South African unemployment: the case of the geoscience graduates

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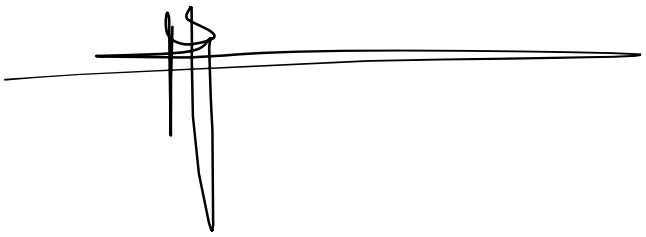

ABSTRACT

Unemployment presents a substantial global challenge, and South Africa is no exception, consistently reporting one of the highest unemployment rates, particularly among its youth population. The recent pandemic has further worsened this situation, notably reflected in the growing difficulties geoscience graduates encounter in finding employment upon graduation. This study aimed to assess the factors contributing to the growing number of geoscience graduates struggling to secure employment from the human resources (HR) perspective. The study assesses the mismatch between the skills required by the job market versus the skills produced by the universities.

A need for partnerships and collaborations between industry and universities to improve the skills and employability of graduates is identified. The study delineates the roles and responsibilities of key stakeholders to remedy the geoscience graduate unemployment problem and proposes strategies for augmenting graduates' expertise, employability, and skill sets.

The study utilised a qualitative design incorporating semi-structured, semi-structured open-ended interviews with the human resources officer (s). Thematic analysis was conducted on the data to understand the perceptions and perspectives of the HR officers. This study reveals that there are several factors perceived to be attributed to the rising geoscience graduate unemployment, and these include, *inter alia*, a considerable misalignment regarding the skills the universities are producing versus the skills required by the job market, the lack of collaboration and partnership between the key stakeholders (i.e. universities, industry, and government) and the misalignment between the available job opportunities and the available graduates. Therefore, this calls for more collaborations and partnerships to solve the problem of geoscience graduate unemployment. This research study is, thus, intended to provide a fresh perspective for policymakers, the geoscience industry and higher education institutional leaders.

KEYWORDS: Geoscience, geoscientists, unemployment, geoscience graduates' unemployment, mining industry, and graduate

DECLARATION

I, Nomvelo Pumla Mkhize, hereby declare that this is my original work. All ideas, concepts, and findings presented within this thesis are the result of my own research efforts unless otherwise cited and referenced. The acknowledgements section has duly acknowledged any assistance received during the research process.

I affirm that this thesis has not been submitted for any other degree or qualification at any other institution. Furthermore, I attest that all sources used in this thesis have been appropriately cited and referenced according to the established academic conventions.

I acknowledge that the data presented in this thesis have been collected and analysed with integrity and adherence to ethical guidelines. Any potential conflicts of interest have been disclosed and managed appropriately.

I understand the academic implications of plagiarism and certify that this thesis is free from any form of academic misconduct, including plagiarism and fabrication of data.

DEDICATION

I dedicate this dissertation to my family, whose unwavering support and encouragement have been my guiding light throughout this journey. Your love, patience, and belief in me have been the fuel behind every step I've taken. To my friends, thank you for standing by my side with words of encouragement and moments of laughter during the challenging times. Your presence has made this experience more prosperous and more meaningful. To my professors and mentors, thank you for sharing your knowledge, wisdom, and guidance, shaping me into the scholar I am today. And finally, to the countless individuals who have contributed to this thesis, directly or indirectly, your insights, feedback, and inspiration have played an invaluable role in its completion. This work is dedicated to each and every one of you with heartfelt gratitude and appreciation.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
4IR	Fourth Industrial Revolution
HBIs	Historically Black Institutions
HR	Human resources
CP1	Consulting Sector Participant 1
CP2	Consulting Sector Participant 2
GP1	Government Sector Participant 1
GP2	Government Sector Participant 2
GDP	Gross Domestic Product
MP1	Mining Sector Participant 1
MP2	Mining Sector Participant 2
MP3	Mining Sector Participant 3
PP1	Government Research Institution Participant 1
PP2	Government Research Institution Participant 2
PP3	Government Research Institution Participant 3
Stats SA	Statistics South Africa
UCT	University of Cape Town
UJ	University of Johannesburg
UKZN	University of KwaZulu Natal
UP	University of Pretoria
WEF	World Economic Forum
Wits	University of Witwatersrand

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1. CHAPTER 1: INTRODUCTION

1.1 Statement of purpose

This study examines the factors contributing to the rise in geoscience graduate unemployment.

1.2 Context of the study

The perennial high graduate unemployment rate in South Africa is one of the country's largest socio-economic problems. In fact, when considering both the global and African contexts, South Africa exhibits one of the highest unemployment rates. According to the World Economic Forum, this trend is set to increase and is mainly attributed to slow economic growth and stringent labour laws (Neufeld, 2023).

In a country experiencing a persistently rising unemployment rate as of quarter four of 2023, the unemployment rate stood at 32.1%, a 0.2% increase from the previous quarter. Especially concerning is the elevated unemployment rate among young people aged 15-34 years, which reached 44.3% in the fourth quarter of 2023 (Stats SA, 2024).

The graduate unemployment rate stood at 10.6%, and the tertiary unemployment rate was 21%, Figure 1 (Stats SA, 2022). Whilst many sectors showed positive figures for employment in Q3, mining remained on a negative trend, recording -0.2% employment. These figures showed an upward trend from 2018 until 2021; since 2022, there has been a downward trend. However, it is unclear how many unemployed geoscientists are within these figures. This is a statistical data gap as it does not break down according to qualification. Even though these figures may seem low, it is important to note that they are on an increasing trend and not all graduate sectors are affected equally.

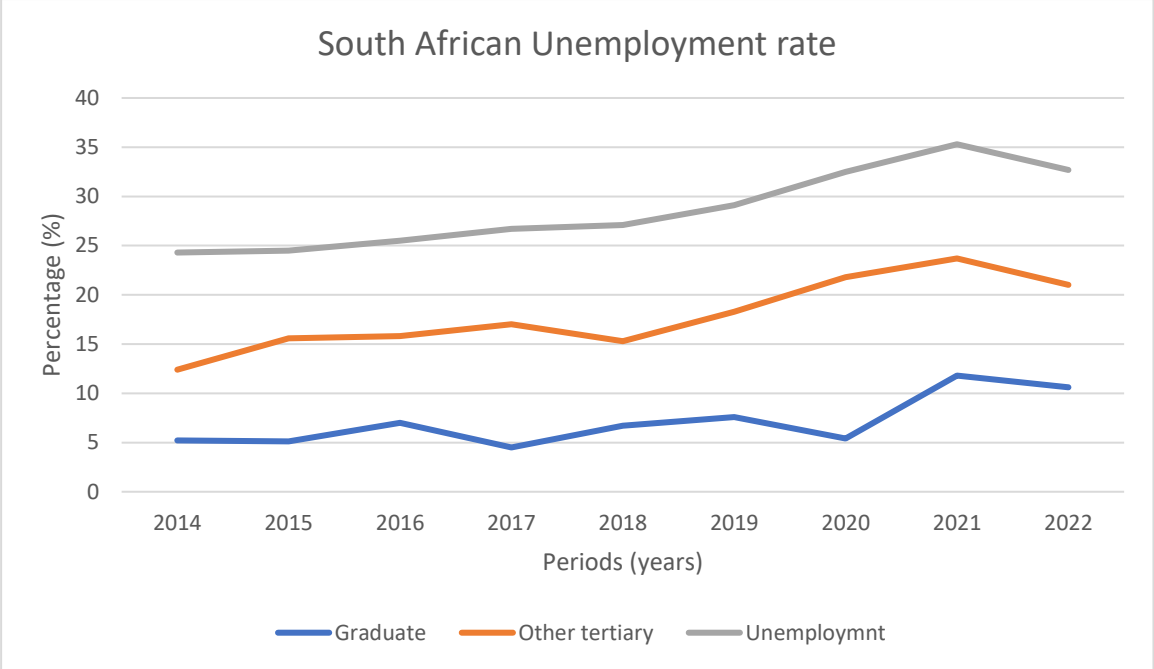

Figure 1: South African unemployment rate trend between 2014 to 2022. Source: Stats SA 2023

South Africa is known for its endowment of several of the largest reserves of minerals in the world. The country has been extracting minerals since the 1800s (Minerals Council South Africa, 2023). As such, the mining sector remains amongst the top economic contributors to the Gross Domestic Product (GDP) (R494 billion, 7.5% in 2022) despite its many vicissitudes in the last decade (Minerals Council South Africa, 2023). As of Q3 of 2022, the mining industry employed over 475 000 people, both skilled and unskilled (Minerals Council South Africa, 2023). Many argue that the industry is a sunset industry due mainly to political uncertainty, labour unrest, shortage of skills, etc. (Lane et al., 2015). This has seen many large mining companies leaving the country or downscaling, resulting in mass retrenchments in a country endowed with a vast labour force.

Geosciences play a crucial role in the South African economy. Geoscience underpins industrialisation, infrastructure development and manufacturing as it provides most of the raw materials required (Curtiss, 2020). The energy and water resources consumed by South Africans are provided through geosciences. These contribute immensely to the functioning of the country's economy.

The geosciences play a pivotal role in the African continent's current and future economic development. They aid economic development by exploring and developing mineral resources essential for the continent's development. Thus, the mining industry's success

relies heavily on the skilled labour force, including geoscientists. Local and international tertiary institutions currently produce this labour force in South Africa. Therefore, it is paramount that there is a healthy pipeline of graduates with requisite skills and practical training. The mines often provide practical training as the universities do not have the capacity (Cameron & Drennan, 2017a). However, due to the limitations, not all graduates get the opportunity to gain practical experience.

The primary employers for geoscientists include mining companies, consulting firms, exploration companies, government and research institutions, and universities. Some graduates opt to emigrate to other countries for better opportunities. Notably, South Africa has a significant unemployment problem for geoscience graduates despite the high demand for geoscience skills in industries such as mining, oil and gas, and environmental management (Farmer & Innes, 2023).

Over time, the mining sector has traditionally been a major source of employment for geoscientists, and notable developments have occurred within the industry in recent years. The industry has declined due to labour disputes, declining commodity prices, and regulatory issues (Minerals Council South Africa, 2023). Also, government and private investors should continually invest in research and development for the mining industry to be sustainable. However, this has not been happening at the correct scale, hence a decline in the opening of new mines or the discovery of new reserves (Farmer & Innes, 2023). The unintended ramifications of the aforementioned are the reduction in the number of job opportunities available for geoscientists.

Graham, et al. (2019) assessed the barriers to overall graduate employment. The study showed several factors, including the absence of applicable professional background, inadequate knowledge regarding effective job-hunting techniques, limited social connections, and a significant challenge or obstacle. Work-seeking costs create barriers to securing work.

According to Eunice et al. (2018), the increasingly high level of graduate unemployment and the lack of employment has seen graduates turning to alternatives like alternative career paths, furthering studies, accepting underemployment, etc.

According to Cameron & Drennan (2017), in the past twenty years, South African universities with a geoscience curriculum underwent a radical transformation in terms of the demographics of the student intake. These changes were forced by the post-apartheid

transformation policies, which offered opportunities to the previously disadvantaged, particularly black students and female white students, equal opportunities in geosciences through bursaries. As a result, these institutions started producing elevated volumes of geoscientists. Before this era, the geoscience classes were mainly dominated by white males (Cameron & Drennan, 2017b).

Despite the mines' harsh working conditions and location, the higher average salaries in geosciences make the field attractive to those choosing carriers. This can be attributed to the high volume of geoscience students. Despite the increasing number of unemployed geoscience graduates, geoscience continues to be classified as one of the scarce skills in South Africa.

Notwithstanding the shared global challenges like COVID-19 and the dire economic climate, the South African employment rate has been on a downward trend despite the relatively lower graduate unemployment rate (Graham et al., 2019; Ohei & Brink, 2019). The number of graduates produced by South African universities is not commensurate with the job opportunities in the market for certain fields of study, like geosciences.

According to the study by Ohei & Brink (2019), poor economic conditions also contribute to graduate unemployment. The study also indicates that the problem of unemployment is prevalent at all levels of qualifications, irrespective of the qualification type. The study emphasises additional factors such as inadequate job experience, hard and soft skills deficiencies, and graduates' inability to effectively apply the knowledge acquired through university education. Consequently, South African youth continue to face challenges in the job market. The study suggests that higher education institutions should take proactive measures to cultivate graduates equipped with essential skills, coherent knowledge, and practical applications. It advocates for implementing work-integrated learning as a best practice to address these shortcomings and facilitate improvement (Ohei & Brink, 2019).

The number of unemployed geoscience graduates continues to increase, and some can be seen on the street corners begging for employment. What could be the problem? Are the universities and tertiary institutions producing more graduates than the workforce can absorb? Not much is understood as to why there is a decline in the intake of geoscience graduates. Nonetheless, geoscience graduates continue to encounter difficulties when it comes to securing employment. In the literature, few studies have analysed the factors contributing to geoscience graduate unemployment.

1.3 Research problem

South Africa relies on geoscientists for a multitude of reasons. They are integral to the exploration and extraction of the country's ample natural resources, such as oil, minerals, and gas, vital for economic growth and development (Manduca et al., 2012). Additionally, geoscientists play a crucial role in environmental management, assessing the impact of human activities on ecosystems and implementing conservation measures (Cawood P, 2008). Furthermore, geoscientists contribute significantly to water resource management by assessing and monitoring groundwater and surface water availability, which is essential for addressing the country's water security concerns.

Moreover, their expertise in natural hazard assessment helps mitigate risks associated with earthquakes, landslides, and floods, enhancing resilience against such events (Leroy et al., 2009). Lastly, in infrastructure development, geoscientists provide essential insights into the safety and stability of construction projects such as roads, bridges, and dams.

Despite the multitude of reasons why we need geoscientists in the country, the problem of geoscience graduate unemployment continues to persist. The poor coordination between the geoscience industry and the universities has manifested in high volumes of geoscience graduates struggling to secure employment. The numbers produced are not proportional to the job opportunities in the market. Conversely, the job market faces a skills shortage as the graduates do not possess the requisite skills required by the industry, particularly soft skills and practical skills, even though the market is inundated with unemployed graduates (Lane et al., 2015). To further exacerbate the skills shortage problem, the industry also loses professional skills to other countries or global companies, leaving a significant gap. Despite a few graduate programmes to circumvent this crisis, the problem persists.

A joint solution is required between the universities and the job market to solve the geoscience graduate unemployment. Suppose the universities are producing graduates that are not of the right practical and soft skill sets for the job market. The industry should partner with universities, provide direction, and supplement the shortfalls of skills. In that case, job market human resources managers must understand the skills and capabilities

produced by the universities and implement structures to develop and retain the skills for sustainability (Lane et al., 2015). In addition, many industries are undergoing digital transformation, and so is the mining industry, yet tertiary institutions are not keeping up with this trend. This creates a redundancy problem for the skills being produced today as they might be unable to adapt to future jobs.

Despite the critical role of geoscience in national development and economic growth, geoscience graduates in South Africa face high levels of unemployment. The problem of geoscience graduate unemployment is poorly understood, and there is a lack of research on the challenges geoscience graduates face in finding employment in the sector.

The research problem statement: There has been a growing number of geoscience graduates who are battling to find employment in South Africa, and the contributing factors to this problem are not clearly understood. This study intends to uncover and provide an understanding of this problem and provide recommendations to address and improve the employability of geoscience graduates in the sector.

Research sub-problems:

- There appears to be a mismatch between the skills produced by the universities versus the skills demanded by the industry.
- There are insufficient collaborations and partnerships between the relevant stakeholders, i.e., universities, industry, and the government.
- There are not enough opportunities presented to geoscience graduates.

