments for research and innovation. These hubs, such as the Innovation Hub in Pretoria and the Stellenbosch Innovation District, provide infrastructure, support services, and collaborative spaces for researchers, entrepreneurs, and businesses. Science and Technology Parks (STPs) are designed to bring together research institutions, businesses, and government

agencies to promote innovation and technology transfer. These parks serve as platforms for collaboration and knowledge exchange. The National Intellectual Property Management Office (NIPMO) plays a role in managing intellectual property arising from publicly funded research. This office helps facilitate the commercialization of research outcomes, ensuring that innovations contribute to economic growth.

The Research Chairs Initiative aims to attract and retain leading researchers by establishing research chairs in critical areas. These chairs are funded to conduct research and mentor postgraduate students, contributing to the development of expertise in key fields. Incentives for Research and Development (R&D) Tax Credits: South Africa provides tax incentives to businesses engaged in research and development activities. These incentives encourage companies, including those in the engineering sector, to invest in innovative projects and contribute to technological advancements. These policies collectively aim to create a vibrant research and innovation ecosystem in South Africa, making the country an attractive destination for skilled professionals, including engineers.

6.7 Collaboration with Private Sector

The South African government has initiated various programs and partnerships with the private sector to create a conducive environment for skilled professionals. Collaboration with industries is essential to identify and address challenges that may contribute to emigration; the interviews revealed that there is a belief that such collaboration can be further enhanced and promoted. The National Skills Fund is a government initiative that aims to facilitate partnerships between the public and private sectors to address skills development challenges. The NSF provides funding for skills development initiatives that align with the needs of industries, promoting collaboration between government, businesses, and educational institutions. However, some of the engineers that have benefited from such initiatives lack retention strategies to keep them within South Africa. The Sector Education and Training Authorities (SETAs) are industry-led bodies that facilitate

collaboration between the government and private sector to address skills development in specific sectors. They play a crucial role in identifying the skills needs of industries, developing sector-specific training programs, and ensuring that training initiatives align with industry requirements. The interviews revealed that thechallenges faced by Sector Education and Training Authorities (SETAs) in South Africa regarding the retention of skilled professionals may include various issues related to skills development, funding, alignment with industry needs, and administrative complexities.

One challenge is ensuring that the skills development programs initiated by SETAs align with the current and future needs of industries. There may be a disconnect between the skills acquired by individuals through SETA programs and the actual requirements of the job market. SETAs may face administrative complexities, including bureaucratic processes, that can hinder the efficient implementation of skills development programs. Streamlining administrative procedures is crucial for the effective delivery of training initiatives. Limited funding can be a significant challenge for SETAs. Adequate financial resources are necessary to support various training and development programs. Funding constraints may impact the scale and quality of initiatives aimed at retaining skilled professionals. Effective collaboration with employers is essential for the success of SETA initiatives. Some SETAs may face challenges in engaging employers and establishing partnerships that lead to meaningful skills development and retention programs. Ensuring the quality and impact of skills development programs requires effective monitoring and evaluation mechanisms. Some SETAs may face challenges in establishing robust systems for tracking the outcomes of training initiatives and making data-driven improvements. In a country as diverse as South Africa, geographical disparities can pose challenges. Some regions may have more limited access to SETA programs and resources, impacting the equitable distribution of skills development opportunities. It's important to note that addressing these challenges requires ongoing collaboration between SETAs, government bodies, employers, and other stakeholders. SETAs play a crucial role in the South African skills development landscape, and overcoming these challenges is essential for their effectiveness in retaining skilled professionals.

6.8 International Collaboration and Partnerships

Engaging in international collaboration and partnerships can contribute to knowledge exchange and create opportunities for professionals to work on global projects without leaving the country. The interviews revealed that South African universities participate in the Erasmus+ Programme, which supports international cooperation in the field of higher education. It includes student and staff exchange programs, joint master's degrees, and capacity-building projects. South Africa is part of the BRICS group (Brazil, Russia, India, China, and South Africa), which facilitates collaboration in various sectors, including science, technology, and innovation. Joint initiatives and projects contribute to knowledge exchange and technological advancements. The South Africa-European Union Science and Technology Cooperation Agreement fosters collaboration in research and innovation. It provides a framework for joint projects, knowledge transfer, and partnerships between South African and European entities.

The Research Chairs Initiative (RCI), supported by the National Research Foundation (NRF), includes collaboration with international experts holding research chairs in South African institutions. This initiative contributes to knowledge exchange and enhances the global perspective of research projects.
South African researchers and institutions collaborate with international research organizations to participate in joint projects, share expertise, and access global research networks. Such collaborations enhance the country's research capabilities and provide opportunities for professionals to engage in international initiatives. The South African Research Chairs Initiative (SARChI) program, supported by the NRF, establishes research chairs in various fields. Some of these chairs involve collaborations with international institutions and researchers, fostering global partnerships and knowledge exchange. South African researchers actively participate in international research projects and consortia, contributing their expertise to global initiatives. These projects cover a wide range of disciplines and provide professionals with opportunities to collaborate on a global scale.

According to Chikanda (2008), the reality that developed nations derive benefits from the cultivated human resources of developing countries is widely acknowledged. However, the challenge lies in the reluctance to assign a tangible value to the exchange of intellectual assets. Interestingly, in contrast to scenarios involving the physical prowess of individuals, like the migration of talented athletes such as soccer players, there is typically a consensus on a transfer fee before a player can switch clubs. This practice extends from local to international levels. Paradoxically, when it comes to the migration of skilled professionals like doctors, there exists a conspicuous absence of such arrangements. These professionals are expected to move freely between countries, creating a situation that puts the countries that invested in their training at a disadvantage. While debates on the compensation payment by developed nations have been ongoing since the 1960s, none of these countries has shown the willingness to embrace the idea.

Whether engaged in active recruitment or not, the undeniable truth persists that developed nations are enjoying the advantages of an asset they did not contribute to creating. The hesitance to provide reparations or, at the very least, some form of compensation, serves as an illustration of the lack of sensitivity among the benefiting countries to the challenges confronted by engineering systems in the global south. The initiation of a program of this nature would signify an acknowledgment of the issues that migration has imposed on the engineering systems of developing countries. Hence, endeavours at the national level aimed at diminishing the departure of petrochemical engineers from developing nations like South Africa should be augmented by robust regional and potentially global policies. These overarching policies can then be translated into specific strategies by organizations. Nevertheless, potent national policies have the potential to significantly mitigate the factors prompting engineers to relocate to more developed countries, often referred to as "push factors."

6.9 Migration and Retention Strategies and Policies

One objective of the study was to ascertain the perspective of expatriate engineers regarding existing policies aimed at mitigating South Africa's engineering talent exodus. The rationale behind involving emigrant engineers in this assessment was their unique ability to objectively evaluate the impact of retention policies, having experienced them firsthand. However, despite their firsthand experience, these policies did not achieve the intended outcomes. Recognizing the deficiencies in current policies is essential for developing effective solutions in the future. Largely, the industry experts and human resources practitioners were against the strict policies that would force or hinder the engineers from emigration if there were determinants that are outside the engineering sector, such as the external factors, e.g., the economic health of South Africa, shortage of electricity, political situation in South Africa, and issues such as crime and violence and the level of unemployment.

Participant Human Capital 007 argued as follows

> *"Issues that are affecting some of the engineers at exit interviews indicate that, in their views, the shortage of electricity is causing further negative issues that impact the economy of the entire South African country. There is a huge political uncertainty in South Africa due to the poor confidence in the South African government, looking at the poor levels of service delivery by the public sector. These further impacts possible investments to South Africa, which then create a ripple effect into increased unemployment, increased levels of corruption, and the unstable weak currency. International prospects seem like the only option; they seem to prefer it."*

The engineers feel that they have the qualifications, but the opportunities for employment are limited. In terms of race and gender too, qualified African engineers seem to struggle in getting meaningful employment and would opt for international opportunities. They indicate that some of the engineers do not want to work for the public sector due to how the sector is managed and administered. High levels of corruption and poor management of recruiting policies. In terms of White engineers, the recruitment practices that are associated with Employment

Equity and BBBEE leave no room for them to have jobs in South Africa; that is why after receiving their qualifications and registrations, the international arena serves as the only option available for them to score reliable employment contracts.

Participant Human Capital 007 argued as follows.
“Contracts that are awarded to preferred engineering companies are awarded based on corruption-related processes.”