This research problem is investigated by interviewing geoscience Human Resources (HR) officers responsible for recruiting geoscience graduates. As a result, it offers valuable insights into recruiters' perceptions, interpretations, narratives, and experiences regarding factors contributing to the inability of several geoscience graduates to secure employment. Moreover, the findings of this study suggest potential solutions to the issue and could inform policy interventions aimed at enhancing the employability of graduates in the sector.

1.4 Research objectives

1.4.1 Primary objective

The primary objective of this study is *to determine the factors contributing to geoscience graduate unemployment from the perspective of the HR officers.*

1.4.2 Secondary objective

The secondary objectives are, in addition to the primary objective, to provide additional information to understand the research study and ensure that the study is comprehensive. The secondary objective of this study is to *identify potential interventions to mitigate the issue of geoscience graduate unemployment in South Africa.*

In completing the above-stated objectives, the research findings can assist by evaluating existing policies and developing policies and interventions to address these challenges. The research aims to improve geoscience graduates' outcomes and create a more prosperous society by contributing to existing knowledge in this area.

1.5 Significance of the study

The prevalence of graduate unemployment has been extensively researched in general. However, there has been a paucity of studies that have explored perceived sources of geoscience graduate unemployment. In fact, previous studies have ignored the nuances within various disciplines and the correlation, if any, between a particular discipline and the unemployment rate. This study appreciates that the genesis for graduate unemployment may differ from discipline to discipline. For instance, law graduates might not have the same barriers to the job market as geoscientists. Therefore, the uniqueness of this study is the focus on a particular niche, the geoscience graduates.

This study, with this particular focus on geoscience graduates, provides a deeper understanding of the factors that contribute to unemployment among geoscience graduates and allows for a more nuanced understanding of these issues through the prism of the HR officers. It will enable HR officers to share their insights into the skills and experience employers are looking for and the challenges that graduates face when applying for jobs.

Finally, the study recommends effective ways of addressing the issue pertaining to geoscience graduate unemployment as it demonstrates an in-depth understanding of the issue and the needs of geoscience graduates.

Despite South Africa's tremendous mineral endowment, there remains a high percentage of unemployment among geoscience graduates. Also, despite their access to academic institutions and good credentials, many graduates fail to find work in this field of study, resulting in a lack of practical experience and fewer prospects for professional advancement (van Lill & Bakker, 2022). Unemployment among geoscience graduates in South Africa is an intricate issue that needs a diversified strategy to address the underlying reasons to provide long-term solutions.

Researchers have analysed and studied several perspectives and causes of the overall South African graduate unemployment. Moreover, Statistics South Africa (Stats SA), every quarter, captures unemployment statistics in the country despite its criticism. However, there is still a gap in the details of sector-specific graduate unemployment and the causes thereof. This study examines the potential causes of the increase in graduate unemployment in geoscience. Furthermore, possible solutions for geoscience unemployment will be recommended.

In the South African context, there are several reasons why analysing geoscience graduate unemployment is essential. Moreover, there are several angles from this analysis can be looked at. The factors linked to graduate unemployment by other researchers include skills mismatch, lack of relevant practical experience, global competitiveness, economic climate, changes in the job market (e.g., technology), lack of jobs, etc. Moreover, the impact of graduate unemployment includes economic, social, and underemployment.

The mining industry is among the significant contributors to South Africa's economy. Hence, its sustainability is paramount. As mentioned earlier, geoscientists are vital in mining exploration, exploitation, and development.

Several researchers (Eunice et al., 2018; (Oluwajodu et al., 2015) have recommended graduate unemployment in their focus areas. Even though these papers are looking at other fields of graduate unemployment, they have provided the following recommendations:

- In their research, Graham et al. (2018), having identified skills mismatch as one of the factors contributing to graduate unemployment, recommend a well-coordinated relationship between qualifications and practical work experience to ensure that graduates are a better fit for the labour market. They also argue that this initiative will provide an essential investment towards tertiary education and training (Graham et al., 2019).
- Furthermore, in their study, Eunice et al. (2018) also recommend reviewing and revising the tertiary institution's curriculum to ensure that the graduates produced fit the job market requirements. This recommended approach requires that the government of South Africa and the tertiary institutions, in partnership with labour, form a collaboration. They also question the student uptake of the tertiary institutions, which is not informed by the needs of the job market, thus resulting in higher volumes of graduates produced compared to the available job opportunities.

Thus, this study analyses the documented recommendations undertaken by various researchers (Baldry, 2016; Haselberger et al., 2012; Oluwajodu et al., 2015) on the overall graduate unemployment assesses if these identified factors and recommendations are also applicable to the geoscience graduate unemployment. Moreover, it establishes other factors that are unique to the geoscience field.

The study provides valuable insights into the complex issue of geoscience graduate unemployment and offers a useful framework for future research and policy interventions in this area.

1.6 Delimitations of the study

This research focused on the factors contributing to South African geoscience graduate unemployment from the perspectives of the HR practitioners responsible for the recruitment of geoscientists. In doing so, the study analysed the experiences, views, and their perception. The HR officers targeted are those in the mining, consulting, and government sectors.

This study does not interrogate career prospects and geoscience graduate employment rate, nor does it look at the individual graduate experience during job searching and their perspectives in general. In addition, the research does not intend to provide quick or short-

term remedies to the problem of unemployment among geoscience graduates in South Africa. However, it focuses on understanding the underlying reasons and recommending long-term solutions.

The study methodology included semi-structured, open-ended, in-person interviews of the *human HR officers* in the geoscientific sectors.

1.7 Definition of terms

- A geoscientist is a professional who studies the earth, its natural resources, and its physical properties (King, 2008).
- A graduate is defined as an individual possessing a bachelor's degree or equivalent, along with higher educational attainments such as honours, master's, and doctoral degrees (Van der Berg & Van Broekhuizen, 2012).
- Geoscience is a field that encompasses many different specialities, including geology, oceanography, atmospheric science, and environmental science (King, 2008).
- Soft skills refer to interpersonal, social, and communication abilities that enable individuals to effectively interact with others, navigate social situations, and perform tasks in various professional and personal contexts (Marin-Zapata et al., 2021).
- Technical skills refer to the specific abilities and knowledge required to perform tasks related to a particular profession, industry, or field (Marin-Zapata et al., 2021).
- Unemployed graduates refer to "*higher education graduates in different fields of study who, due to lack of labour, demanded skills or slow economic growth, are unable to secure a job"* (Tshishonga, 2019)
- Unemployed geoscience graduates are those who studied geoscience and have not attained employment.
- Unemployment official definition according to Stats SA (2022): persons according to the Official definition are those (aged 15–64 years) who:
  a) "Were not employed in the reference week; and
  b) Actively looked for work or tried to start a business in the four weeks preceding the survey interview; and

c) Were available for work, i.e., would have been able to start work or a business in the reference week or

d) Had not actively looked for work in the past four weeks but had a job or business to start at a definite date in the future and were available."

- Unemployment rate *is "the proportion of the labour force that is unemployed"* (Stats SA, 2022)

1.8 Assumptions

The assumption is that all the geoscience companies employ graduates. Another assumption is that geoscience graduates from different universities possess the same skills and knowledge and stand for the same employment opportunities.

1.9 Chapter outline

Chapter One: This chapter details the background of the study, where the mining industry is the significant employer of geoscience graduates in South Africa. The industry is analysed, and the graduates' statistics are presented. The critical role geosciences play is highlighted in this chapter. The chapter takes a closer look into the field of geoscience and the geoscientists in terms of the universities that produce them, the places they work, their importance in the bigger scheme of things, etc.

A presentation of the high-level overview of previous studies on graduate unemployment in South Africa. The research problem, rationale and objectives are detailed in this chapter.

Chapter Two: This chapter examines previous research on the subject or related subjects. An analysis and a criticism of what different authors say about the problem of overall graduate unemployment and its causes and impact are documented in this chapter. Moreover, the recommendations provided in these studies are analysed and cross-referenced where applicable.

Chapter Three: This chapter encompasses the methodology utilised in this study. The study will adopt a qualitative research approach, consisting of semi-structured, open-ended in-person interviews with geoscience graduates HR officers to investigate the factors contributing to geoscience graduate unemployment and the perceived skills gap

between graduates and the job market. This chapter details and motivates the techniques used in this study and the rationale for selecting the techniques to achieve the study results.

Chapter Four: This chapter analysis the results of the study and draws into the findings of the other authors. The results are presented and analysed.

Chapter Five: This chapter comprehensively documents a detailed discussion and interpretation of the raw data and results. It includes a comparison between this study's results and previous research findings, outlining alignments and conflicts where relevant. Furthermore, the chapter delves into the implications of the findings.

Chapter Six: The conclusion chapter summarises the research findings and their importance while highlighting the limitations and problems encountered during the research. A research gap for further studies is presented in this chapter.

2 CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter seeks to review the literature on graduate unemployment in South Africa. Like many other countries, South Africa has seen a rise in graduate unemployment in recent years, a situation that COVID-19 has further exacerbated. Graduate Unemployment globally and in South Africa has been explored and researched extensively by several researchers. However, there is little literature on factors contributing to geoscience graduate unemployment in South Africa. Thus, little about the factors contributing to geoscience graduate unemployment or the potential remedial actions are understood. However, there is clear evidence indicating a substantial rise in the number of geoscience graduates facing difficulties in obtaining employment in recent years. As such, many unemployed graduates are currently either underemployed or emigrating (Batu, 2016). Those lucky to find internship programmes are usually exploited, treated unjustly, overworked, and underpaid (Mseleku, 2023).

Consequently, an analysis of geoscience graduate unemployment is paramount. This literature review aims to assess the factors contributing to geoscience graduate unemployment in South Africa, examine the economic consequences, and identify

potential solutions to address this issue. By analysing existing research and data, this literature review aims to comprehensively understand the current state of geoscience graduate unemployment in South Africa and analyse several studies' recommendations.

In South Africa, the geoscience industry is responsible for developing and managing natural resources such as water, minerals, and energy, which are critical to human existence. This, therefore, implies that geoscience aids the country's economic development. However, this industry has even been considered a sunset industry due to many factors (Badenhorst, 2021). The industry is, unfortunately, on a downward trend in terms of its contribution to the country's economy and GDP.

Over the past ten years, investment in developing new mines has dwindled, coupled with a decline in productivity (Badenhorst, 2021). Similarly, the contraction industry is no different. This has been attributed to factors like policy uncertainty, political unrest, cost of production, etc. Moreover, the lack of government investment in economic growth, exploration, research, and development (R&D) has also resulted in the closure of some mines and consulting firms or no industry growth. With the mining industry being the major employer of geoscience graduates, this has had negative ramifications for the graduates. Hence, there is a glaring increase in geoscience graduate unemployment. This is over and above the fact that universities produce more geoscience graduates faster than the available jobs in the market (Börner et al., 2018).

The literature review will explore a link between general South African graduate unemployment and geoscience graduate unemployment and determine the factors resulting in the latter phenomenon according to the literature.

2.2 Background Discussion

The dispensation of democracy and the injustices of the apartheid era meant that the previously “white universities” had to become more accessible to previously disadvantaged groups, particularly black students. This transformation resulted from deliberate transformation agendas and policies between the universities and the mining companies around the 1990s (Tredoux, 1999). Baldry's study (2016) highlights that while the transformation of the education system aimed to empower previously disadvantaged groups, the current issue of graduate unemployment is undermining the effectiveness of these strategies. The net effect of these transformation strategies is the large volume of

graduates to the extent that the job market is unable to accommodate, resulting in the problem of graduate unemployment. According to Baldry (2016), this problem of graduate unemployment is four times more prevalent for black Africans when compared with white graduates of the same qualification.

South Africa has been grappling with high unemployment rates for several years and is currently amongst the highest in the world. Compared with 43 other countries, South Africa's graduate employment rate ranked at number 39 (OECD, 2022). As such, Unemployment poses a notable challenge in South Africa, especially among young people. The COVID-19 pandemic has also significantly impacted South African employment by exacerbating a dire situation (Stats SA, 2022).

Globally, academics have proposed several potential reasons for graduate unemployment. Some scholars suggest that the surge in graduate numbers is a contributing factor (Green & Henseke, 2021), while others emphasise the significance of work experience (Passaretta & Triventi, 2015). Additionally, there's discussion regarding the alignment of taught skills with employer demands (Demissie et al., 2021) and the impact of technological advancements (Sutherland, 2020). Despite numerous policy interventions based on these explanations, the problem of youth unemployment persists.

The causes of graduate unemployment in South Africa are complex and multifaceted. Factors such as a lack of relevant skills and attributes required by employers, structural inequality, economic factors, and limited job opportunities have been identified among the causes of graduate unemployment (Mseleku, 2022; Ohei & Brink, 2019). According to Baldry (2014), the cause of the increase in graduate unemployment has been primarily linked to the Black African demographic, individuals with diploma and certificate qualifications, graduates in humanities, and recent graduates.

Various policies and initiatives have been put in place by the government to tackle the issue of unemployment, such as the National Development Plan 2030, colloquially known as NDP2030, which aims to create jobs and boost economic growth. Moreover, the government has increased support for universities and entrepreneurship. However, the issue of unemployment in South Africa remains a significant challenge that requires sustained efforts and collaboration from all sectors (Baldry, 2015).

The field of geoscience is diverse, and it has three subdivisions, i.e., physical geology, environmental geology, and historical geology. Looking at the history of geoscience in South Africa, in 1999, according to Tredoux (1999), there were 13 geoscience departments in South Africa which were producing 150 junior degree students, with 120 masters' students and 60 PhD students currently registered. These figures were mainly dominated by white males even though there was starting to be a significant number of black students in the undergraduate, unlike the postgraduate (Tredoux, 1999).

This high unemployment among geoscience graduates in South Africa is highly concerning, as it impacts individuals' livelihoods and has broader consequences for developing the country's natural resources. Additionally, this tendency may have long-term ramifications for the industry since a lack of competent workers may limit the sector's capacity to innovate and thrive.

There are various reasons why it is critical to examine geoscience graduate unemployment in South Africa, including the economic impact, national development, social impact, etc. This literature review examines what different researchers found to be attributed to general graduate unemployment. Geoscience is an essential industry in South Africa, notably in the mining and resources sector. Unemployment among geoscience graduates can severely influence the country's economic growth since it indicates a skills deficit in a required field.

The unemployment experienced by geoscience graduates in South Africa could lead to several detrimental consequences within the industry. Firstly, there's the risk of losing valuable talent as graduates seek employment opportunities elsewhere, potentially resulting in a brain drain. Secondly, this situation may contribute to a skills gap within the geoscience sector, compromising the quality of work and diminishing South Africa's competitiveness on a global scale. Thirdly, the repercussions extend to the economy, potentially slowing down mining and energy sectors, which rely heavily on geoscience expertise. Lastly, unemployment carries significant societal implications, including financial strain, mental health challenges, and social unrest. Addressing this issue requires South Africa to fully leverage its geoscience talent and foster sustainable growth (van Lill & Bakker, 2022).

Graduate unemployment has been attributed to several negative social consequences. These may include feelings of social isolation, worthlessness, despair, and mental health

problems such as depression and anxiety (Graham et al., 2019). Furthermore, unemployment can contribute to poverty, social exclusion, crime rates, and social unrest (Eunice et al., 2018).

Graduate unemployment substantially and complexly impacts the South African economy concerning increased social welfare costs, talent and brain drain, exacerbated social unrest, etc. (Eunice et al., 2018). Unemployed graduates frequently turn to social welfare programmes to make ends meet. This strains government budgets, which may affect other sectors of the economy. The issue of graduate unemployment exacerbates the number of individuals living below the poverty threshold.