Prof. Mark Swilling, in an interview he had with Newzroom Afrika, under the topic “Why engineers are leaving the industry,” indicated that other engineers refuse to work and to participate in institutions that are dysfunctional. Dysfunctional engineering institutions in South Africa, leading engineers to emigrate, are characterized by systemic issues that hinder professional growth, fulfillment, and the effective contribution of engineers. Professor Mark Swilling has highlighted some key aspects of these challenges, which may include engineers facing constrained opportunities for career development and advancement within the existing institutional framework.

The lack of clear pathways for professional growth can contribute to frustration and a sense of stagnation. Engineering institutions may lack robust support systems for engineers, both in terms of mentorship and resources. The absence of effective guidance and assistance can lead to a feeling of isolation and hinder the development of a thriving professional community. Institutions may not adequately recognize and reward the expertise and contributions of engineers. This lack of acknowledgment can demotivate professionals who seek validation and appreciation for their skills and efforts. Excessive bureaucratic processes and red tape within engineering institutions can impede efficiency and innovation. Engineers may find themselves entangled in administrative challenges that divert their focus from core professional activities.

Insufficient investment in research and development initiatives within engineering institutions can hinder the pursuit of cutting-edge projects and technological advancements. This limitation may discourage engineers who aspire to work on

innovative and impactful endeavors. A lack of essential infrastructure and resources within engineering institutions may compromise the ability to carry out projects effectively. Engineers may be forced to work with outdated equipment or face resource shortages, negatively impacting their performance and job satisfaction. Engineering institutions may struggle to align their objectives with addressing broader societal challenges. Engineers, particularly those motivated by a desire to make a meaningful impact on society, may feel disillusioned when institutional priorities do not align with societal needs. Persistent issues of inequity and lack of diversity within engineering institutions can create a hostile environment that pushes engineers to seek more inclusive and supportive professional settings abroad. Professor Mark Swilling's insights may further illuminate specific instances and solutions related to dysfunctional engineering institutions in South Africa, providing valuable perspectives for addressing these challenges.

6.10 Conclusion

The chapter has explored and assessed existing policies aimed at mitigating skilled migration within the engineering sector in South Africa. Through interviews, the chapter offers policy recommendations to tackle the country's brain drain issue. Additionally, it evaluates the viability of implementing migration strategies, specifically engaging the engineering community in initiatives that directly contribute to the country's engineering development and establishing conducive conditions for adopting such strategies.

Moving forward, Chapter 7 concludes the thesis by summarizing the key findings of the study and offering policy suggestions to address the crisis in human resources within South Africa's petrochemical sector.

6.1 Concluding Remarks

From the time when the study was conducted in 2023, South Africa has had several notable developments observed on both the political and economic fronts post the Covid-19 pandemic. The government implemented various economic recovery measures to mitigate the impact of the pandemic on businesses and livelihoods. This includes financial support for small and medium-sized enterprises (SMEs), stimulus packages, and infrastructure investment initiatives aimed at creating jobs and boosting economic growth. South Africa implemented social relief measures to support vulnerable populations affected by the pandemic, including cash transfers, food assistance programs, and support for unemployed individuals. Despite the challenges posed by the pandemic, South Africa has maintained political stability, with the government continuing to function and address the country's pressing issues. However, political tensions and social unrest have occasionally arisen, reflecting underlying socio-economic disparities exacerbated by the pandemic.

The pandemic accelerated South Africa's digital transformation, with increased adoption of remote work, e-commerce, and digital platforms for service delivery. This shift has prompted investments in digital infrastructure and innovation, laying the groundwork for future economic growth. Overall, while the Covid-19 pandemic presented significant challenges for South Africa, the country has demonstrated resilience and adaptability in responding to the crisis, making progress on various fronts to mitigate its impact and chart a path towards recovery and future growth.

In conclusion, understanding and addressing the emigration determinants while implementing effective retention strategies are crucial for retaining skilled personnel in the South African petrochemical sector. Collaboration between industry stakeholders, government agencies, and educational institutions is essential to develop sustainable solutions that promote talent retention and contribute to the sector's long-term growth and competitiveness.

7 CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter brings the research journey to its final stage by synthesizing the study's findings, drawing evidence-based conclusions, and outlining actionable recommendations. Building on the preceding chapters, it distills the core insights on the determinants of emigration and the effectiveness of retention strategies for skilled personnel in the South African petrochemical sector. In doing so, the chapter directly addresses the research questions, assesses the extent to which the study's objectives have been achieved, and reflects on the implications of the findings for both theory and practice. Furthermore, it presents the contributions this research makes to the academic discourse on skilled labour mobility and human capital management, while also identifying the study's limitations. The chapter concludes by suggesting directions for future research, ensuring that the knowledge generated here can inform ongoing debates and guide practical interventions in a rapidly evolving global and national context.

The previous chapter presented analysis and discussion of the policy implications in South Africa for emigration and the impact on the petrochemicals sector.

findings on the emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector. The focus of the previous chapter was to present analysis of results to provide answers to the main research objectives, which were as follows.

a. What is the profile of skilled professionals emigrating from SA, particularly from the petrochemicals sector?

b. What is the nature (landscape) of skilled professionals' emigration from the petrochemicals sector?

c. What characterizes the levels and trends of emigration of professional engineers from SA, particularly in the petrochemical sector?

d. What are the determinants for skilled professionals to emigrate from SA, particularly from the petrochemicals sector?

e. What are the possible retention strategies that organisations within the petrochemicals sector in SA can adopt to retain some of the engineers?

This study used a mixed-method approach where the quantitative data of the study was gathered using a questionnaire survey, while the qualitative data was gathered using an interview protocol. This chapter presents conclusions and recommendations as well as limitations of the study. Furthermore, this chapter presents further research studies on the gaps identified in the study, which are also covered.

7.2 Implications of the study

There may be several perspectives on the classification of implications of the study. However, implications of the study can be generally classified into theoretical, managerial, practical, and methodological implications. Emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector can be understood in terms of how the findings contribute to, challenge, or extend existing migration theories.

7.2.1 Theoretical Implications of the study

The study findings validated the push-pull framework (Lee, 1966) as it identified specific factors such as security, service delivery, health care, and high corruption that push skilled engineers from South Africa. Furthermore, the findings also corroborated the push-pull framework with specific factors, which included better remuneration, better career development, and better opportunities. These factors

pull the skilled and experienced engineers to consider working in foreign destinations.

The silence on remittances is challenging the traditional brain drain perspectives, which assert that skilled workers maintain ties with their home countries through supporting their families financially back home (Saxenian, 2005). However, the findings corroborated the brain drain theory, as it was revealed that engineers often return to South Africa due to the short-term nature of their contracts as well as due to the lower cost of living in South Africa compared to countries abroad, especially in the western world. The findings also supported the brain drain theory, demonstrating that emigrant engineers contribute (bring back on their return) a wealth of knowledge and diaspora knowledge networks to South Africa's socio-economic development and technical advancement.

Herzberg's Two-Factor Theory distinguishes between hygiene factors (such as salary and safety) and motivators (such as career growth and recognition) as critical elements to be included in retention strategies to alleviate emigration of professionals. Based on the findings of the study, this theory needs to be reviewed to include expanded and clear factors, which should include social factors (such as work-life balance, safety, and security), personal development factors (like mentorship, training, and career development path), and economic factors (such as salary, monetary benefits, work promotion, recognition, and rewards).

In line with institutional theory, the results showed that emigration is made worse by weak institutional contexts (such as inconsistent policies and high levels of corruption) (North, 1990). Therefore, successful retention strategies could highlight the role of public-private partnerships in creating favourable labour ecosystems. The findings also attach importance to training engineers as one of the aspects that is critical to enhance firm competitiveness. Therefore, retention strategies

should be developed in support of resource-based theory, which frames skilled labour as a strategic resource.

New Theoretical Frameworks for Developing Economies

The study proposes a context-specific model integrating macro (national policies), industry practices, and micro (individual motivations) factors affecting skilled migration in resource-dependent economies. In this case, national policies should include a review of migration policies that can make it possible to manage professional outflows through instruments such as in-service training and bonding professionals for a specific number of years. The framework should also give priority to safety policies (supported by a clear implementation and monitoring plan) to ensure the compliance of organizations with standards. This will help with having high safety standards, ensuring employees feel safe in the workplace. Compensation and benefit policy should be part of the framework. It is important for the compensation and benefits policy to reflect the realities of the South African market and to be closely linked to global trends.