Moreover, graduates who struggle to find employment in their field are more prone to mental health issues (van Lill & Bakker, 2022). This often turns out to have a detrimental impact on their well-being and the well-being of their families. They frequently experience stagnation in their lives as they invest significant time and energy in their professional lives, hoping that once they attain employment, they can fulfil their adulthood commitments (van Lill & Bakker, 2022). Moreover, a lack of jobs in the geoscience field can deter students from pursuing geoscience degrees, resulting in fewer graduates and a potential loss of employment.

Talent loss and brain drain are other social impacts attributed to graduate unemployment (Musara, 2020; Ramchander, 2019; Sutherland, 2020). When there is a lack of job prospects in the country, talent is lost to other countries as the graduates tend to emigrate to countries with better job prospects. The consequence of this emigration is brain drain and, therefore, depletion of the nation's human capital. Moreover, graduates commonly look for work in other employable fields while they wait to find a job in their field of study when they struggle to find employment in that industry. In these situations, geosciences suffer from knowledge loss and become underemployed.

Undoubtedly, the economic exclusion of South African youth (18-35 years) in the job market severely impacts the country's GDP. Thus, high levels of graduate unemployment can have a negative impact on the economy. It can lead to reduced productivity, income, and economic growth, leading to decreased economic development (Van der Berg & Van Broekhuizen, 2012).

The potential ramifications of geoscience graduate unemployment in South Africa can be dire if the problem persists. They could range from reduced economic growth to increased social and environmental challenges.

2.3 What could be the factors contributing to geoscience graduate unemployment in South Africa?

Numerous factors contribute to the unemployment experienced by South African graduates. These challenges include a scarcity of relevant work experience, intense competition for limited job openings, discrepancies between graduates' technical and soft skills and employers' requirements, labour union regulations and policies, inadequate funding for research initiatives, and sluggish economic conditions (Graham et al., 2019; Hwang, 2017; Mseleku, 2022). Studies also found that the education system in South Africa does not adequately prepare graduates for the job market, and there is a need for greater collaboration between educational institutions and employers to address this issue. In addition, Graham et al. (2019) alludes to the fact that graduates face challenges accessing information about available job opportunities and navigating the job application process, particularly those from disadvantaged backgrounds.

A gap in the literature exists when it comes to understanding the factors contributing to geoscience graduates' unemployment from the perspective of the HR officers responsible for recruiting geoscience graduates. This research seeks to close this gap by looking more closely into geoscience graduate employment and checking linkages with the overall school of thought regarding broader graduate unemployment.

2.3.1 Skills mismatch/mismatch between the labour market and the job market

In the past, possessing technical skills was often sufficient to secure employment. However, in recent years, there has been an increasing emphasis on the importance of soft skills for graduates to be considered employable. A disparity between the skills imparted by universities and those demanded by the labour market has been recognised as a contributing factor exacerbating graduate unemployment (Demissie et al., 2021; Oluwajodu et al., 2015). This mismatch has resulted in high unemployment for graduates despite the high demand for technical skills in the labour market. Failure of the South

African graduate market to produce the skills required by the industry leaves employers with no choice but to look to the international market, worsening the situation of graduate unemployment in the country.

The fact that the world has technologically advanced at a higher pace compared to higher learning institutions has resulted in the redundancy of some skills produced by traditional universities (Sutherland, 2020). This means that some of South Africa's skills base is presently redundant and, therefore, not ready for future jobs, further exacerbating the graduate unemployment issue and making South African graduates less competitive. Sutherland (2020) also alludes that, with all things considered, the significant skills shortage in the country is a result of the failures of the higher education system and weak governance.

Furthermore, authors like (MIKEŠ, 2015; Schoeman, Blaauw & Pretorius, 2008) also link South African graduate unemployment with the economic status of the country's failure of the universities to provide industry-required skills. As such, Mikes (2015) argues the relevance of geoscience education due to the field's dynamism. He believes that geoscience is a complex system science and earth system science that is rapidly evolving. However, the academic curricula cannot keep pace with the latest developments to ensure that graduates have the skills necessary to thrive. Like in most fields, there is frequently a delay between cutting-edge research and its integration into mainstream education, leading to a disparity between graduates' skillsets and those demanded by employers (MIKEŠ, 2015). Moreover, he highlights that the universities' curriculum is not informed by the industry even though it is for whom the graduates are produced. While academic degree programs provide a foundation of knowledge and intellectual skills, employers also seek job-specific skills not typically taught in universities (Börner et al., 2018).

In collaboration with the industry, universities must offer practical training and internship programs to bridge this gap and enhance students' employability. Ensuring academic programs incorporate modern geoscience skills into their curricula is also paramount. Universities must regularly update their courses and teaching methods to keep up with industry standards and technological advancements. The key drivers of the evolution of the geosciences field in recent years have been technology and the need for sustainable mining practices (Zulu et al., 2021).

To bridge this gap, Mikes (2015) proposes establishing an international professional geoscience body to define and monitor the skills supplied by the universities and skills demanded by the job market. This proposed body should consist of experts from academia, government, and industry to identify the critical skills needed in the field and ensure that these are reflected in the curricula of geoscience programs worldwide (MIKEŠ, 2015). Moreover, conferences play an essential role in this process, providing a forum for experts to share their latest research and discuss the skills most in demand in the field. The international professional geoscience body should use these conferences to identify emerging trends and update the skill sets recommended for graduates (Oluwajodu et al., 2015).

In addition, the international professional geoscience body could facilitate international collaborations and knowledge-sharing, ensuring that the graduates, when they leave universities, are well-equipped to work in various geoscience sectors (MIKEŠ, 2015).

2.3.2 Lack of opportunities for geoscience graduates

The geoscience industry consists of the mining, consulting, and government sectors. However, the mining and consulting sectors remain the significant employers of geoscience graduates. Unfortunately, these sectors have faced significant challenges in the last decade due to the economic downturn. The contributing factors include high commodity prices, high labour costs, poor economic growth, and low productivity to labour unrest (Moraka & Jansen Van Rensburg, 2015). These challenges have manifested in reduced employment and some even closing down. As a result, the industry has been shrinking, which has led to fewer job prospects for geoscientists.

Moreover, most of the companies in this industry are financially constrained. Therefore, there has been a significant reduction in programmes like graduate programmes, internships, and bursary programmes aimed at training graduates or students and improving their employability. The consulting industry is project-driven, and the reduced economic growth results in reduced construction or development projects requiring geoscientists. This also has a negative impact on graduate employment.

South African mining sector is on a journey (even though moving at a snail's pace) to adopt digital transformation/4IR technologies to reduce their operation costs and

competitiveness and improve working conditions (Zulu et al., 2021). This, too, comes at a cost of jobs in a country endowed with the labour force.

Albeit the industry remains a significant employer in South Africa, and there are still opportunities for skilled workers and professionals in areas such as engineering, geology, and management, just fewer for graduates (Minerals Council SA, 2022). On the positive side, the industry's growing focus in collaboration with the government is on developing local skills and creating more inclusive employment opportunities, which could benefit job seekers from previously disadvantaged communities. However, South African geoscience graduates continue to compete with other countries regarding the job market. High levels of graduate unemployment can make the country less competitive, as it may indicate that the country is not producing enough skilled workers to meet the demands of the global market (Minerals Council SA, 2022).

2.3.3 Proposition

Relevant technical skills provided by the universities do not suffice for the current industry needs as an additional soft skills layer is lacking within the educational curriculums; thus, the skills supplied by the institutions of higher learning are misaligned to the industry needs.

The lack of internships, bursaries, and training programmes available for students and graduates may be responsible for the rising geoscience graduate unemployment in South Africa.

To test this proposition, the perspectives of the HR officers on the skills the recruiters are looking for will be collected and analysed. Moreover, there will be an analysis of the support and resources currently available to geoscience graduates during their education and post-university. This will enable a better understanding of the factors resulting in increased geoscience graduate unemployment and develop potential solutions or interventions to address this problem.

2.4 Improving the employability of geoscience graduates

The South African problem of graduate unemployment is multidimensional and, therefore, requires multifaceted solutions. As such, different research authors have written in-depth about this problem and offered possible recommendations. This section

intends to explore some of these recommended solutions. These include skills matching between universities and the job market through partnerships, increasing job opportunities, particularly in the training programme, and improving the quality of education and training (Graham et al., 2019; Mseleku, 2022). These studies also emphasise the importance of involving unemployed graduates in policy-making to ensure their perspectives and needs are considered. Moreover, the study recommends that the government and other stakeholders work together to address unemployment. This includes implementing policies to promote job creation and economic growth, providing more support for education and skills development, and improving the coordination between education institutions and industry to ensure that graduates have the necessary skills and experience to enter the job market.

Graham et al. (2019) add that removing the barriers that graduates face requires a comprehensive approach that includes targeted interventions to improve graduates' skills and work experience, increased investment in the formal economy, and measures to reduce discrimination in the labour market.

2.4.1 Stakeholder partnerships and collaborations

Partnerships between government, industry, and universities have proven effective when addressing many countries' skills mismatch challenges (Azman et al., 2020; Fongwa et al., 2019). With the government providing financial instruments and an enabling environment through policy, the universities and industry can provide practical experience and skills to prepare them for work. This will ensure that the graduate skill sets and knowledge produced by the universities are those that are required by the job market. This strategy also improves the country's graduates' competitive advantage compared to those from other countries, as they would best fit the country's industry (Okolie, Nwosu & Mlanga, 2019).

Furthermore, Graham et al. (2019) suggests that targeted interventions to improve graduates' skills and work experience, such as apprenticeships, internships, and other work-based learning opportunities, are paramount. This could help graduates acquire practical skills and experiences employers value and increase their employability. Also, career guidance services can help geoscience graduates to identify job opportunities and prepare for the job application process. Job placement services can assist graduates in finding job openings and connecting with potential employers.

Several forms of government intervention tools to address graduate unemployment have been proposed in the literature worldwide. These interventions include skills development programmes, employment subsidies, job creation programmes, entrepreneurship programmes, collaborations, etc. (Azman et al., 2020; Mian et al., 2022; Musara, 2020).

According to Musara (2020), by providing mentorships, training and financial assistance, the government can create a fertile environment for graduates to venture into entrepreneurship instead of waiting for employment. This will solve unemployment and contribute to the country's economic development and social issues (Adonis V, 2022). Moreover, the government can promote entrepreneurship among graduates by providing access to credit and enabling a regulatory environment and other forms of support (Graham et al., 2019).

In fostering the collaboration efforts, the graduates would acquire the relevant skill sets required by the job market through vocational training, apprenticeships, and internship programs (Abelha et al., 2020; Mseleku, 2022). The government could offer subsidies or tax incentives to employers who hire graduates, particularly those in high-demand fields, or develop and implement policies prescribing employment rules (Graham et al., 2019). To curb discrimination in the labour market, Graham et al. (2019) suggests enforcing anti-discrimination laws and promoting diversity and inclusion in the workplace. This could help ensure that graduates are evaluated equally rather than their race, gender, education institution attended, or other personal characteristics, as these demographics have been shown to the graduate unemployment status (Baldry, 2016).

Government investments in the country's economy aid job creation and reduce unemployment (Graham et al., 2019). Investment in the country’s economy creates more job opportunities and stimulates economic growth, increasing demand for skilled workers.

Even though there have been several government initiatives and policies to address youth unemployment, the problem persists. The initiatives introduced by the government to fight unemployment include the NDP2030, Employee Tax Incentive and Youth Enterprise Development Strategy (National Planning Commission 2013) (Jubane, 2021). These transformative agendas imposed by the government on the industry through regulations and other policy instruments have somewhat forced the industry to improve its diversity (Moraka & Jansen Van Rensburg, 2015). They have resulted in the inclusion

of previously disadvantaged South African groups. However, some challenges and barriers still undermine the intentions of these policies. Some of these challenges include a lack of suitable graduates according to the job requirements, a lack of funding from the government on things like infrastructure to enable growth and development of the industry and a scarcity of collaboration between government and industry (Moraka & Jansen Van Rensburg, 2015).

Analysing graduate unemployment can inform government policy regarding education and training programs. It can help policymakers design programs that address the labour market's needs and improve graduates' employability.

Several authors (Abelha et al., 2020; Fadhil et al., n.d.; Fongwa et al., 2019; Igwe et al., n.d.) provide suggestions on enhancing graduate sustainability from different countries' perspectives. However, most agree that the solution mainly lies in strong collaboration and partnerships between universities and the industry. Geoscience graduate unemployment in South Africa can be addressed through measures that address the labour market's demand and supply sides.

Other ways geoscience graduates can improve their employability are by attending coordinated conferences, joining professional organisations, and participating in geoscience forums. Developing interdisciplinary skills such as data analysis, computer programming, or project management and furthering their studies to master's and PhD levels can make them competitive.

2.4.2 Proposition

Through partnerships between government, universities, and private entities, the employability of geoscience graduates can be improved by equipping them with skills necessary for the job market.

2.5 Analytical Framework

This chapter presents the theoretical and conceptual frameworks that will form the basis of this study. Several theories exist that can be used to understand graduate unemployment. The most common frameworks include human capital,

screening/signalling hypotheses, and discrimination hypotheses (Van De Rheede et al., 2012).

According to the human capital theory, graduate unemployment stems from a discrepancy between the skills and knowledge possessed by graduates and those sought after by employers. This mismatch can be attributed to various factors, including the absence of work-integrated learning opportunities in higher education and the substandard quality of certain university programs.

The screening/signalling hypothesis argues that graduate unemployment is caused by employers using graduates' educational credentials to screen potential employees (Van De Rheede et al., 2012). This means that graduates with a degree from a prestigious university are more likely to be hired, even if they do not have the skills and knowledge the employer seeks.

The discrimination hypothesis argues that graduate unemployment is caused by discrimination against certain groups of graduates, such as race, women, minorities, and graduates from disadvantaged backgrounds. This discrimination can take several forms, such as employers being less likely to hire these graduates or paying them lower wages.

The theory used for this study is the human capital theory, which will be discussed in detail in the subsequent theoretical framework section.

2.5.1 Theoretical Framework

The theoretical framework selected for this study is the human capital theoretical framework. We start by defining human capital and human capital theory: Human capital is an economic concept highlighting the importance of investing in education and skill development to enhance individual and societal economic outcomes (van der Merve, 2010). Human capital is crucial for the economic advancement and growth of a nation. Therefore, it is the government and private sector's responsibility to invest in human capital and utilise existing human capital.

Therefore, the human capital theory posits that formal training provided by tertiary institutions enhances an individual's productive capacity (van der Merve, 2010). This theory comes from an American economist, Greg Becker, who highlighted the need to invest in people by improving their qualities, directly impacting productivity and financial output (Van De Rheede et al., 2012). According to this theory, people who acquire more

education and skills are more likely to have higher earning potential, better job prospects, and more significant opportunities for career advancement in an ideal world. Thus, it promotes investment in higher education as it shows the correlation between qualifications and one's economic status. To this effect, geoscience graduates hope that by investing in education, they will have better job prospects and financial status.

In the South African context, human capital theory can provide some insight into graduate unemployment as it suggests that investments in education and skills development increase an individual's human capital and enhance their employability. Yet, there is still a vast number of graduates who remain unemployed. This study then examines why human capital can still not resolve geoscience graduate unemployment.

The number of graduates produced by South African institutions has increased drastically over the years; therefore, there is no issue of human capital. This, thus, implies that the unemployment issues in South Africa are multifaceted. Hence, there exist additional specific factors that contribute to the occurrence of graduate unemployment, notwithstanding the accumulation of human capital. These factors encompass skills mismatches, diminished job prospects, and so forth.

However, the human capital theory has been criticised for not considering work's changing nature. The skills and knowledge that are required for jobs are constantly changing. The theory does not adequately account for this and may not be as effective in explaining graduate unemployment in today's economy. Moreover, the theory does not consider the role of discrimination. It assumes that all individuals have an equal chance of getting a job, regardless of race, gender, or other personal characteristics. However, there is evidence that discrimination can affect graduate unemployment.