The framework should enforce industry practices that encourage investment in technology and infrastructure and the use of modern tools and techniques, as well as a strong focus on research and development to enhance innovation. This new framework should also focus on strengthening industry, government, research institutions, and academic institutions' partnerships or collaborations to raise the bar for innovation. This may give professionals a good challenge at work, which can give them opportunities to grow, and this may reduce turnover intentions.

7.2.2 Managerial and Practical Implications

The findings of this study have profound managerial and practical implications for petrochemical firms, human resource professionals, policymakers, and industry stakeholders in South Africa. The study helps petrochemical companies and human resources managers to develop and implement retention strategies to

counteract emigration. Some of these strategies include offering competitive compensation and benefits through aligning salaries with global standards (e.g., benchmarking against Europe, North America, or the regional markets) and offering tax-efficient incentives (e.g., housing allowances, stock options, and retention bonuses).

The study helps petrochemical companies and human resources managers to develop career development and upskilling plans that focus on investing in continuous professional development (e.g., certifications, overseas training). The study also helps petrochemical companies and human resources managers in having a clear implementation of promotional pathways to reduce stagnation for engineers.

The study helps petrochemical companies and human resources managers with how to plan for an effective work-life balance & employee well-being. This work-life balance can be achieved through introducing flexible work arrangements (remote work, compressed workweeks).

Petrochemical companies are advised to have effective succession planning and knowledge transfer. This can be done through developing talent pipelines (such as apprenticeships and graduate programs) to mitigate skills gaps. Petrochemical companies are advised to encourage knowledge-sharing systems (such as mentorship, digital documentation, and knowledge sharing using advanced technologies such as artificial intelligence). This will go a long way to prevent brain drain.

Industry associations also play a critical role in the retention of skilled and experienced engineers in South Africa. These associations can play this role by establishing industry-wide retention standards (such as shared best practices and wage guidelines). Industry associations can lobby for sector-specific immigration

policies to fast-track work permits for critical skills. Most importantly, industry associations can partner with universities to align curricula with industry needs, which helps to reduce the risk of skills mismatches.

Government and policymakers also play a crucial role in the retention of skilled and experienced engineers within the petrochemical sector in South Africa. The government can institute macroeconomic and policy interventions such as providing tax incentives for retention. In this case, the government can offer corporate tax breaks for companies investing in local skills development. The government should put more efforts and resources into addressing key push factors that include safety concerns, corruption, and load-shedding to offer an enabling environment for socio-economic development. Additionally, the government should permit professionals to have dual citizenship. This will encourage expatriates to maintain ties at home and share their expert knowledge. These expatriate engineers can even provide remote consulting roles, which can benefit the industry through their experience and knowledge that they can offer to the industrial sector and the country. The government should review the Education & Skills Development Policies, focusing more on strengthening Science, Technology, Engineering, and Mathematics (STEM) education to ensure a sustainable talent pipeline. Finally, the government should also expand work-integrated learning (such as internships and learnerships) in petrochemical fields in partnership with private players in the industry.

7.3 Recommendations of the study

There are several initiatives that can be undertaken to curtail engineers from leaving South Africa to work abroad. Some of these initiatives are discussed in the subsequent subsections.

7.3.1 Enhance Policy Implementation

The government should ensure that equity policies are genuinely empowering all professionals, providing clear career development pathways and meaningful opportunities.

7.3.2 Improve Working Conditions

Government and the private sector should address workplace dynamics to foster an inclusive environment where all professionals feel valued and have opportunities for advancement. The work conditions should be enhanced, and significant safety measures should be improved at the workplace.

7.3.3 Competitive Compensation

Government and the private sector should offer salaries and benefits that are competitive with international standards to retain talent. The improved salary structures should compete with global markets.

7.3.4 Professional Development

Organizations should invest in continuous training and development programs to enhance skills and career satisfaction.