In addition, the theory is considered too simplistic. It assumes that the only factor determining an individual's earnings is their level of education. However, many other factors, such as the individual's skills, experience, and location, can also affect wages.

Thus, graduate unemployment challenges the notion that investing in education leads to higher productivity and earnings. Despite acquiring higher education, graduates may struggle to find employment and fail to achieve the expected return on their educational investment. The theory of human capital assumes that education increases productivity but overlooks other factors, such as innate abilities, that can contribute to productivity.

Additionally, obtaining more education does not always guarantee a significant increase in productivity.

Moreover, South African graduate unemployment cannot be viewed in isolation, as many contributing factors exist. The entire education system's value, from demographics to the primary education system, right to the tertiary education system, should be assessed when dealing with this problem. An entire value chain must be analysed and improved to ensure the systems work. This is the theoretical approach Ssempebwa (2008) used when analysing graduate unemployment in Uganda, Figure 3.

According to Ssempebwa (2008), the framework views the system as an open system theory that enables one to understand the university education system as an open system that interacts with its environment, including the education system and society. The inputs into the university education system are secondary school leavers seeking admission, and the output is graduates who enter the labour market or pursue self-employment. The university education system process involves training and educating students enrolled in study programs.

He further states that the fitness for university system output and graduate employability depends on university-training-related and society-related factors. University-training-related factors include the number of students enrolled, the study programs offered, the training in entrepreneurial skills, and the attitude towards graduate self-employment (Ssempebwa, 2008). Society-related factors include the number and type of graduates demanded employment in the labour market, socio-economic factors influencing graduate self-employment, and the congruity between these factors.

The congruity between the number of job seekers and available job opportunities, university training, contemporary labour market needs, and graduate self-employment is crucial in enhancing the employment of university graduates. In cases where there is a paradox, graduate unemployment can result. The framework assesses, links, and proves the contribution of university training and society to graduate unemployment. Essentially, the breakage in the ecosystem is reflected by the lack of employability of graduates in the community.

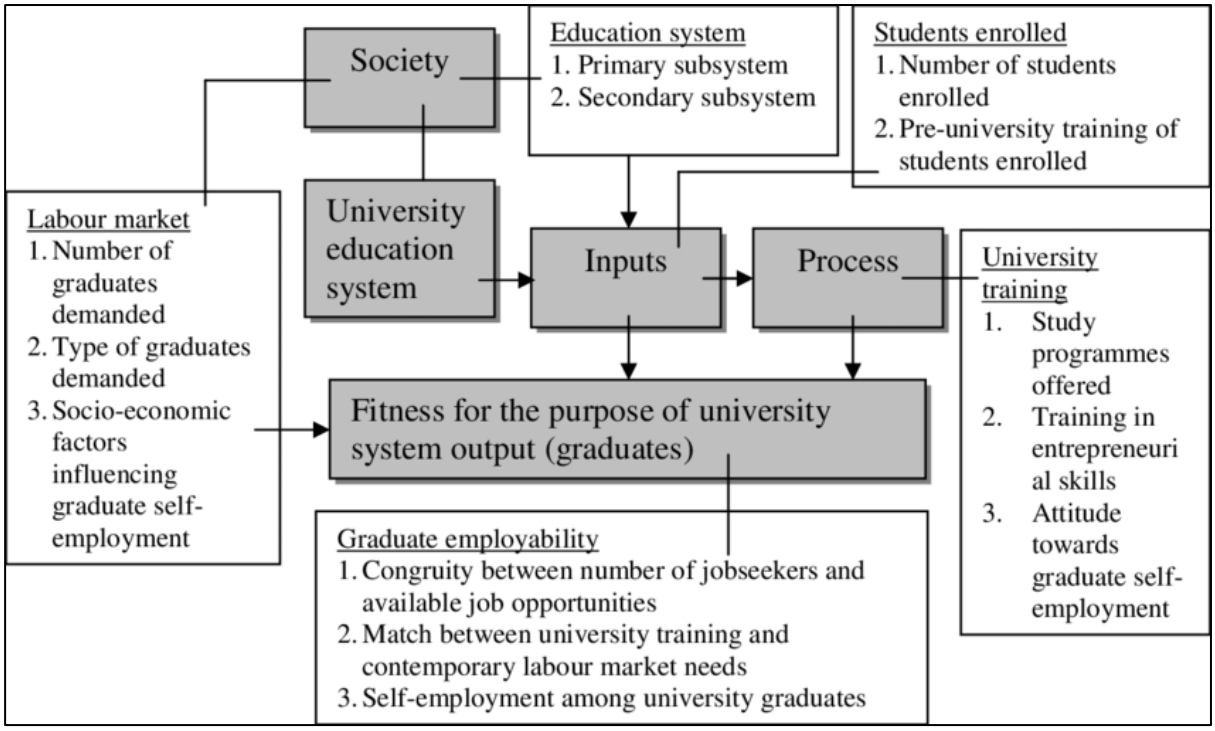

Figure 2: Theoretical framework for the study of factors influencing graduate unemployment. Source: (Ssempebwa, 2008)

2.5.2 Conceptual Framework

In a country battling a constant rise in graduate unemployment, with a focus on geoscience graduate unemployment, this research aims to provide a conceptual framework for understanding the factors contributing to geoscience graduate unemployment. This will be achieved by understanding the status quo of geoscience unemployment and looking at what the literature says are the factors contributing to overall graduate unemployment in South Africa and other countries. An understanding of what employers are looking for when searching for a suitable geoscience graduate will be gained through interviews with HR officers responsible for geoscience recruitment. Finally, unemployed geoscience graduates will be interviewed to understand their skill sets and what they think could be problems for failing to secure employment. The collected data will be analysed and cross-referenced to understand the gaps between what the recruiters are looking for versus the available skills and the expectations from the unemployed geoscience graduates.

The conceptual framework for researching geoscience graduate unemployment in South Africa will be based on the identified objectives, literature review, formulated research questions, applied methodology, data analysis, and conclusion and recommendation.

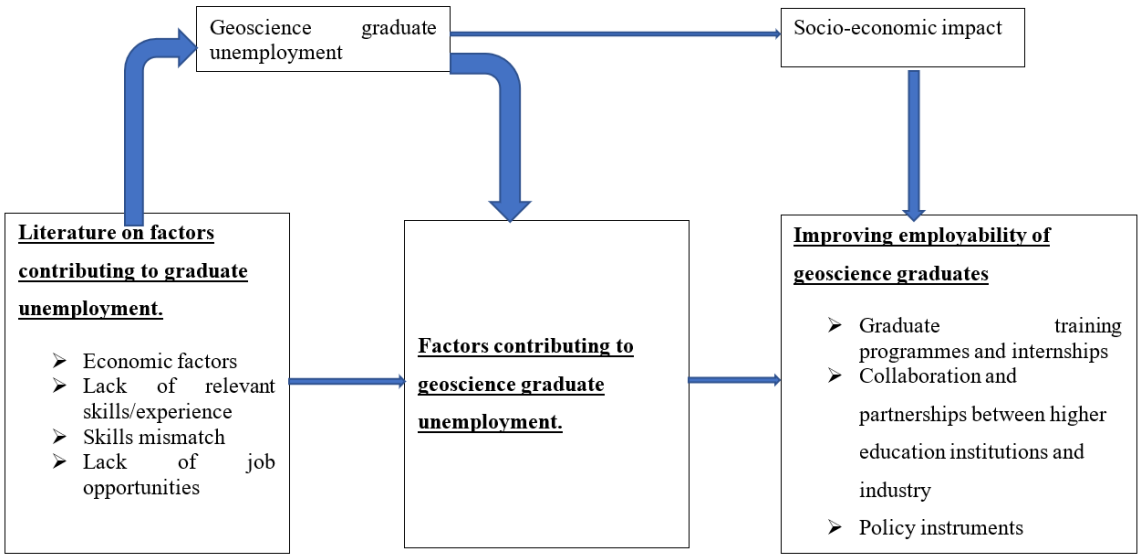

Figure 3: Conceptual framework.

2.6 Conclusion of Literature Review

This literature review chapter examined previous research on graduate unemployment or related subjects with the extrapolation of geoscience graduate unemployment due to a lack of literature on the subject. Having conducted this comprehensive literature review on graduate unemployment in South Africa, it is glaring that this is a complex issue with multifaceted causes and far-reaching implications. The implications of graduate unemployment vary from economic to social, and it affects graduates differently depending on demographics and other factors.

While it is evident that there is no one-size-fits-all solution, several researchers have suggested interventions to remedy the dire situation. These suggestions include increased collaborations and partnerships between government, universities and industry, investment in the education system, multiple forms of addressing skills mismatches, promoting entrepreneurship education and support, investment in economic growth, etc. However, any policy interventions must be evidence-based and tailored to the specific needs of the country's unique socio-economic context. Addressing graduate

unemployment is essential for promoting inclusive economic growth and ensuring that young people can participate fully in the country's economic development.

In conclusion, the literature takes stock of the status quo of graduate unemployment and identifies and highlights the factors contributing to graduate unemployment and the ramifications thereof. Moreover, the recommendations provided in these studies will be analysed and cross-referenced where applicable for this study.

The following propositions have been developed to achieve the objectives of this study and the research question. Therefore, through this study, the problem of geoscience graduates' unemployment in South Africa can be better understood and addressed.

Proposition 1: Relevant technical skills provided by the universities do not suffice to the current industry needs as there is an additional soft skills layer that is lacking within the educational curriculums. Thus, the skills supplied by the institutions of higher learning are misaligned to the industry's needs.

Proposition 2: Through partnerships between government, universities, and private institutions, the employability of geoscience graduates can be improved by equipping them with skills necessary for the job market. Table 1 demonstrates the research objectives and the propositions of the study.

Table 1: Consistency table of research objectives and propositions

RO	Research Objectives	Prop#	Propositions
Primary objective	To determine the factors contributing to geoscience graduate unemployment from the perspective of the HR officers	1.	Relevant technical skills provided by the universities do not suffice to the current industry needs as there is an additional soft skills layer that is lacking within the educational curriculums; thus, the skills supplied by the institutions of higher learning are misaligned to the industry needs.

Secondary objective	To identify potential solutions or interventions to address the geoscience graduate unemployment problem in South Africa	2.	Through partnerships between government, universities, and private entities, the employability of geoscience graduates can be improved by equipping them with skills necessary for the job market.

3 CHAPTER 3: RESEARCH METHODOLOGY

A qualitative research method was employed to achieve this study's objective of investigating the factors contributing to the growing geoscience graduate unemployment. This qualitative research approach entailed semi-structured, open-ended in-person interviews with HR officers responsible for recruiting geoscience graduates in different geoscience sectors, mining, consulting, and government sectors. The qualitative research method was selected because it provides an in-depth understanding of the researcher's narratives, interpretations, experiences, and perceptions. It allows interaction with the recruiters in their natural setting, studying their behaviours, and collecting primary data.

Through the interviews, a detailed holistic understanding of the contributing factors to the apparent increase in geoscience unemployment was sought. Moreover, it aided the understanding of the gaps and skills mismatches between the skills graduates possess and the skills demanded by the industry. With the understanding that the field of geoscience is dynamic, thus the skills required are anticipated to change over time. This view will further inform the recommendations for the problem of geoscience unemployment and the potential interventions.

3.1 Research approach

This study employs a qualitative research approach to comprehensively investigate the issue of unemployment among geoscience graduates in South Africa. The research approach is structured into three key phases: document analysis, qualitative interviews, and the development of potential interventions.

Relevant papers, including policies and industry reports, were collected and systematically reviewed. This review extracted information on trends in geoscience graduate employment and existing policies and identified sector challenges.

Participants included employers in three geoscience sectors, namely, mining, government, and consulting, which are the dominant sectors employing geoscientists. To gain a detailed holistic view of the factors contributing to the growing number of unemployed geoscience graduates, semi-structured face-to-face interviews were conducted with HR officers in mining, government entities, and consulting firms responsible for recruiting geoscience graduates. These interviews provided primary data essential for a comprehensive understanding of the research question.

The interviews were recorded, and detailed notes were taken during the process. The collected data was then analysed using thematic analysis, facilitated by the Delve software tool. This method identified recurring themes and patterns, providing insights into personal and structural factors contributing to unemployment and potential gaps between education and industry needs.

Based on the findings from the document analysis and qualitative interviews, potential interventions to address the unemployment issue were identified. This involved reviewing best practices from other countries and consulting with stakeholders in the geoscience sector.

This study adhered to ethical guidelines to ensure the confidentiality and anonymity of participants. Informed consent was obtained from all interview participants, and ethical approval was sought from the relevant institutional review board.

The research aimed to comprehensively understand the unemployment issue among geoscience graduates in South Africa and develop actionable recommendations to enhance their employability.

3.2 Research design

This research followed a semi-structured, open-ended, face-to-face interview methodology. A selected and interested sample of participants was interviewed using constructed open-ended guided questions. The participants were allowed to choose an interview platform they were more comfortable with, ensuring they were relaxed. During

the interview, notes were taken, and the interviews were recorded upon the participants' consent. Primary data was collected through the interviews.

A cross-sectional research design was employed, allowing the researcher to discern the employer's viewpoint and comprehend what actions unemployed graduates need to take to enhance their employability or augment their employment prospects. This design is well-suited for the study as it captures the present status of geoscience graduate unemployment in South Africa, furnishing a comprehensive overview of the issue within a specified timeframe (Brown, 2015).

In addition, the cross-sectional design is more efficient because it allows for data collection from various participants at a single point in time whilst exploring multiple factors such as the availability/frequency of geoscience jobs, the demand for geoscience graduates, the job market requirement of skills, etc. This also enables exploration and understanding of the relationships between these factors, if any, and comparison between variables, which can provide insight into potential disparities and inform targeted interventions.

While a cross-sectional design offers valuable insights into geoscience graduate unemployment in South Africa, it is essential to note that it does not capture longitudinal trends or causality as it is limited by time. However, it provides a snapshot of the situation at a specific point in time within the research timeframe.

Once the data was collected, a thematic data analysis technique was used. This analysis method is widely used in qualitative research to analyse and interpret qualitative data.

The advantage of semi-structured in-person interviews is that they provide rich and in-depth detailed data, including participant’s experiences, views, interpretations, and emotional behaviours. Participants are often more willing to share information in person than through other methods (Rahman, 2023). The disadvantage is that they are often time-consuming and expensive, requiring the researchers to travel to various locations to conduct the interviews. Additionally, some participants may feel uncomfortable discussing sensitive or personal topics in person, which could affect the collected data quality and result in limitations and bias (Rahman, 2023).

3.3 Data collection methods

The research utilised a qualitative methodological approach to gather primary data, employing semi-structured, open-ended, face-to-face interviews with HR officers. The potential participants were searched online using the company websites and referrals. They were approached through email to secure consent and an appointment for the interview.

3.4 Population and sample

To achieve the research objectives, a convenience/volunteer sampling of the population of the HR officers responsible for recruiting the geoscience graduates through interviews. The approached potential participants volunteered to participate in the research study. This sampling technique was selected because the geoscience industry is divided into mining, consulting, and government sectors. Thus, stratified sampling enables subgrouping of the population according to homogeneity, as per the industry, such that similar groups are grouped together (Etikan, 2017).

A total of 20 participants were initially targeted, but ten were interviewed. This number was considered sufficient to provide quality data and a rich understanding of the experience (Hennink et al., 2019). The interviews were held virtually and physically, depending on the interviewees' preferences. They consisted of a set of guided, semi-structured, open-ended questions, the responses recorded and recorded with notes.

3.4.1 Population

The population for this research includes all mining companies, government entities, and consulting firms that employ geoscience graduates. Thus, the HR officers in these firms constitute the study population. However, the sampling frame comprises the HR officers, who are accessible through the Internet and referrals.

The population of the interviews targeted 20 HR officers responsible for recruiting geoscience graduates. However, saturation might be reached before the targeted participants, depending on the responses obtained (Hennink et al., 2019). This is where no new information will be received from the participants (Lowe et al., 2018). This is a point where the interviews are discontinued, and the results are analysed. The saturation

point is usually reached between 9 and 17 interviews, ensuring the quality and validity of the findings (Hennink et al., 2019).

3.4.2 Sample and sampling method

A convenience or volunteer sampling technique was employed during this study's sampling; the approached potential participants volunteered to participate in this study. This approach was selected because it is efficient and economical (Gill, 2020). The population sampled lacks homogeneity, as the industry is subdivided into three categories: mining, consulting, and government sectors. These sectors operate in different landscapes and, therefore, have different dynamics. Thus, the population was subdivided according to these categories to enforce homogeneity.

According to Etikan et al. (2017), this sampling technique tends to improve the precision and accuracy of estimates by considering the unique characteristics of each category, as it provides more reliable and detailed information about the sample. An equal sample size from each category, even if they differ in size, allows for more efficient comparisons between categories.

According to Gill (2020), in qualitative research, a researcher ought to pre-determine their sample size to meet the requirements and sufficiently answer their research question, as there are no strict rules for sample size. As such, often, the initially planned sample size may need adjustment as the study progresses, depending on feasibility and the specific needs of the research (Gill, 2020). Thus, in this study, a sample of 20 targeted participants was considered a meaningful sample without the burden of extensive data gathering, mainly when time constraints are a factor and when there are accessibility difficulties for participants (Baker & Edwards, 2012).

The interview guide questions provided insight into the factors contributing to the rise in geoscience graduate unemployment, whether due to a lack of job opportunities, skills mismatch, or the lack of collaborative efforts between different affected stakeholders. A set of eleven questions were asked during the interview, and these questions are attached in Appendix A.

3.5 The research instruments

To achieve the study's objectives, semi-structured, open-ended interviews were conducted face-to-face with HR officers responsible for geoscience graduate recruitment in their selected convenient and relaxed environment. The interview involved a series of carefully formulated interview guide questions adopted from the literature. These questions are open-ended and flexible, so comprehensive information was sourced from the participants through follow-up questions based on their responses.

This semi-structured, open-ended interview data collection method was selected because it would assist the researcher in gaining a deeper understanding of complex topics and gathering rich, qualitative data (Alsaawi, 2014). They can also help to build rapport and trust with participants, allowing researchers to collect more detailed and nuanced information during and after the interview.

However, the selected interview approach presents some limitations because the interviews are time-consuming and costly due to travelling, and the data collected may be biased or subjected to the researchers' views as she may approach the research with preconceived ideas, which may then render the data irrelevant (Peters & Halcomb, 2015).

3.6 Procedure for data collection

For this data collection process to be effective, robustness, comprehensive understanding, and meticulous documentation were essential. Quantitative data systematic approach entails a thorough process of problem identification, data collection, analysis, explanation, evaluation, and interpretation (Nassaji, 2020). Therefore, rigour and quality standards are imperative when conducting qualitative research.

The interviews were subdivided into five phases, namely, 1) introduction, where the two parties introduced themselves and the purpose of the interview is discussed, 2) a warm-up discussion ensuring that the participant is relaxed and easier questions are discussed, 3) Main body where the majority of the questions were discussed in a conversation format with minimal interruptions from the interviewer, 4) cool odd stage which involved discussion of the final question to conclude the interview, and finally 5) the closure of the interview (Alsaawi, 2014).

The data collection procedure for the HR responsible for recruiting geoscience graduates who were earmarked for interviews were emailed. The email communication detailed the purpose of the study, and its intent was sent with a request for an interview appointment. Once consent was granted and the interest was shared, a meeting was scheduled with the participant depending on the selected interview platform. The interview guide questions were shared upon consent to the interview.

The interview was kept to about 30 minutes to ensure that the researcher did not lose the participants' focus and that the interview was finished whilst the interviewee was still interested. During the interviews, pre-designed and carefully selected questions were asked. The responses were recorded with the interviewee's permission, and notes were captured for reference.

The interviewer listened attentively, with limited interruptions, to the responses while carefully paying attention to the interviewee's body language. This helped the researcher gain insight into the emotional connection and empathy of the interviewed HR officer, which is critical when collecting qualitative primary data (Muncy & Kasala, 2020).

Once the data collection process was concluded, data was analysed using the thematic data analysis method, which involved coding and identifying themes or patterns.

From the interview, an insight into the requirements and expectations of the employers from the geoscience graduate was sought. In addition, an analysis of existing written or visual materials from other secondary sources was conducted.

Qualitative data sampling can be instrumental in understanding the causal effects of unemployment on geoscience graduates by providing in-depth insights into the problem (Belotto, 2018). It enables the exploration of individual experiences, identifying common themes in the data and understanding contextual factors.

Table 1 below maps the alignment between the interview questions and the research proposition.

Table 2: Mapping of research questions to interview questions.

PROPOSITION	**QUESTIONS**
Opening questions	**Q1:** How many years of experience do you have in HR?

PROPOSITION	QUESTIONS
	Q2: On average, how many graduates does your company employs in a year?
Proposition 1: Relevant technical skills provided by the universities do not suffice to the current industry needs as there is an additional soft skills layer that is lacking within the educational curriculums. Thus, the skills supplied by the institutions of higher learning are misaligned to the industry's needs.	**Q3:** What critical skills do you look for when hiring? **Q4:** What are the common factors that disqualify potential geoscience employees? **Q5:** How do you stay up to date with trends and developments in the geoscience field, and how do you ensure that your organisation remains at the forefront in assisting with upskilling geoscience **Q6:** How do the recruiters perceive the alignment between the acquired geoscience skills and the skills demanded by the industry in South Africa? **Q10:** What do you perceive as the main contributing factor to geoscience graduate unemployment in South Africa?
Proposition 2: Through partnerships between government, universities, and private institutions, the employability of geoscience graduates can be improved by equipping them with all the skills necessary for the job market.	**Q7:** What support systems, if any, are available to geoscience graduates in South Africa to improve their employability and job prospects? **Q8**: What do you think is the industry's role in ensuring the readiness of geoscience graduates for employment? **Q9:** How do recruiters perceive the role of universities and educational institutions in preparing geoscience graduates for the job market in South Africa? **Q11:** Has the company been downscaling or upscaling in the past five years?

3.7 Data analysis strategies and Interpretation

The data analysis strategy used during the study is a deductive thematic data analysis approach, which is a method used to analyse data by searching common or repeated patterns in the interview response data and developing codes and themes against the conceptual framework (Belotto, 2018; Kiger et al., 2020; Vaismoradi et al., 2016). The

thematic data analysis has been selected for this study because it is considered a flexible and robust method for analysing qualitative data, which aids the understanding of the participants' experiences, thoughts, or behaviours (Kiger et al., 2020). Thematic analysis helps the researchers to uncover the underlying themes and concepts from the participants' responses or narratives. In addition, it allows the identification of common themes and patterns, providing answers to the research questions (Lester et al., 2020).

The information obtained during the interviews was captured, structured, analysed, and interpreted for the interview result analysis. This data was also matched and validated by the secondary data sourced from the literature. The data analysis process follows a widely recognised six-step method for thematic analysis. These steps encompass familiarising oneself with the data, generating preliminary codes, identifying themes, reviewing these themes, defining and labelling them, and ultimately producing the final report (Kiger et al., 2020; Vaismoradi et al., 2016).

During the familiarising stage, data from the recording and interview notes was organised and transformed into a textual format. Critical points and main issues are highlighted during this process for coding purposes. Then, the researcher familiarises themselves with the data by reading and re-reading it to comprehensively understand it. During this process, they actively engage with the data to identify patterns, repeated ideas, and concepts that emerge from the data set (Lester et al., 2020).

The code-generating stage involves identifying potential areas of interest and connections within the raw data, and themes are developed once the codes have been identified. The themes are developed by gathering various codes through analysis, which involves combining, comparing, and even graphically mapping how codes are related to one another (M. Hennink & Kaiser, 2022). Then, the process of reviewing themes by ensuring the appropriate fit of the codes, the defining and naming of the codes, which involves the creation of definitions and narrative descriptions of the themes and then the reporting of the findings followed.

Unfortunately, the thematic data analysis has some limitations, amongst which is the difficulty of identifying themes, mainly when there are extensive data sets to analyse. Moreover, it presents a risk of bias or the researcher’s specific paradigm views and assumptions, impacting the trustworthiness of the findings and interpretations thereof (Kiger et al., 2020).

3.8 Possible limitations and challenges of the study

The potential limitations of the study are as follows:

- The targeted sample size was 20 participants. There is a possibility that not all the targeted participants will be interested in participating in the study. Thus, there might be limitations when it comes to the sample size. The sample size might be too small, and the study might not represent the entire population of geoscience graduates in South Africa. This could limit the generalizability of the findings.
- The availability of accurate and reliable data is a potential limitation of the study.
- Limited knowledge of other critical components of the study or tools required in the study can negatively impact or compromise the credibility of the research.
- The research may be affected by emotions, bias or the researcher's or the participants' biases of the participants. This will compromise the subjectivity of the study.
- Time constraints may be a limitation of the study. Because the study has other dependencies like critical approvals, this might affect the available time to conduct the study and the depth and breadth of the research.

3.9 Quality assurance

This research study follows qualitative data collection and analysis methods in the sense that an interview-based strategy was employed. Thus, in the qualitative aspect of the research, the study's transferability, dependability, credibility, and confirmability were explored for quality assurance.

Table 3 Quantitative and qualitative quality assurance table (Lincoln & Guba, 1986)

Quantitative	**Qualitative**
External validity (generalisability)	Transferability
Reliability	Dependability
Internal validity	Credibility
Objectivity	Confirmability

3.9.1 Qualitative quality assurance

This process intends to ensure that the qualitative research of this study meets the research quality standards and authenticity as prescribed by the study of Lincoln & Guba (1986). (Lincoln & Guba, 1986). It ensures that the research findings are credible, dependable, transferable, and confirmable (Morse, 2015). The assessment of how these quality assurance strategies were applied in this research is discussed in detail in the sections below. Other qualitative quality assurance techniques include member checking, peer debriefing, triangulation, and reflexivity (Morse, 2015). Peer debriefing consists of seeking other researchers' feedback on the credibility and dependability of the research findings. Triangulation involves using multiple data sources to verify the findings, while reflexivity involves acknowledging and accounting for the researcher's biases and subjectivity.

3.9.1.1 Transferability

Transferability pertains to the degree to which the findings of a study can be extrapolated or applied to other contexts or research settings (Morse, 2015). In the case of geoscience graduate unemployment research in South Africa, to be deemed transferable, the study's findings ought to be applied to other similar contexts or settings, such as other African countries or other disciplines with similar concepts of graduate unemployment issues, political landscape, and economies. The research methodology is descriptive, transparent, and simplified. The perspectives and testimonies of the participants were conveyed unbiasedly.

3.9.1.2 Credibility

Credible qualitative research is one whose findings precisely represent the experiences and viewpoints of the participants and, therefore, are trustworthy and believable (Lincoln & Guba, 1986). To deem research credible, it ought to be plausible and accurate and without any bias (Tracy, 2010). In the case of a geoscience graduate unemployment research in South Africa, credibility involves evaluating the extent to which the findings are believable and accurately reflect the experiences and perspectives of the selected participants.

Techniques like member checking, triangulation, peer briefing, and reflexivity were used to achieve the credibility of this study (Tracy, 2010). Other data sources are consulted during the triangulation process to validate this research's findings. Reflexivity is used to remove bias and the researcher's assumptions. This is achieved through transparency of the research findings to the participants.

3.9.1.3 Dependability and Confirmability

Dependability refers to the consistency of findings over time and across various contexts. Confirmability, on the other hand, relates to the degree to which the findings of a qualitative study are free from bias and subjectivity (J. M. Morse, 2015). Triangulation was used to ensure both the dependability and confirmability of this study. Moreover, the research was reviewed by a competent external reviewer.

3.10 Ethical considerations

To ensure ethical compliance in this study, permission was sought through ethical clearance, and the ethical standards and guidelines were adhered to. Moreover, the participants participated voluntarily. Both privacy and confidentiality were enforced and maintained throughout the study.

The potential participants were required to respond by providing consent if they wanted to participate in the study. Upon receiving approval, the interview guide questions were then shared with the meeting invitation. However, the provision of consent did not mean that the participants could no longer withdraw from the study when they wished, as it is still their right.

Privacy and confidentiality were ensured by always keeping the participants anonymous. Participants were asked to remain anonymous or consent to their identity not being hidden. The data will be published based on how participants prefer privacy.

Ethics forms the most integral part of this research. Thus, an ethics form was submitted to the Wits ethics committee for approval prior to commencement. The committee ensured that the study met the ethical guidelines. This research ensures that the ethics guidelines are permanently adhered to through the monitoring process. This process upholds the integrity of the study.

3.11 Limitations of the study

There are many limitations which affected the study and, therefore, the results of the investigation. The study's first limitation was finding contact details of the relevant HR practitioners who were willing to participate in the study. It was found to be challenging to get research study participants. Of the 20 participants initially targeted to participate in the study, ten were interviewed because the study reached saturation point, where additional data did not provide new insights.

In addition, the availability of accurate and reliable data on the geoscience graduate unemployment was a limitation of the study. There is no statistical data on the number of geoscience graduates in the country who are currently unemployed. Whilst the time available to conduct the study was a constraint. Because the study has other dependencies like critical approvals, this might affect the available time to conduct the study and the depth and breadth of the research.

The study sample of ten interview participants is limited, and the authors suggest that the study should be continuously repeated to provide a more comprehensive understanding of geoscience graduate unemployment.

However, despite these limitations, the study offers valuable perspectives on perceptions of geoscience graduate unemployment as it draws on actual primary data. The study results have implications for various stakeholders, including universities, managers, and policymakers.

While the study acknowledges its limitations, it underscores the importance of addressing geoscience graduate unemployment and offers actionable recommendations for the relevant stakeholders to consider in the subsequent section.

4 CHAPTER 4: PRESENTATION OF FINDINGS

4.1 Introduction

This chapter presents the findings of a qualitative study conducted through the interviews of HR officers responsible for recruiting geoscience graduates in three sectors: mining, consulting, and government. The study aimed to assess the factors contributing to the notable rising number of geoscience graduates encountering challenges in securing

employment in South Africa. This and the lack of literature on this subject have prompted a need for a deeper understanding of the contributing factors to the problem of geoscience graduate unemployment. Thus, this study aimed to unveil and comprehend the underlying causes of the problem of geoscience graduate unemployment in South Africa, offering recommendations to relevant stakeholders to enhance the employability of geoscience graduates within the sector.

The primary data for this study was collected using a qualitative research method, employing semi-structured, open-ended face-to-face interviews with HR officers in the three geoscience sectors. Research study participants were identified through online company website searches and referrals. Contacts were initiated via email to request participation and a mutually convenient interview schedule upon consent.

The initially targeted number of the sample was a minimum of 20 participants. However, due to the data saturation, ten participants ended up being interviewed. This is a point where collecting more data no longer provides additional insight into the research.

Four of the ten interviews were conducted face-to-face, while others were conducted virtually on Teams. The interviews followed a guided, semi-structured approach, with responses recorded through audio recording and supplemented with detailed notes.

Upon completion of the data collection through the interviews, the data was processed and analysed using a thematic approach, which draws up common themes in the responses to draw conclusions and recommendations.