7.3.5 Strengthen Economic Stability

The government should implement broader economic policies that address the underlying factors driving emigration, such as economic instability and safety concerns

7.3.6 Policy Recommendations

A raft of policies should be reviewed to improve the working conditions for engineering professionals. The following aspects should be considered.

a. Collaboration with government agencies to introduce retention policies,

b. Establishment of scholarships with work-back obligations for engineering students,

c. Strengthening of STEM education and industry-academic collaborations and
d. Implementation of exit interviews and data tracking to monitor migration trends

6.2 Limitations of the study

This study on emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector used a mixed-method approach (it used both qualitative and quantitative methods) to gather and analyse data. A mixed method was used with the intention of limiting several risks, such as the risk of rigor, representativeness, or generalizability of the findings, and balancing the gathering of comprehensive information to have a clear understanding of the emigration determinants and retention strategies of skilled personnel in the South African petrochemical sector. Despite efforts to limit the above risks, a mixed-method approach presents several methodological, practical, and contextual limitations, particularly in this study's setting.

6.2.1 Methodological Limitations

The study faced challenges associated with the integration of qualitative and quantitative data, which could not align seamlessly. This misalignment could have been the source of conflicting findings between quantitative results and qualitative insights. Resolving these discrepancies presented challenges to the researcher.

This study was exposed to self-selection bias, where skilled workers who have already emigrated proved harder to reach, and this could have skewed the findings toward those still in South Africa. The assumption in this case is that those who are already outside of the country have different experiences and perspectives compared to those that are still based locally on the subject matter under

investigation. The study was also exposed to non-response bias, where some high-profile engineers who were serving in senior roles within their respective organizations could have avoided participation in the study due to confidentiality concerns and non-disclosure agreements that are in place.

The study interviewed a total of 12 engineering professionals and 12 human capital professionals within the petrochemical sector. This cannot adequately represent the entire petrochemical sector. Therefore, the findings of the study may not be generalizable to a larger population. This also means that the findings may not apply to other industries (e.g., healthcare, information technology) facing similar brain drain challenges.

6.2.2 Practical Limitations

There were several implications for practical orientation. It was logistically challenging to track former engineers abroad. This constrained the data collection process, and with this constraint, only a few interviews could be done compared to what was planned originally. Some of the petrochemical companies restricted access to current employees due to sensitivity around turnover data.

Mixed-methods research requires more funding and time than single-method studies. The researcher had limited time and financial resources to conduct the study. Rapidly changing migration trends such as economic shifts, political shifts, new visa policies, Black Economic Empowerment regulations, and recessions may quickly make findings of the study obsolete.

6.2.3 Contextual Limitations

The researcher could not have gotten the desirable number of people participating in this exercise due to the sensitivity of the topic. For instance, participants could have underreported emigration intentions to avoid appearing disloyal to their

employers. Furthermore, issues pertaining to crime, corruption, and general poor governance could have been censored or downplayed due to the sensitivity of political climates in various countries where professional engineers are located.

6.3 Further studies

The limitations presented in this study provide suggestions for future research. First, participants of the survey questionnaire were randomly selected (focusing on the petrochemical sector), while purposive sampling was used to select interviewees for the qualitative part of the study. This issue limits the generalizability of the findings. It is advisable to consider expanding the research study to cover other sectors of the economy and not limit it to one sector, as is the case here.

It was also highlighted that participants in the study were hard to reach. Therefore, a blend of purposive and snowball sampling could be used in future research studies to enable tracking hard-to-reach emigrants via professional networks (LinkedIn, alumni groups). A mixed-method approach was used in this study. However, its limitations were contextualized as the potential of conflicting findings. Therefore, it is advisable to triangulate data sources by combining surveys, interviews, and secondary data for validation.

A cross-industry analysis can be conducted to compare emigration drivers and retention strategies between the petrochemical sector and other high-skill industry sectors such as information technology, healthcare, and mining. It will be worthwhile to conduct a study in the future to investigate how South Africa’s challenges align with or differ from other resource-dependent economies like Nigeria’s oil sector, Brazil’s energy industry, and countries in the Middle East. This enables South Africa’s case to be benchmarked against regional and global markets.

A longitudinal study on emigration trends can be conducted for tracking skilled engineers over time: this will enable the study to measure the impact of policy shifts, such as immigration laws, labor laws, and other dynamics like politics on migration decisions and retention strategies. One can use simulation policy interventions to predict how hypothetical government policy shifts, such as tax breaks and safety reforms, can reduce emigration in South Africa.