The subsequent sub-sections closely examine the participants' demographics and the study results.

4.2 Data analysis

The primary data collected comprised written responses and interview notes captured during the interviews. The responses of the interviewed HR officer participants were captured in a Word document, which was cleaned, analysed, and sorted. The author familiarised herself with the data, and once she was familiar with it, it was transferred to Delve tool software as transcripts, a qualitative data analysis tool. In the software, initial codes were generated and processed; thereafter, themes were generated. The data analysis report was generated from the theme.

Furthermore, each question posed during the interviews underwent analysis, juxtaposed against responses from other participants in other sectors. Discrepancies and convergences among these sectors were scrutinised to comprehensively grasp the graduate labour market dynamics. Subsequently, these outcomes informed provisional policy recommendations to potentially mitigate the factors contributing to geoscience graduate unemployment.

The participants all agree that soft skills are critical when recruiting. Even though they all attest to their respective organisations' initiatives to assist learners, students, and graduates in improving their employability, more still needs to be done through industry-university partnerships. The subsequent sections assess the participants' demographics for a better understanding of their responses and contributions to the study, and they further discuss the themes identified in the responses and finally link the different themes to the study's propositions.

4.3 Background information of participants

4.3.1 Demography - Gender, race, and age profile of participants

An invitation for participation in this study was sent to HR officers from three sectors, namely, the mining sector, the consulting sector, and the government sector, all of which recruit geoscience graduates. Table 2 depicts the different demographic categories of the participants interviewed in this study.

Of the ten participants interviewed, six were female, while four were male. An examination of the age demographics revealed a range from 30 to 55 years, indicating a diverse age representation. Furthermore, the participants exhibited extensive experience in the field of HR, with tenure ranging from 5 to 30 years.

Based on the participant's age and experience, it can be inferred that a significant portion of these HR practitioners possess considerable expertise and are well-versed in effective practices for geoscience graduates within their industry. Moreover, they demonstrate a thorough understanding of the dynamic nature of the field and its shortcomings.

Regarding racial demographics among the study participants, one participant identified as Coloured, one as White, and the remaining eight identified as Black. It's important to note that all interviewed participants hold South African nationality.

The interviewed candidates primarily come from companies focused on upscaling rather than downscaling their operations, except for mining companies, which tend to experience fluctuations based on commodity prices and the country's economic conditions. Consequently, the graduate intake within the mining sector is subject to variability. Additionally, the majority of the represented companies have a staff complement of more than 500 individuals, with only two having fewer than 500 employees. This analysis instils confidence in the study, as it suggests that the recruitment volumes and participants' experiences are adequate for deriving meaningful findings for this study.

Unfortunately, the consulting sector was underrepresented, with only two participants interviewed from this cohort. However, the extensive experience spanning over 15 years in various consulting firms instils some confidence regarding the accuracy of results from this sector. In contrast, the government sector was well represented, with five of the interviewed participants coming from this sector. Consequently, the results for this sector show a higher confidence level. However, it is essential to note that although there were five Participants from the government sector, three were from a parastatal institution.

Table 4: Demographic analysis of the Sample of the study

		Representation (no.)
Number of samples (N)		**10 participants**
Gender	Male	4
	Female	6
Sector	Mining Sector	3
	Consulting sector	2
	Government sector	5
Role	Talent management	3
	Middle Manager	1

	HR officer/practitioner	6
Age	30-40 years	5
	41-50 years	4
	>50 years	1
Race	Coloured	1
	White	1
	Black	8
Experience in Human resources	5-10 years	5
	11-30 years	5
Company size	Below 500 employees	2
	Above 500 employees	8

4.4 Emergent themes

During the analysis and coding of the responses from the interview, it became clear that three themes are present in this study. These themes include skills requirements and mismatch, the partnership between the industry and universities, and industry opportunities. Each theme is discussed in detail in the subsequent sections.

Moreover, it was apparent during the study that are many dynamics that could be linked to graduate unemployment. These dynamics encompass socio-economic status, demographics like race, curriculum structure, institutional characteristics, graduate attributes, and economic and labour market conditions. Whilst some participants are of the view that the misalignment of skills and lack of collaboration between industry and higher education institutions are not so much of the factor leading to graduate unemployment as compared to race and socio-economic status.

4.4.1 Skills requirement and mismatch

The participants highlighted the typical set of skills they are generally looking for when interviewing graduates. According to this study's participants, the common skills the HR officers are looking for include technical expertise, confidence, the correct attitude, the ability to work in a team, problem-solving skills, and a demonstration of some leadership

skills and technical capabilities. One participant even indicated that they are also looking for graduates who will fit the organisation's culture.

CP2 extracts: *"compatibility to business needs, values and culture."*

Conversely, the mining industry seems to be looking for more than the aforementioned skills due to the risk involved in the mining sector as it can be seen in the extract below, *MP1*, from a participant in the mining sector. This implies that this sector is even more competitive than the other sectors. Moreover, judging from these requirements, the assumption is that the mining sector prefers graduates with some prior training or experience because MP1 indicated that usually, it takes the company a while to train them and get the graduates to a level required by the mine. This is because of the high risk in the mining industry.

An extract from the MP1:

"*People's skills, technical background and experience, practical background, management skills, time management, communication, presentation skills, teamwork ability, knowledge of the legal environment in the mining sector, knowledge of regulations in the mining, finance background, cost management, proactivity rather than reactivity"*

According to the majority of the participants, traditional universities do not offer comprehensive training dedicated to developing soft skills. Therefore, it is currently at the honours of each graduate to acquire these skills as they are highly sought after by employers. Consequently, it becomes difficult for those graduates who have not acquired these skills to secure employment. Even so, for companies still using old interview systems, the panel interviews. This style of interviews was observed to be still predominantly applied by the government sector.

GP2: "*The outdated interview process used often disadvantages some graduates who are unable to sell themselves."* Particularly government institutions whose recruitment processes are highly regulated and outdated.

GP1: *Since the recruitment process is highly regulated, the interview process is outdated and, therefore, doesn't look at other aspects of the candidates, i.e., there are no practical application requirements during recruitment*".

Moreover, these outdated interview processes are prone to corruption, as indicated by interview participant PP1: *"Corruption is also making it difficult for graduates to secure employment".*

This study shows that, even though the universities have a role to play in developing the skills of the graduates, it is also on the graduates' honours to ensure that they also develop themselves. This can be seen in the extract from participant MP2: *"Also, the honours are with the graduates to keep up to date with the new developments".*

The universities provide comprehensive theoretical content for the modules. However, they lack practical experience in the work. The job market is mainly interested in the practical experience of the graduates. This results in a mismatch between what the university offers versus the job market's requirements. Also, the qualification or level of qualification the graduates possess in some instances is misaligned to the requirement of the employer:

Participants CP1 and PP2 highlight the point of a job requiring a master's degree whilst most graduates seeking employment possess an honours degree: *"Not right fit qualification according to the requirements of the company, i.e. when the company is looking for a candidate with a master's degree, and the interviewed candidate has an honours degree".*

Unfortunately, often, there are financial access problems or social problems when graduates want to further their studies. The importance of furthering studies was emphasised by one participant during the interview: CP2 extract: "*Access to post-graduate studies is often a challenge for some graduates. At times, they do not have money to further their studies. The level of qualification companies seek is a higher calibre, which excludes graduates of lower qualifications, and they become less likely to be employed.*

The strategic direction of companies also perpetuates the skills mismatch problem. Depending on a company's strategic direction, the focus on graduate employment may be in a specific field of geoscience, which means that the emphasis on employment will be on graduates with that qualification. This then leaves out those graduates possessing another field of qualification in geoscience.

Most participants pointed out things like lack of confidence, negative attitude, lousy tone of communication, lack of passion and lack of research as some factors that would negatively affect the graduates during the recruitment process.

One common thread that can be deduced from the interviews is that most companies, if not all, are looking for top achievers regarding graduates. Very few are prepared to offer training to the middle achievers (50-60s mark average). Unfortunately, there is a large pool of the middle achiever compared to the top achiever pool. However, some candidates indicated that graduates do not necessarily need to acquire all the necessary skills required for the job market; if they have a learning correct attitude, then internal training programmes assist in building both technical and soft skills.

4.4.2 The partnership between the industry and universities in ensuring that graduates are better prepared for employment

The need for collaboration and partnerships between the universities responsible for producing and preparing the geoscience graduates and the industry, the beneficiary of these graduates cannot be stressed enough, as pointed out but the interview participants. They further stressed out that, both parties ought to play their part in the development of the consistent pipeline of the graduates ready for employment.

MP3 extract: "*The universities must partner with businesses to find out what they require and implement it". "There has to be a partnership between the industry and the university."*

Furthermore, internships, industry-sponsored projects, and cooperative education programs offer students valuable chances to acquire practical experience and apply theoretical knowledge in real-life contexts. In return, employers' benefit from a pool of graduates with the specific skills and competencies necessary for success within their organisations. Consistent communication, feedback mechanisms, and sustained partnerships between universities and employers contribute to continuously refining educational programs. This ensures that graduates are not only academically proficient but also well-prepared to confront the challenges of the contemporary job market. This collaborative endeavour significantly improves the employability of graduates and

cultivates a workforce that closely aligns with the needs of industries and businesses. One thing apparent from this study is that universities and industry have a huge role in solving the issue of geoscience graduate unemployment, individually and/or collectively. The subsequent sections will look at the roles of the universities and industry individually according to the perspectives of the HR officers.

All participants indicated the need for partnership between industry and universities to improve the employability of geoscience graduates.

GP2 extract: "*There has to be a partnership between the industry and the university".* MP2 extract: "*There is a serious gap between what the universities produce and the job market requirement".*

PP3 extract: "Lack of alignment with the job market and university".

MP1 extract: "This misalignment is common throughout other fields of study. Therefore, as a result, companies have a lot of work to transition these university graduates to what the company requires".

They said that through this partnership, it is only when the universities can begin to better prepare the graduates for future jobs. Several suggestions were presented by the participants, some of which include, the restructuring of the curriculum to allow for industry expects to offer some modules to provide hands-on experience to the students. Another suggestion is for the companies to have programmes that provide vacation work to other students than the ones they fund.

CP2 extract: "Recently, a few universities, like UJ, Wits, and Stellenbosch, have started to reach out to companies to request them to come and speak to students. As a result, companies prefer the universities they have partnered with in this manner. However, the smaller universities like the University of Vender are forgotten by the industry".

CP1 extract: "We have geoscientists within our company who are regularly invited to UCT, UJ, and Stellenbosch as the alumina who are asked to speak on their subject matter of expertise".

4.4.2.1 Role of Universities in ensuring that graduates are better prepares for the job market

Universities play a central role in preparing graduates for job market success by implementing strategies beyond traditional academic instruction. The participants all indicated that the universities ultimately have a responsibility to provide graduates with soft skills relevant to the job market. However, the recruiters acknowledge that this function is currently lacking as the graduates they receive lack the fundamental soft skills required in the job market, even though they are technically sound.

Universities can align course content with current industry demands by purposefully designing curricula integrating practical experiences like internships, thus bridging the gap between theory and application. It's crucial to also focus on developing soft skills such as effective communication, critical thinking, and technical proficiency. Establishing partnerships with industry stakeholders facilitates a reciprocal exchange of insights, ensuring educational programs stay relevant and responsive to workforce needs.

MP2 extract: "*Theoretically, they prepare the graduates, but the practical aspect is lacking", "Universities are not doing enough. Currently, their structure is too academic".*

Career counselling services guide students in making informed decisions about their professional paths, while alumni networks offer valuable connections to accomplished graduates. Integrating technology and cultivating a research-oriented culture equip graduates with digital literacy and analytical skills. Initiatives promoting international exposure and cultural competence prepare students for global employment opportunities. The participants emphasise that the universities must remain adaptable, consistently seeking feedback and refining programs to meet the evolving dynamics of the job market, ultimately contributing to the comprehensive preparation of graduates for diverse and dynamic professional environments.

Furthermore, the jobs of the 21st century have certainly changed, and as such, the way of teaching ought to adapt. Technology is heavily influenced by the jobs of today and the future. The extracts from PP3 and GP1 emphasise the need for updating the university programmes to ensure that they are preparing the graduates for the jobs of

the future and, therefore, ensure that they are not misaligned with what the job industry seeks:

PP3 extract: *"Teaching is outdated; hence, there is a lot of unemployment", "Methods of teaching need to be updated as they don't support the requirements of today",* GP1 extract: *"Universities are not adapting to what the future work looks like."*

4.4.2.2 The role of the industry in ensuring that graduates are employable

The participants acknowledge that although many companies in the industry have programmes to assist with the employability or uptake of geoscience graduates, there is still much room for the industry to do more. There is nothing in terms of policies that force companies to have graduate or internship programmes in place; however, there are government-private collaboration initiatives like the Yes youth programme, which seeks to reduce youth employment.

MP3 extract*: "There must be regulation from DMRE to force mining companies to have graduate programmes, internships, bursaries, etc. There can be some incentives to enforce this. Because now, the industry is not doing enough to support the graduates."*

Through the interviews, it is apparent that many private and government institutions have some programmes in place to assist the learners, students, and graduates in the form of bursaries from leaner level to student, internships, coaching and mentorship programmes, vacation work and graduate training programmes to improve the employability of geoscience graduates. However, there is a lack of consistency and enforcement for these initiatives, and therefore, they are conducted at the company's discretion.

MP3 extract: "We conduct c*areer exhibitions to expose students to the experts in the field and available opportunities in the company*." MP2 extract: "*We offer our bursary beneficiaries vacation work whilst they study*". PP3 extract: "We *have several Training (coaching and mentoring) programmes offered to graduates*", CP1 extract: *"We have bursary offerings to students, vacation work opportunities to ensure the students are exposed to the job and internship programmes" GP1 extract: "The department offers bursaries to support the students. Through these programmes, the students get training, in-service and vacation work training, which gives them full hands-on exposure to the jobs they will do. For example, the department trains its students and graduates at the*

Roodeplat Dam Centre. Moreover, the department collaborates with municipalities to train the students and ensure total hands-on exposure. We hold their hands until they get to the professional stages." CP2: "We really focus on math and science at the scholar level, and then we focus on creating visibility of opportunities within geoscience—bursaries of about ten scholars a year. We have about 30 active bursaries a year. We have partnered with the Gauteng government to award 100 bursaries to deserving students. So, we're trying to infiltrate the schools."

4.4.3 Industry available opportunities

There seems to be a mixed perspective regarding graduate job prospects and other available instrument like internships and graduate programmes within the industry to aid employability of geoscience graduates. The HR officers in the mining sector believe that due to the economic downturn, the low commodity prices, and the uncertainty in the South African mining sector, most mining companies are downscaling and, as a result, retrenching. These events highly affect the graduate intake as companies would not have the resources to train and absorb graduates. They would instead remain with experienced employees. During such times, graduate and internship programmes are also affected as companies would spend less or not at all due to a lack of financial resources.

Other recruiters believe that there are many job opportunities in the market for graduates. However, graduates either do not conduct enough research to find these opportunities or lack the resources to search for jobs. At times, they do not have a passion for geoscience and end up in the geoscience career for other reasons. GP1: "*At times, graduates do not have the passion for their field of study but do it because they need to survive or there are better job prospects".*

In most cases, the job opportunities in the geoscience sector are located in remote areas, i.e. mining companies are often far from civilisation. At times, this is an inhibiter for graduates who are unwilling to relocate to these remote areas for many reasons. Recruiters in the consulting and mining sectors pointed this out. "*Graduates always want to work closer to home and are unwilling to relocate to other areas far from home or civilisation".* This results in graduates competing for job opportunities in or near the cities. Ggraduate's preference for jobs further exacerbates the problem of graduate unemployment. Even

though there may be job opportunities available in the market, when they do not coincide with the preference of some graduates, they wouldn't be considered by those graduates.

The outdated interview process in government institutions is an inhibitor for some graduates who cannot sell themselves during the interview process. They end up losing opportunities. Conversely, the consulting and mining sectors demonstrate more modernised and flexible recruitment methods, ensuring comprehensiveness and inclusivity.

5 CHAPTER 5: DISCUSSION OF FINDINGS

5.1 Introduction

This study aimed to investigate possible causes and the factors resulting in geoscience graduate unemployment through interviews with the HR officers responsible for recruiting geoscience graduates. Several researchers have studied the factors contributing to the general or other sector's graduate unemployment in South Africa. No literature exists on the subject of geoscience graduate unemployment. As such, this author saw it fit to close this gap by embarking on a study to examine the possible causes of geoscience graduate unemployment in South Africa from the perspectives of the HR officers.

The results from the study demonstrate that factors contributing to geoscience graduate unemployment are multifaceted, as it may be due to the mismatch between the skills demanded by the job market and the supply of skills the graduates possess. Practical solutions to the problem of geoscience graduate unemployment are identified through this research and other research. Through collaborative efforts between the universities and industry to ensure the requisite skill sets required by graduates during employment are provided and the curriculum talks to the needs of the industry, the graduate unemployment problem can be improved. Moreover, Terrance (2023) states that many graduates struggle to attain employment; he proposes two solutions to be explored by graduates instead, which could solve the graduate unemployment in South Africa, namely, the enforcement of hands-on practical job skills set approach and entrepreneurship development approach.

5.2 Discussion about the primary objective

Primary objective: *To determine the factors contributing to geoscience graduate unemployment from the perspective of the HR officers.*

The study's findings indicate that from the perspectives of HR officers, multiple factors contribute to the increasing unemployment of geoscience graduates in South Africa. It is not only the set of skills they have in the mining sector in the country but also the institutions they attended and posse employers' perceptions of those institutions. This discrepancy arises from the substantial investments made by industries in major universities such as Wits, UJ, and UP. Employers tend to favour graduates from non-access universities over historically black institutions due to perceptions about these institutions and their perceived lack of engagement with employers to understand the requisite skills for success (Baldry, 2016). When considering costs, employers prefer to allocate resources towards candidates from non-access universities, as recruiting expenses are significant and worthwhile only for candidates possessing the necessary skills.

The perspectives offered by HR managers stimulate a reflection on endogeneity regarding industry perceptions of prestigious universities and their role in shaping the development of geoscience graduates (Marin-Zapata et al., 2021). Specifically, it prompts inquiry into whether the prevailing perception of the geographical location of top-tier universities influences the selection of sources for geoscience graduates. While these supportive measures are valued and contribute significantly, they unintentionally marginalise other universities, sustaining prevailing perceptions of candidate quality.

The results have shown that educational qualification alone is not the only criterion for gaining employment. However, higher-level qualifications do increase the likelihood of securing a job, with specific sectors emphasising the importance of advanced studies for enhancing employability, such as preferring candidates with a master’s degree (Demissie et al., 2021). The study reveals employers prioritise work experience, specific skills, and qualifications tailored to their requirements. Nonetheless, this practice can present a challenge as it may hinder the development of industry-specific experience among candidates.

As the economy evolves, organisations adapt their business needs accordingly in the

realm of labour demand. These shifts in business requirements necessitate corresponding adjustments in the qualifications and skills organisations seek. Consequently, a graduate lacking the requisite qualifications or skills demanded by an organisation may face prolonged unemployment until their capabilities align with current demand (Börner et al., 2018). Thus, it can be inferred that fluctuations in business requirements directly influence labour demand.

The problem of skills emerged as a potential factor contributing to graduate unemployment. The research revealed that employers place a premium on specific competencies such as leadership, soft skills, managerial abilities, and cultural compatibility. There has been a notable growing emphasis on soft skills that graduates must possess for better employability prospects (Succi & Canova, 2020). This increase has mainly been observed in the last 5-10 years. This can be seen in the findings of this study, as all the interviewed participants expressed the importance of not only technical skills but also soft skills, which are often overlooked during the development of graduates. Graduates lacking these essential skills may struggle to secure employment. Additionally, the findings indicate that employers do not view skills acquired solely through university education as adequate. Such skills might be perceived as overly theoretical or insufficiently applicable to the workplace (Succi & Canovi, 2020). Therefore, it is necessary to complement university-based skills with additional, job-relevant competencies.

Table 3 lists the 20 skills identified in their study perceived to be required by employers. In addition, the study conducted by Borner et al, (2018), indicates the growing significance of distinctly human skills, such as communication, negotiation, and persuasion. Of the 20 listed skills, 14 were listed by this study's interview participants. This demonstrates the importance of soft skills for graduate employability. The author concludes that this study demonstrates the soft skills highlighted by the recruiters, which are the skills required by the job market in the geoscience sector (Börner et al., 2018)The available literature lacks this information, as researchers have predominantly focused on demonstrating the skill requirements of graduates in general or other sectors, like the banking sector study by Oluwajodu et al. (2021). Even though this study is in a different sector, the challenges of skills mismatch corroborate.

Table 5: A list of 20 skills found to be what employers are looking for in the employability of graduates (Haselberger et al., 2012).

Category	Skill
Personal	**1. Being Committed to Work –** make a commitment to the organisation and understand its specific characteristics
	2. Being Professionally Ethical – take actions while bearing in mind the principles and ethics of the profession in daily activities
	3. Being Tolerant to Stress – show endurance in complicated or stressful situations
	4. Creativity/Innovation Skills – contribute new ideas to develop improvements in the products or services of the organisation as well as in the activities performed in the job
	5. Learning Skills – provide a self-assessment of necessary knowledge (theoretical or practical) and take measures to acquire and implement this knowledge
	6. Life Balance Skills – manage successfully the frequent conflicts between life and work
	7. Self-Awareness Skills – grasp our real weaknesses and strengths
Social	**8. Communication Skills –** transmit ideas, information and opinions clearly and convincingly, both verbally and in writing, while listening
	9. Conflict Management & Negotiation Skills –conciliate different opinions to reach an agreement that satisfies everyone
	10. Contact Network Skills – develop, maintain, and foster contacts
	11. Culture Adaptability Skills – carry out managerial and entrepreneurial processes in multicultural environments
	12. Leadership Skills – motivate and guide others to get them to contribute effectively
	13. Team-Work Skills – to build relationships based on participation and cooperation with other people
Methodological	**14. Adaptability to Change Skills –** redirect the course of action to meet goals in a new situation
	15. Analysis Skills – draw conclusions and forecasts for the future by acquiring relevant information from different sources
	16. Continuous Improvement Skills – perform the activities, duties and responsibilities inherent to the job under quality standards and strive for excellence
	17. Customer/User Orientation Skills – identify, understand and satisfy efficiently the needs of customers
	18. Decision Making Skills – make the decisions necessary to achieve objectives quickly and proactively +B18
	19. Management Skills – set goals and priorities through the selection and distribution of tasks and resources
	20. Results Orientation Skills – make organisational efforts profitable while having always in mind the goals pursued

The findings of this study, corroborated by literature, revealed that there are many dynamics resulting in the unemployment of graduates in South Africa; these encompass socio-economic status, demographics like race, curriculum structure, institutional characteristics, graduate attributes, and economic and labour market conditions (Baldry, 2016; Börner et al., 2018; Demissie et al., 2021; Haselberger et al., 2012).

The interviews revealed that some sectors have better job prospects for geoscience graduates than others. In as much as the consulting sector may employ fewer graduates than the mining sector, the fluctuations in the mining sector result in uncertainty regarding the absorption of graduates over the years. Also, in the consulting sector, graduates' intake depends on project availability because they determine the financial resources to participate in graduate programmes.The government sector graduate intake was observed to be far less than that of the other sectors. However, overall, as all sectors actively contribute to initiatives to enhance graduate employability, this study concludes that they all exhibit commendable intentions towards providing graduates with improved job prospects. Similarly, the choice to hire graduates is aligned with ensuring a prosperous supply of suitable candidates and fostering the development of specialised skills tailored

to meet company needs. The consistent recruitment of graduates each year underscores the willingness of all sectors to engage with graduate employment. Furthermore, the implementation of graduate development programs, facilitating the recruitment of new graduates annually, serves as additional evidence of this commitment across sectors.

Succi & Canovi, 2020, demonstrate that there are disparities in the perception of the perceived importance of soft skills for employability by graduates and employers. Some skills are perceived as more critical by graduates, while employers perceive others as more important. When examining skills like communication, as demonstrated in Figure 4, we can see that the author found that graduates deem this skill more important than the employer. Thus, they would put more emphasis on developing this skill than teamwork skills, which employers deem more critical. Furthermore, in this research, it can be noted that different sectors prioritise different sets of skills based on the nature of their business, i.e., the consulting sector found to be is seen to be prioritising leadership, communication, and teamwork amongst their skills requirements.

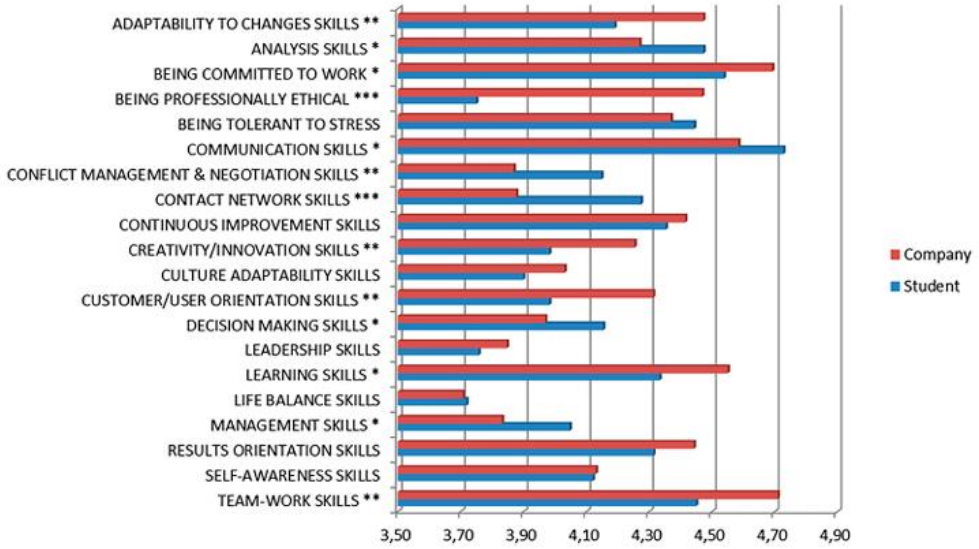

Figure 4: A comparison between the skills ranking by students and employers, (Succi & Canovi, 2020)

5.3 Discussion pertaining to the secondary objective

Secondary objective: *to identify potential interventions to mitigate the issue of geoscience graduate unemployment in South Africa*

The secondary objective of this study can be linked to themes 2 and 3: the partnerships between industry and universities and the availability of industry opportunities. This

study identifies potential solutions to the problem of geoscience graduate unemployment. According to most interview participants, there are job opportunities and instruments like graduate programs and internships available to graduates. However, challenges such as the misalignment between the skills graduates possess, their preferences within various fields of geoscience, and the location of job opportunities remain significant obstacles (Börner et al., 2018; Marin-Zapata et al., 2021). Many jobs in this industry are located far from cities, making relocation difficult for many job-seeking graduates.

Additionally, some study participants argued that many graduates lack the tools to research and find these opportunities effectively. Others suggested that some graduates pursue geoscience to escape poverty or because they perceive the field to offer better job prospects and substantial remuneration rather than out of passion. These factors contribute to the increasing unemployment rate among geoscience graduates.

The issue of unemployment among geoscience graduates in South Africa is closely linked to the broader macroeconomic landscape characterised by longstanding unemployment. Terrance (2023) revealed that factors such as the country's economic conditions and global economic trends significantly influence employment opportunities, particularly within the mining sector. Without effective implementation of instruments such as the National Development Plan or policy reforms to address unemployment, graduate unemployment is likely to persist. Addressing the challenge of geoscience graduate unemployment requires a comprehensive overhaul of South Africa's educational system, demanding committed leadership at both political and social levels. Only through coordinated efforts can the current pool of unemployed graduates be empowered to contribute meaningfully to South African society and become part of a productive workforce.

This study emphasises the need for collaboration between industry, government, and educational institutions (Demissie et al., 2021). Through such collaborative efforts, the problem of geoscience unemployment can be reduced. Industry can provide direction regarding strategic needs and required skill sets, while the government can establish and implement policy instruments. Universities, guided by collaboration with both stakeholders, can reform curricula to align with job market requirements. This collaboration can also help graduates acquire essential "soft skills" necessary for effective organisational contribution, such as time management, public speaking, interpersonal

communication, teamwork, ethical business practices, and meeting etiquette. Governments could further support this initiative by offering financial assistance for hiring graduates, thus expanding the pool of job opportunities for recent graduates.

The collaboration between the job market and universities is vital to ensure that graduates are thoroughly prepared and possess the skills employers seek (Demissie et al., 2021; Haselberger et al., 2012). This partnership benefits both entities, facilitating a smoother academic and professional transition. Assessing industry trends provides universities with valuable insights into current needs and skill prerequisites, forming a foundation for curriculum development tailored to the evolving demands of the professional landscape.

For South Africa to enhance economic growth and prosperity, it is crucial to bridge the gap between the skills required by the industry and those offered by universities (Börner et al., 2018). Demissie et al. (2021) recommend that universities modify their curricula to meet job market needs, with industry support guiding these changes. When universities and industries forge such partnerships, the employability of graduates improves, directly corroborating the findings of this study. By effectively identifying the specific skills demanded by employers and incorporating them into their curricula, universities can significantly enhance graduates' appeal to potential employers.

This study also revealed existing collaboration efforts between industry and universities; however, more is needed to bridge the gap. Historically, predominantly white universities like Wits, UCT, and Stellenbosch have collaborated with industry experts and provided opportunities for students to engage with these professionals. In contrast, historically black universities (HBIs) have lagged in this aspect. Terrance (2023) and Oluwajodu et al. (2015) found that a university's location influences employer career exhibitions, resulting in stronger relationships between employers and universities in more accessible locations. This translates into a preference for graduates from these universities, disadvantaging graduates from HBIs.

Universities play a central role in preparing graduates for job market success by implementing strategies beyond traditional academic instruction. Participants indicated that universities have a responsibility to provide graduates with relevant soft skills for the job market, as corroborated by studies conducted by Börner et al. (2018), Demissie et al. (2021), and Haselberger et al. (2012).

5.4 Linking themes to propositions of the study

Proposition 1: *Relevant technical skills provided by the universities do not suffice to the current industry needs as there is an additional soft skills layer that is lacking within the educational curriculums. Thus, the skills supplied by the institutions of higher learning are misaligned to the industry's needs.*

This proposition aligns with themes 1 and 2, skills requirements and mismatch, *and industry available opportunities*. The findings of this study and other studies (Börner et al., 2018; Demissie et al., 2021; Terrance, 2023) demonstrate a misalignment between the skills supplied by the universities and the skills demanded by the job market. This growing number of geoscience graduates struggling to secure employment is a testament to this. The university curriculum mainly focuses on developing the student's technical capabilities, leaving a gap in the soft skills that should assist graduates in becoming employable. Moreover, the curriculum does not take cognisance of the industry's strategic direction in the sense that it fails to cater to current and future job requirements and is, therefore, often outdated (Haselberger et al., 2012).