6.4 Statement of novelty of the study

This study introduces a novel, multi-dimensional framework for analyzing skilled emigration and retention strategies in South Africa's petrochemical sector by uniquely integrating the following aspects.

i. Sector-Specific Push-Pull Analysis

Unlike broader brain drain studies, this research isolates petrochemical professionals, who are a critical yet understudied group in migration literature, to identify industry-specific drivers (e.g., corruption, political factors, safety risks, personal factors, and economic factors).

ii. Diaspora Engagement as Retention Lever

Moving beyond traditional 'brain drain' paradigms, the study explores how South African petrochemical firms can harness expatriate networks for skills transfer and investment (popularly referred to as brain gain). This retention strategy has not been previously explored in resource-based economies.

iii. Policy-Employer Nexus

The study innovatively bridges macro (national policy) and micro (organizational) perspectives, proposing actionable retention strategies that are tailored to South Africa's dual challenges of skills scarcity and economic instability.

Previous research studies either generalize across sectors or neglect the interplay between corporate retention efforts and macroeconomic policies in developing economies. This study fills that gap with actionable, context-specific insights while advancing migration theories. The study shifted from generic skilled migration studies and was focused on the engineers within the petrochemical sector's unique dynamics. It linked firm-level human resources strategies with national policy reforms. The study also provides new retention concepts where it proposes diaspora networks as a retention tool, not just a loss or brain drain.

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Society of Petroleum Engineers (SPE): (2021)Training and Development

APPENDICES

APPENDIX 7: PROFILE OF INTERVIEW RESPONDENTS

Industry Expert

#	Profile Number	Gender	Age	Race	Language	Qualification	No Years Work Experience	Year Migrated
1	Expert_001	Male	41 – 50	White	English/ Afrikaans	PhD Chem Eng	10 -14	2005 - 2017
2	Expert_002	Male	51 - 60	White	English	BSc	15-20	2006 - 2019
3	Expert_003	Female	31 - 40	Asian	English	BEng	15-20	2005 - 2020
4	Expert_004	Female	< 30	African	English/Afrikaans	Hons Chem Eng	10 -14	2019 – still in the Middle East
5	Expert_005	Male	31 - 40	African	English/Isizulu	BEng/MBA	10-14	2011 – Still in the Middle East/Angola
6	Expert_006	Female	51 - 60	White	English	BSc	21 - 30	2008 - 2020
7	Expert_007	Male	41 – 50	African	English/Sesotho	BSc Hons	15-20	2010 – Still in the USA (Houston)
8	Expert_008	Male	31 - 40	White	English	BEng	10 -14	2005 – Still in Australia
9	Expert_009	Male	31 - 40	Asian	English	BEng	10 -14	2020 – Still in the UK
10	Expert_0010	Male	51 - 60	Coloured	English/Afrikaans/IsiZulu	BSc	21 - 30	2010-2015
11	Expert_0011	Female	41 – 50	White	English	BEng	10 -14	2012-2016
12	Expert_0012	Male	51 - 60	White	English	PhD Chem Eng	21 - 30	2003 -2007

Human Capital Practitioners

#	Profile Number	Gender	Age	Race	Language	Qualification	No Years Work Experience	No of Years in the Development and Implementation of Retention Strategies
1	HumCap_001	Female	31 - 40	African	English/IsiZulu	BA Degree and Diploma in HR	15-20	10
2	HumCap_002	Female	41 – 50	African	English/IsiXhosa	MBA	10 -14	12
3	HumCap_003	Male	51 - 60	Asian	English	MA	21 - 30	15

4	HumCap_004	Male	31 - 40	African	English/Sesotho	MBA	15-20	10
5	HumCap_005	Male	51 - 60	White	English/Afrikaans	BA Degree Arts	21 - 30	15
6	HumCap_006	Female	31 - 40	Coloured	English/Afrikaans	Higher Diploma /BA Degree	15-20	20
7	HumCap_007	Male	51 - 60	African	English	Hons Degree in Soc Sc	21 - 30	22
8	HumCap_008	Male	< 30	African	English	MA	10 -14	10
9	HumCap_009	Female	< 30	Coloured	English	Hons Degree Psychology	10 -14	08
10	HumCap_0010	Female	51 - 60	African	English	Masters	10 -14	08
11	HumCap_0011	Female	31 - 40	White	English/Afrikaans	Higher Diploma /BA Degree	15-20	09
12	HumCap_0012	Female	41 – 50	African	English/Sesotho	BA Degree and Diploma in HR	10 -14	10