As such, the industry is left with the mammoth task of training the graduates post-university through programmes like graduate programmes and internships to tailor them to their needs. Some companies have instruments like vacation work, which assist in bridging the gap. These programmes prepare the students for the jobs. Such opportunities during university or post-universities, in as much as they are available, cannot cater to all the students or graduates as they are insufficient. Currently, companies are not forced to offer programs like vacation work. It is at their discretion when they have financial resources and are willing. The participants all agreed that companies ought to do more in this respect. Also, the number of students accepted for geoscience must be cognizant of the needs of the industry to avoid huge surpluses.

These themes demonstrate the rising emphasis on soft skills and their importance for the employability of graduates. Skills like confidence, teamwork capabilities, communication, leadership traits, and problem-solving skills are among the highly featured skills according to the HR recruiters' perspectives.

Traits like lack of research, showing no interest, lack of confidence, arrogance and missing interviews were highlighted as factors that often result in graduates not attaining employment.

Proposition 2: *Through partnerships between government, institutions of higher learning, and private institutions, the employability of geoscience graduates can be improved by equipping them with all the skills necessary for the job market.*

This proposition links to the theme: *The partnerships between the industry and universities ensure graduates are better prepared for employment.* The theme highlights the importance of partnerships between industry and universities in preparing graduates for the workforce. At the same time, the proposition expands on this idea by advocating for broader collaborations involving government and private entities to ensure graduates are equipped with the necessary skills demanded by the job market. This study and many other studies (Haselberger et al., 2012; Succi & Canovi, 2020) identify this collaboration as the panacea to the problem of graduate unemployment.

Through partnerships between government, universities, and private entities, the employability of geoscience graduates can be improved by equipping them with all the skills necessary for the job market. The skills produced by the universities would be informed by the skills demanded by the job market and the industry's strategic direction.

The emphasis is on collaboration between various stakeholders, which is paramount for addressing the skills gap, which will, in turn, result in enhanced graduate employability and a positive impact on the country's economic growth. Therefore, the proposition aligns with and builds upon the theme by emphasising the significance of partnerships in addressing the challenges geoscience graduates face in securing employment and ensuring their readiness for the workforce.

5.5 Conclusion

In conclusion, this study has shed light on the multifaceted factors contributing to geoscience graduate unemployment in South Africa, particularly from the perspective of HR officers. The issue extends beyond educational qualifications to encompass various socio-economic and industry-related dynamics.

The findings highlight disparities in employment opportunities based on factors such as the institution attended, industry perceptions, and geographical location. There is a clear preference among employers for graduates from certain universities, leading to the

unintentional marginalisation of others. Additionally, while higher qualifications enhance employability, employers prioritise practical skills and experience over theoretical knowledge.

The study emphasises the need for collaborative efforts between industry, government, and educational institutions to address graduate unemployment effectively. Recommendations include aligning university curricula with industry demands, enhancing career counselling and job placement services, fostering partnerships between universities and businesses, and implementing policies to stimulate economic growth and job creation.

Furthermore, interventions aimed at facilitating graduates' access to job opportunities, such as internships and graduate programs, must address challenges related to skills mismatch, job preferences, and geographic constraints. Moreover, emphasis should be placed on equipping graduates with essential soft skills necessary for organisational productivity.

Addressing geoscience graduate unemployment requires comprehensive reform of South Africa's educational system and committed leadership at political and social levels. Through collaborative efforts and targeted interventions, the current pool of unemployed graduates can be empowered to contribute meaningfully to South African society and become part of a productive workforce.

5 CHAPTER 6: RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

This chapter summarises the research findings and their importance and presents the recommended solutions to the factors responsible for geoscience graduate unemployment. It also highlights the limitations and problems encountered during the research. This chapter presents a research gap where further studies could be done to gain a comprehensive understanding of the research problem.

6.2 Overview of the study and objectives

Unemployment among geoscience graduates in South Africa poses a significant challenge, reflecting broader issues within the country's labour market.

In line with the conceptual framework of this study, the literature points out several factors which could be attributed to the unemployment globally and in South Africa, some of which included the economic climate which impacts the availability of job opportunities and the mismatch between the skills demanded by the job market and those supplied by the higher education institutions. This problem has implications for the socio-economic issues in the country. Baldry (2016) indicates that race and socioeconomic status are more significant factors in graduate unemployment. Pointing out that those of lower socio-economic status and black Africans are four times less likely to find employment compared to their opposite counterparts.

This study aims to comprehensively examine the factors contributing to geoscience graduate unemployment, focusing mainly on the perspectives of HR officers. Additionally, it seeks to identify potential solutions or interventions to address this pressing issue within the South African context.

The primary objective of this study is to investigate the factors underlying geoscience graduate unemployment as perceived by HR officers. By delving into the perspectives of key stakeholders in the recruitment process, including HR professionals, this research uncovers the intricacies of graduate unemployment within the geoscience field. Through qualitative analysis and interviews, the study elucidates the various factors shaping employment outcomes for geoscience graduates. These range from the educational background, whereby the skills produced by the universities misalign with those demanded by the job market as the universities are mainly focused on the development of technical skills, to the lack of collaborations between key stakeholders, the job market, universities, and government who have a critical role in ensuring the employability of geoscience graduates. Also, the country's economic landscape limits the opportunities available to develop graduates.

In addition to understanding the root causes of geoscience graduate unemployment, this study proposes potential solutions or interventions to address this persistent issue. By exploring avenues for collaboration between industry, government, and educational institutions, the research devises strategies to enhance graduate employability and reduce

unemployment within the geoscience industry. Through a multi-stakeholder approach, including consultations with industry, policymakers, and academic experts, the study presents this as an actionable measure that can effectively mitigate the challenges faced by geoscience graduates seeking employment in South Africa.

By addressing the primary objective of understanding contributing factors and the secondary objective of identifying solutions, this study provides valuable insights into the complex issue of geoscience graduate unemployment in South Africa. Through rigorous analysis and stakeholder engagement, the research endeavours to contribute to developing evidence-based policies and initiatives aimed at improving employment outcomes and fostering economic prosperity within the geoscience sector and beyond.

6.3 Conclusion regarding research propositions

In conclusion, regarding the skills required by graduates for employability, HR recruiters actively seek geoscience graduates with a well-rounded skill set that combines technical expertise and essential soft skills. Analytical skills, including critical thinking and problem-solving abilities, are crucial for interpreting complex geological data and making informed decisions. Effective communication skills in technical writing and presentation enable graduates to convey geological information to diverse audiences.

Teamwork and collaboration are essential, emphasising interdisciplinary cooperation and positive contributions to team dynamics. Adaptability is vital, with graduates expected to thrive in various work environments and remain current with evolving geoscience technologies. Additional qualities sought by recruiters are attention to detail, time management, ethical considerations, and environmental awareness. Networking and relationship-building skills, as well as digital literacy with industry-standard software, further enhance the employability of geoscience graduates. Job seekers must emphasise these skills in resumes and interviews to showcase their readiness for roles within the geoscience field. Specific emphasis on certain skills may vary based on job requirements and industry expectations.

6.4 Recommendations

Geoscience graduate unemployment in South Africa is intricately linked to the broader macroeconomic context of long-standing unemployment. As observed during the study, the country's economic landscape or the world in general can immensely contribute to graduate employment in the mining sector. Graduate unemployment will persist unless instruments like the NDP2030 or policy reforms effectively tackle unemployment and produce tangible outcomes. Addressing the specific issue of geoscience graduate unemployment necessitates a comprehensive overhaul of South Africa's educational system, requiring committed leadership at political and social levels. Only through such concerted efforts can the current pool of unemployed graduates be transformed into a productive workforce that enriches South African society.

One significant implication highlighted is the recognition that graduate unemployment can have long-term detrimental effects on the economy. In response to this finding, the study proposes several recommendations to reduce geoscience graduate unemployment. These recommendations could include initiatives to better align university curricula with industry needs, improve career counselling and job placement services for graduates, foster partnerships between universities and businesses, and implement policies to stimulate job creation and economic growth.

Private and government entities, alongside educational institutions, can collaborate to offer career guidance for graduates, ensuring a diverse array of employable subjects and courses. Such collaboration can also enhance the development of essential "soft skills" crucial for graduates to contribute to organisational productivity effectively. These skills encompass teamwork, ethical business practices, interpersonal communication, public speaking, meeting etiquette, and time management. Governments can further support this initiative by offering subsidies for graduate recruitment, thereby expanding employment opportunities for young graduates.

6.5 Suggestions for future studies

In as much as the author was able to provide some insight into the intricate geoscience graduate unemployment through the perspectives of the HR officers in the South African context by looking into multiple variables. However, more research is required to cover the perspectives of the geoscience graduates, their opinions, job market situations, and

policy instruments. According to Demissie et al. 's study (2021), In the Ethiopian context, various factors such as demographic characteristics, curriculum features, institutional culture, graduate attributes, economic and labour market conditions, as well as global and emerging issues, can all play significant roles in predicting the employment outcomes of graduates. As such, all these factors ought to be tested in the South African context.

Therefore, further research surrounding unemployment among geoscience graduates in South Africa necessitates a multifaceted approach, beginning with a thorough examination of statistical data and demographic characteristics is paramount. Delving into official records, surveys, and databases is essential to ascertain the scope of the issue while analysing demographic factors such as age, gender, race, and educational background, which provides valuable insights into potential disparities and patterns. Moreover, investigating the institutions attended by these graduates offers critical context regarding educational quality and networking opportunities.

Concurrently, exploring the social issues intertwined with unemployment, including economic conditions, government policies, and industry demand, is indispensable for understanding the broader societal dynamics. Furthermore, gaining insight into the factors contributing to unemployment from both graduate and managerial perspectives is imperative. Direct engagement with geoscience graduates through surveys, interviews, or focus groups allows for identifying challenges such as skills mismatches and limited access to job opportunities. Conversely, understanding the hiring criteria and challenges line managers face offers valuable perspectives on industry trends and potential barriers to employment. By synthesising these diverse viewpoints, researchers can delineate targeted interventions and policies aimed at alleviating unemployment among geoscience graduates in South Africa, thereby fostering enhanced prospects for their meaningful integration into the workforce and career progression.

Lastly, (Terrance, 2023) suggests that the problem of graduate unemployment has been widely studied and, therefore, well understood; thus, more research should focus on finding solutions to graduate unemployment.

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8 Appendix A: Interview guide questions

1. How many years of experience do you have in HR?
2. On average, how many graduates does the company employ per year?
3. What critical skills do you look for when hiring?
4. What are the common things that disqualify potential geoscience employees?
5. How do you stay up-to-date with trends and developments in the geoscience field, and how do you ensure that your organization remains at the forefront in assisting with upskilling geoscience students or graduates to ensure they have the required skills?
6. How do the recruiters perceive the alignment between the acquired geoscience skills and the skills demanded by the industry in South Africa?
7. What support systems, if any, are available to geoscience graduates in South Africa to improve their employability and job prospects?
8. What do you think is the industry's role in ensuring the readiness of geoscience graduates for employment?
9. How do recruiters perceive the role of universities and educational institutions in preparing geoscience graduates for the job market in South Africa?
10. What do you perceive as the main contributing factor to geoscience graduate unemployment in South Africa?
11. Has the company been downscaling or upscaling in the past 5 years?

9 Appendix B: Organisation: request for approval

University of the Witwatersrand,
Faculty of Commerce, Law and Management
011 717 3544

Company address

15 June 2023

Dear Sir,

Re: Permission to conduct research.

My name is Nomvelo Mkhize.

I am studying for a Master of Business Administration at the Wits Business School at the University of the Witwatersrand. I am seeking permission to do research at [company name]

I am researching factors contributing to geoscience graduate unemployment in South Africa. I intend to interview Human Resources (HR) officers responsible for recruiting geoscience graduates. Through these interviews, I intend to understand the factors contributing to a growing number of geoscience graduates failing to secure employment from the perspective of HR officers. Once I have identified these factors, I will also look at their impact on South Africa's industry and economy. In addition, I intend to provide recommendations for mitigation and interventions. Therefore, I have selected your company because it operates in the geoscience industry and thus employs geoscientists.

The research will entail collecting data from HR officers responsible for recruiting geoscience graduates in the organisation. The interviews will be in-person and conducted at the location selected by the participants. They will take 30 minutes. During the interview, the participants will be asked for consent to record the session and notes of the discussion will be captured. Participants will be asked to give their written or verbal consent before the research begins. Their responses will be treated confidentially, and identities (their names and the name of the organisation) will be anonymous unless otherwise expressly indicated. Individual privacy will be maintained in all published and written data resulting from the study.

The results will be communicated in the final approved research dissertation, which will be published by the school.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this project without any penalty. There are no foreseeable risks in participating in this study. The participants will not be paid for this study.

All research data will be preserved for reference or verification purposes.

I, therefore, request permission in writing to conduct my research at your organisation. The permission letter should be on your organisation's headed paper, signed and dated, and specifically referring to myself by name and the title of my study.

Please let me know if you require any further information. I look forward to your response as soon as is convenient.

Yours sincerely,

Ms. Nomvelo Mkhize
076 541 3663
2628110@students.wits.ac.za

Research Supervisor's details:
Dr Renee Horne
011 717 3612
renee.horne@wits.ac.za

10 Appendix C: Research consent form

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Title of project: South African unemployment: the case of geoscience graduates

Name of researcher: Ms Nomvelo Mkhize

I, ……, agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I can volunteer to take part in the study	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that direct quotations from my interview may be used by the researcher in their research dissertation	YES	NO
I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research dissertation	YES	NO
I agree that other researchers may use the information I provide in my interview (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on	YES	NO

…… (signature)
…… (name of participant)
…… (date)

…… (signature)
…… (name of researcher)
…… (date)

11 Appendix D: Participant Information Sheet (PIS)

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Dear Sir / Madam

My name is Nomvelo Mkhize. I am a Master of Business Administration student at the University of the Witwatersrand, Johannesburg. My supervisor is Dr Horne. I am conducting research on the factors contributing to geoscience graduate unemployment in South Africa. The study title is: South African unemployment: the case of geoscience graduates.

I am inviting you to take part in an interview. If you decide to take part, your participation in this research study will last about 30 minutes The interview will be conducted in-person, at a place of your own comfort and at your convenient time.

With your permission, I would like to audio record the interview. This data will be stored in a password-locked computer and will be kept for verification and reference purposes for at least 10 years. Only the researcher will have access to the data.

The interview will be confidential and anonymous. When I share the results of the research study, I will not include your name or anything else that could identify you. With your permission, other researchers may use the data collected from this research study, but your name and any personal information will not be used or passed on.

If you decide to take part in the research study, it should be because you want to volunteer. You do not have to take part. You can stop being in the study at any time. You do not have to answer any questions if you do not want to. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life, as the risk has been categorized as minimal.

This research study will be written up as a dissertation. The report will be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,
Nomvelo Mkhize

Researcher:
Nomvelo Pumla Mkhize, 2628110@students.wits.ac.za, 076 541 3663

Supervisor: Dr Renee Horne, renee.horne@wits.ac.za, 011 717 3612

12 Appendix E: Ethical clearance certificate

Graduate School of Business Administration
University of the Witwatersrand, Johannesburg

Wits Business School

Wits Business School Ethics Committee
Constituted under the University Human Research Ethics Committee (Non-Medical)

Ethics Clearance Certificate

Ethics protocol number: WBS/BA2628110/784

This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).

This certificate is only valid if accompanied by formal permission from the relevant stakeholder(s).

Project title	South African unemployment: the case of the geoscience graduates
Investigator / Researcher	Ms Nomvelo Mkhize
Nature of Project	MBA (Research Article)
Decision of the Committee	Approved, provided stakeholders and participants are guaranteed confidentialty.
Issue Date of Certificate	9/11/2023
Expiry date	Date of submission of the project / research report
Chairperson	Dr Pius Oba ☎ +27 11 717 3976 +27 82 733 6587 pius.oba@wits.ac.za

Declaration by Researcher

One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

Signature

12/09/2023
Date: