# Introduction

Over the past 50 years the South African labour market has been characterised by a history of skills-biased labour demand, with employment largely shifting from the primary sector towards the secondary and tertiary sectors (Bhorat & Hodge, 1999, Edwards, 2001, Bhorat et al., 2014a).   In recent years, continuing this trend, growth in high-skilled occupations has outpaced trends in medium and unskilled occupations (Bhorat et al., 2014). Alongside shifts in labour market demand have come changes in the higher education (HE) landscape in South Africa. For example, institutions formerly known as technikons have been amalgamated as universities of technology, several higher education institutions have merged to form larger institutions (e.g., The University of Johannesburg) and, extending from changes in secondary education and fee structures, access to higher education has increased substantially over the past 20 years.  Despite these changes, as indicated by recent analyses (e.g., Moleke, 2010) and reports published by the South African Department of Higher Education and Training (DHET 2018), enrolments for degree programmes producing graduates with skills low in demand in the economy continue to rise, while enrolments in scarce skills programmes remain low.

Coupled with ongoing structural unemployment, technological advancements, changes  in skills-demands, and global economic forces, has led to a significant skills-mismatch  in the South African economy (Pauw et al., 2008). Despite increases in the number of university graduates, there exists an over-supply of graduates unable to find suitable employment and an under-supply of graduates capable of fulfilling the demands of the economy (Reddy et al., 2016).

Amongst the complex mechanisms governing South Africa’s employment levels, the country has experienced dramatic growth in its labour force since democratisation in 1994. With a doubling of unemployment between 1995 and 2001, according to [(Banerjee et al., 2008)](https://www.zotero.org/google-docs/?oBbQg2) Moreover, a categorical shift from primary to secondary and tertiary sectors can be associated with a vast increase in demand for skilled occupations throughout the job market, altering “the composition of employment in terms of educational attainment, favouring more skilled workers” [(Banerjee et al., 2008, p.724)](https://www.zotero.org/google-docs/?QGQbZA)Furthermore, this shift in labour demand stemming from sectoral and economic changes, is structural by nature whereby a change in production methods is shifting the country towards a more technological and capital-intensive approach. According to [(pauw et al., 2008, p.45)](https://www.zotero.org/google-docs/?NJzQAs) “production is shifting towards more skills- and capital-intensive industries, while the adoption of technologically more advanced production processes has also had an adverse effect on demand for low-skilled workers”. In addition, this is exacerbated by globalisation whereby pressures to match competing global industries are high, and therefore  further decreases demand for lower skilled workers. In addition, the supply of labour being is also agitated by the emigration of existing skilled-labour market rigidity which often accounting for an increase in wage rates. This increase in wage rates primes the economy toward more efficient methods of production which in turn affects the structure of employment further, increasing demand for higher skilled workers, placing pressure on the existing labour force and graduates coming into the economy, increasing the intensity of a possible skill mismatch.

There seems to be a lack of conventional terminology used within the academic sources referenced, and this may create confusion when combining ideals, thus for the purposes of this study we refer to the ‘demanded skills shortage’, which acts as an umbrella term, encompassing a ‘skill mismatch’, arising from a direct mismatch between labour demanded and subsequently supplied, ‘quality mismatch’, referring to a mismatch arising from either a perceived or actual quality mismatch and lastly, ‘unskilled-labour growth’, referring to the portion of the shortage contributed to unskilled labourers without a formal standard of education entering the market. There seems to be a lack of conventional terminology used within the academic sources referenced, and this may create confusion when combining ideals, thus

The term skills mismatch describes the gap in skills between what the economy is demanding and the skills that are being supplied by the labour force. Studies and evidence shows that the mismatch occurs all over the world and across different sectors of the economy (Cappelli, 2015; Mateus et al., 2016; Mcguinness et al., 2017; Verhaest et al., 2017).

The South African skills mismatch has been discussed at length by Mncayi and ﻿Dunga﻿ in 2016, Grapsa in 2017, Bhorat et al. in 2017 and many others. There have been various factors throughout the country’s history that either directly or indirectly contribute to the pattern... Mncayi & ﻿Dunga (2016), for instance, argue that one of the major contributors has been that students end up in the incorrect field of study to meet the skills required in the economy.. In addition, the quality of education received by higher education institutes has exacerbated the problem (Reddy et al., 2016).

## Research Problem

The problem of a skills mismatch is compounded through the lack of truly informative and representative data that can be used to better grasp the skill mismatch that may exist within the South African labour market. This lack of information lies on both the demand side, in that information on what skills are demanded by the labour market is insufficient, and the supply side, in that information on what skills and knowledge graduates possess is insufficient.

## Research objectives

 To provide a structure to the investigation, x specific objectives were formulated.

·     Research objective one: *Identify whether a skill mismatch exists within the context of the South African labour market.*

·      Research objective two: I*dentify where this mismatch exists.*

·      Research objective three: *Identify trends with regard to this mismatch.*

## Approach

To address this issue, we look to make use of publicly available data sources. To obtain data about higher education institutions we will use the open data sets provided by the Department of Education and Training (DHET) and the Council for Higher Education (CHE). To obtain data about the skills and knowledge in demand we are going to use the Quarterly Labour Force Survey data produced by StatsSA. We will then combine these sets in a meaningful way to produce a detailed description of the mismatches, if any, between the two.

# Literature Review

To provide a theoretical grounding and contextual background we aim to unpack various characteristics of the demand and supply of South Africa’s labour market. In addition, both external and internal factors are considered when analyzing the skill mismatch phenomenon within South Africa.

## South African Labour Market

The following sections will dive into the South African labour market. Firstly, looking at the historical aspects due to the country’s history playing such a prominent role in the current economy. The section that follows will analyse the climate within the current labour force.

### Historical Aspects

[Bhorat (2005](https://www.zotero.org/google-docs/?2sP0AX)) demonstrates the dramatic growth of the labour force with an inability to absorb the mass of entrants since democratisation in 1994, solidified by [(Banerjee et al., 2008)](https://www.zotero.org/google-docs/?FAOSW9) noting the oversupply of labour to be overwhelming. It was understood that the main aspects attesting to such rates of disparity were age, race, province and education level [(Festus et al., 2016)](https://www.zotero.org/google-docs/?eloG40).

The South African labour market has traditionally been dominated by the primary sector, however, since 1970, there has been a shift towards a more capital intensive, secondary and tertiary sector driven economy (Bhorat et al., 2014b:1). This has led to a demand for better educated and more highly skilled workers to match the growth in capital intensity (Bhorat et al., 2014a:317). The South African labour market has struggled to meet this subsequent demand, with only 20.5% of the employed population having a tertiary level education in the year 2014 (Reddy et al., 2016:38).

The skills shortage that exists within the South African labour market has been attributed to, amongst others, the apartheid system, with the denial of quality education to the Black population of South Africa a substantial factor (Mateus et al., 2016:64). Van Broekhuizen, (2016:27) speaks of historically disadvantaged, or Black institutions (HDIs) and historically advantaged, or White institutions (HADs), with employability prospects still, to this day, affected by which category of institution an individual attended.

### Labour Force

Over the preceding decade the South African gross domestic product (GDP) has been characterised by low growth in real terms. Between 2008 and 2014 the average growth was 1.9%. Moreover, the South African economy is highly susceptible to external shocks. An example of this can be seen with the sharp decline in real GDP growth brought about by the 2009 global financial crisis (Reddy et al., 2016, p. 22).

As of the second quarter of 2018, the South African labour force consisted of 22.2 million people, of which 6 million were unemployed. In the second quarter of 2018, 39.3% of people aged 15 to 34 were unemployed. The high youth unemployment rate is further exacerbated by the demographic makeup of the country, with 53.5% of the working age population aged between 15 and 34 (StatsSA, 2018b).

According to [(Banerjee et al., 2008)](https://www.zotero.org/google-docs/?BSxkFx), increasing levels of unemployment can also be linked to ineffective methods of job seeking often brought about by spatial separation between business centres and outlying areas, expensive public transport, high crime rates and high start up costs associated within smaller businesses. However, although necessary to understand in the decomposition of employment rates, structural changes within the economy remain the most prominent features of these high figures.

## Labour Demand

### Structural Changes

Specifically, there is a disproportion expansion of higher-skilled vacancies in comparison to that of lower-skilled within the economy, testimony to the changing nature of labour demand in South [(Bhorat and Hodge, 1999, p.155)](https://www.zotero.org/google-docs/?fkbEvT) argue that the changing structure of labour demand, however, occurs from a shift in production methods resulting from “capital deepening or technological change”. Furthermore, [(Bhorat and Hodge, 1999)](https://www.zotero.org/google-docs/?STRR2X) attests that changes in the nominal wage rate and labour market rigidity during the 1980’s, within the mining sector, brought about a demand for increased production efficiency, changing the structure of labour demanded within the sector. Other examples of changes in the economy as a whole, can be seen with the rapid adoption of IT hardware, creating a movement from primary to secondary and tertiary sectors and incidentally increasing demand for higher-skilled workers. Reddy *et al,.* (2016) categorized this as a long-term structural shift towards a more service-oriented economy. Furthermore, Bhorat *et al*., (2014b:20) notes that within-sector shifts dominated between-sector shifts in the country as a whole. These different micro and macro-economic factors within the country are causing “a rising share of more skilled labour” and a “declining share of the lower skilled occupations” (Bhorat & Hodge, 2005).

### Technological Impact on Demand for Labour

Technology has many different effects on the labour market but it generally decreases the demand for unskilled labour (Bhorat et al., 2010). As previously discussed, between the period 1970-1995 the country was going through drastic changes. These included a vast number of new entrants into the labour market (most of them unskilled); a decreasing primary sector; and increasing capital intensity. This resulted in a massive increase in unemployment.

The trend of increasing demand for skilled labour continued between 1995 and 2005. Unemployment in the primary sector continued to rise due to the low price of capital relative to labour and the increasing importance of the high skilled tertiary sector (Bhorat et al., 2010).

### Globalisation

The rise of trade liberalisation in South Africa, through import penetration, exporting of raw material and foreign direct investment, has “raised the skill intensity of production” [(Edwards, 2004. p.45)](https://www.zotero.org/google-docs/?ocLAQU), altering the structure of labour demand in the country. Lawrence (2004) suggests that this trade liberalisation accounts for a “trade-induced technological change”, especially for the relatively skill-intensive export sector. . This trend of “labour-saving technologies” (Jenkins, 2008) is also consistent within “middle-income economies” (Lawrence, 2004) like Latin America and is particularly prevalent in the international market for raw materials. Moreover, import penetration has been associated with “defensive investment” (Jenkins, 2008), the movement to more efficient production methods favouring higher-skilled labour, reducing demand for lower-skilled workers. Lastly, foreign direct investment taking the “form of mergers and acquisitions” (Lawrence, 2004) are biased towards higher-skilled workers and is “more skill intensive, capital intensive, productive and export-orientated than domestic owned firms” (Lawrence, 2004), causing a decrease in demand for lower-skilled employees which is further exacerbated by technological transfers which enable a rise in “labour productivity through the shedding of labour” (Lawrence, 2004).

## Labour supply

### Higher Education (HE) landscape

Prior to 2004, the South African higher education landscape consisted of 36 higher education institutions (HEIs), comprising 21 general academic universities and 15 technikons. Historically, this landscape has been fragmented in terms of function, governance, funding, and therefore the quality of education provided. Since the democratisation of South Africa, various policy changes have been implemented, including the amalgamation of the 36 HEIs into 11 traditional universities, 6 comprehensive universities, and 6 universities of technology. Following from these policy changes, a substantial rise in the number of annual graduates from HEIs has been observed, with a count of 40 000 graduates in the year 1986 rising to 165 000 in 2012 and 203 076 in 2016 (DHET, 2018:21). Despite this growth, a steady decline in the ratio of graduates with a National Qualification Framework (NQF) exit-level of seven or higher (university degree holders), to those with NQF exit-levels of five or six (diploma and/or certificate holders) has been observed. This change is suggestive of a decline in the growth of skilled labour, where, in this case, the level of skill is defined through the proxy of educational qualification.

Considering graduate production by field of study, in the most recent findings, 29.1% of graduates were from the Science, Engineering and Technology (SET) fields, followed by  27.8% of graduates in Business and Management, then 22.4% in all other Humanities, and finally 20.7% of graduates in Education (DHET, 2018:21). Reddy et al. (2016:89) note that, given the need to enrol and graduate higher numbers of individuals in the SET field, the fact that SET graduates make up the biggest proportion is a positive outcome. Although there is an increase in demand for skilled labour, it is interesting to note that a paradox exists in that there is also an increase in the unemployment rate of graduates. A recent survey for example, showed that only 60% of students chose a degree based on employment probability (Pauw, Oosthuizen & van der Westhuizen, 2008:52), with Mncayi & Dunga (2016) noting that there is an oversupply of qualifications for skills that are not in demand.

### Emigration of Skilled Workers

 Mateus et al. (2014) argue that a major contributor to the skills shortage in South Africa is the loss of skilled people to emigration. The reasons skilled workers leave the country can be divided into push and pull factors. Push, also referred to as internal factors, being from within the country - such as crime, affirmative action, Black economic empowerment, poor education standards and inadequate government provisions for health care. Pull, also referred to as external factors, are those that are from the receiving country and include wage differentials, differences in quality of life, better education opportunities for children, intellectual freedom and political stability.

Since 2003 South Africa has not kept statistics on emigration. Due to the lack of statistics, Kaplan and ﻿Höppli (2017) based their study on South African born people living in the five major English speaking countries (England, Australia, New Zealand, Canada and the USA). They argue that due to high skills requirement of getting into these countries, any South African born people living in them, count as a loss of skills. Kaplan and ﻿Höppli refer to the loss of skills due to emigration as the ‘brain drain’. The study finds that the rate of the brain drain is increasing and will likely continue to accelerate. The brain drain is contributing to South Africa’s slow growth and could greatly hinder future growth.

### Unionisation and Rigidity

Festus, Kasongo, Moses, & Yu (2016) allude to the notion of market rigidity to “significantly influence the efficiency and equilibrium” of the economy, and especially that of the labour market. An example can be seen when considering the rising wage rates within sectors as a result of unionisation and labour brokers. This increase may lead to a production reformation which ultimately sees the shedding of lower skilled ‘expensive’ workers for more efficient methods of production, often with the use of technological advancements.

## Skills Mismatch Globally

### Towards a definition for skills mismatch

According to Reddy et al. (2016:16) skills are socially constructed and therefore difficult to define, however, in practical terms, educational qualifications may be used as proxies for skills. A skills mismatch is defined by (Pellizzari & Fichen, 2013:6) as the difference between the skills possessed by a worker and those required to perform their job.

There is evidence of skills shortage on a global scale, with (Mateus et al., 2016:1) claiming that countries, employers and organisations continuously express unhappiness with regards to having a shortage of skilled workers in various sectors of their economy.

### Categories of Skills Mismatch

Skills mismatch can be divided into three different types: *demand mismatch*, *educational supply mismatch* and *qualification-job mismatch* (Reddy et al., 2016). A demand mismatch is when the skills being demanded by the economy are not appropriate for the skills that are available in the labour force. For example, in South Africa there is a demand for high skilled labour but an oversupply of low skilled labour. Educational supply mismatch occurs when the skills in demand in the economy are not being supplied by the qualifications being produced by the education system. Qualification-job mismatch occurs when those in the labour market are employed in a field that does not correspond to their educational qualification (e.g., a civil engineer working in the finance sector)  (Reddy et al., 2016).

### International Studies on Skills Mismatch

Pitan and Adedeji  (2012:91) found that employers in Nigeria believed that university graduates were poorly trained and did not have the required skills necessary on the job. Indeed, they found that a skill mismatch of 60.6% existed amongst recent graduates.

Mateus et al., (2016) make reference to the issue of a skills shortage in both Australia and New Zealand, and how they have attempted to address it. In New Zealand for example, the government launched the Skills Action Plan which involved initiatives such as allowing foreign nationals to take on employment in scarce sectors, increased investment in training and apprenticeships, and improved literacy and numeracy campaigns. In Australia, the government also understood the need to respond to their issue of skills shortage. A key strategy introduced involved the establishment of various visa subclasses allowing skilled immigrants to find work and live in Australia (Mateus et al., 2016:70). The article also states that several members of the European Union are experiencing similar skills related issues, with low employment rates, specifically among unskilled individuals.

## Skills Mismatch in South Africa

The shift in the South African economy to a more capital intensive, service-driven structure has led to a shift towards a strongly skills-biased labour demand (Bhorat et al., 2014b:1). Mateus et al., (2016) claim that South Africa is experiencing a shortage of skilled labour and suggest that the Apartheid system, poor post-apartheid education, and the emigration of skilled workers are the primary contributing factors. Supporting this claim, is the statement that the increase in skilled and semi-skilled employment is considerably less than the increase in the supply of labour with tertiary education, suggesting that a skill mismatch exists (Dias & Posel, 2007:26). In other words, there is a supply of skilled graduates, however the skills they possess are not those demanded by the labour market.

### Fields of Study and Graduate Unemployment

Statistics can be misleading on the extent of the graduate unemployment problem due to different definitions of ‘graduate’. For instance, many studies group different qualifications types together (e.g., grouping college graduates with diplomas and university graduates with degrees together) (van Broekhuizen, 2016). However, given this, graduate unemployment is still high. Mncayi and﻿ Dunga, (2016) suggest that one of the reasons for the graduate unemployment problem is that graduates do not consider employment prospects when deciding on their field of study. As a result there are higher levels of unemployment in graduates from certain fields of study and an oversupply of skills not demanded by the economy. There is a high level of demand and many vacancies for certain types of skills but a shortage of people with the qualifications to fulfil that demand (Bhorat & Kimani, 2017, Mncayi & Dunga, 2016). 2012 data shows that while there were 600,000 unemployed graduates, the private sector had 800,000 jobs available ﻿(Mncayi & ﻿Dunga, 2016, p. 414).

### Quality of Education

Data from the years 2010 to 2014 has shown that participation in Technical and Vocational Education and Training (TVET) colleges and universities has increased (Reddy et al., 2016), and it has been suggested that individuals with at least a matric level education, have a decreasing probability of unemployment with increased levels of education (Dias & Posel, 2007). This is supported by the findings of Van Broekhuizen & Van der Berg (2012), who state that graduates, who they define as, “individuals with bachelor’s degrees or equivalents and higher educational qualifications,” as, from and especially beyond matric, having a strong decline in unemployment probability. Dias & Posel (2007), however,  also make reference to the fact that the more educated are not entirely insulated from the growing unemployment that exists in South Africa, and that a possible reason for this may be that potential employers are worried about the quality of education that these scholars receive. In terms of primary and secondary education, Pauw, Oosthuizen, & Van Der Westhuizen (2008) assert that 82% of graduates accepted into tertiary institutions were functionally illiterate, and more than 60% were unable to cope with the level of mathematics and science offered at the institution. Furthermore, noting the heterogeneity in quality of education received at tertiary institutions*,* Van Broekhuizen (2016:26) suggests that the reputation of the particular HEI an individual attended may provide a stronger signal for the potential skills of the individual than the actual qualification held. This means that people need to take into account not only their field of study, but also the institution they attend (﻿Bhorat et al., 2017).

 Reddy et al., (2016) explicitly state that the quality of education in South Africa remains elusive, “leading to low progression through programmes in all-educational institutions, as well as low completion rates from schools, TVET colleges, and universities,” which ultimately exacerbates the skills mismatch that exists.

# Research Design

The study set out to study the skills mismatch  within the country. Education was considered a proxy for skills and as such the supply of graduates was used to represent skills supply. The labour market data collected used to represent skills demand. The following sections will go into greater detail about the data sources and design of the study.

## Data Sources, Processing, and Analysis

Any investigation of labour market dynamics in South Africa is constrained by the availability, coverage, and completeness of relevant data sources. This section begins with an exposition of the data sources used in this analysis and, following this, provides an overview of the procedures adopted to process, combine, and analyse the resulting datasets.

### Data Sources

The analysis presented in this study made use of two distinct sources covering South African labour market trends and graduate characteristics for the period under consideration.  The first source, the *Labour Market Dynamics in South Africa*(LMDSA) datasets (2010 - 2017), consisting of pooled (yearly) data produced on the basis of the rotating panel household sample surveys —the *Quarterly Labour Force Surveys* (QLFS)— conducted by *Statistics South Africa* (StatsSA) for 2010-Q1 to 2017-Q4.  These surveys collect ‘data on the labour market activities of individuals aged 15 years and above’ residing within the country from a sample of approximately 30 000 households per wave.  The survey covers a large set of variables which include respondents’ current occupations, industries, and employment statuses. The second source of data was produced using the DHET’s *Higher Education Management Information System* (HEMIS) through the powerHEDA dashboard. This dashboard enables querying of a data warehouse containing detailed records from HEMIS for all public higher education institutions in South Africa, including the *Classification of Educational Subjective Matter* (CESM) categories,  graduates, and enrolments.   While LMDSA datasets were available for the period 2008 - 2017, owing to changes from the 1982 CESM classification system to the 2008 classification system (persisting in to 2009), consistent HEMIS data was only available for 2010 graduations. Consequently, in the analysis to follow, LMDSA and CESM data were considered for the period 2010 to 2017.

## Data Processing and Analysis

The LMDSA data was downloaded from the DataFirst repository  by the University of Cape Town (UCT). Ten datasets were downloaded, one for each year for the period 2008 until 2017. The relevant variables were extracted from each (e.g. occupation, field of study and education level) and datasets were combined to form a single set spanning all ten years. The CESM data comes in a form that does not require much processing other than the removal of irrelevant artefacts.

### Higher Education Percentage

As this paper focuses on a skills mismatch, only ‘skilled’ occupations were considered. The level of education was considered a proxy for skills and occupations were filtered as such. The levels of education considered for this filter included ‘*Bachelor’s Degree and Post Graduate Diploma’, ‘Bachelor’s Degree’, ‘Bachelor’s Degree and Diploma’, ‘Higher Degree (Masters, Doctorate)’, ‘Higher Degree (Masters/PhD)’, ‘Honours Degree’, ‘Post Higher Diploma (Masters; Doctoral Diploma)’,* and *‘Diploma with Grade 12/Std 10’.* The collection of these levels are hereafter referred to as ‘Higher education levels (HE)’, and an individual that has received a HE level is referred to as a ‘graduate’*.* The proportion of graduates within an occupation is referred to as the HE percentage of that occupation. Occupations that had a HE percentage of less than 30% were removed from the dataset, as it was subjectively decided that occupations that did not meet this threshold were not to be considered as skilled occupations. This procedure was carried out independently for each year that was considered. For example, if for the year 2010 the occupation Nursing had a HE percentage of less than 30%, but for the year 2011 it was above 30%, the occupation would be removed from the 2010 data and would remain in the 2011 data.

### Categorizations of Occupations

Following on from the classification of graduates and the subsequent removal of occupations whose HE percentage was less than 30%, the occupations that remained in each of the years investigated (2010 - 2017) were considered. These occupations were individually placed into occupation categories that were believed (basis of this belief is discussed in the following paragraph) to best describe them using a more general term. These occupation categories are hereafter referred to as ‘bins’. For example, the occupations ‘Accountants and related occupations’, ‘Bookkeepers’, and ‘Government tax and excise officers’ were placed into the ‘Accounting’ bin.

When matching these occupations to bins, there existed many occupations that could be placed with high confidence into their relevant bins – such as the ‘Economists’ occupation to the ‘Economics’ bin. However, there were also occupations with which a relative amount of uncertainty existed as to which bin was most relevant to that occupation, and these therefore needed to be more carefully considered before placement. In order to best make these placements, various factors were considered, such as, the field/s of study relating to said occupation (e.g. if management majors were prolific in that occupation, that occupation may be placed in the ‘Management/Logistics’ bin), and the HE percentage relating to that occupation (e.g. if an occupation had a relatively low/high HE percentage, it would not be placed in a bin where the other occupations in that bin had a relatively high/low HE percentage). For example, ‘Petroleum and natural gas refining plant operators’ was considered for the ‘Chemical engineers’ bin, however, upon observation of the HE percentage of this ‘Petroleum and natural gas refining plant operators’ occupation, it was found to be relatively low when compared to that of occupations in the ‘Chemical engineers’ bin, and was therefore found to be more appropriate to be placed in the ‘Labourer’ bin. *[Add table of categorisation as Appendix].*

### Average of Higher Education Scope

Following on from this, the *average* HE percentage for each bin over the years considered was calculated. Bins with an average HE percentage of less than 30% overall were removed from the dataset. This was done in order to provide a list of bins that could be considered as higher skilled bins.

### Exclusions

Certain occupations do not occur as regularly as others within South Africa and due to this some bins had very few people in them. The bins are needed to make inferences about the demand and supply of skills in South Africa. Bins that had very few people in them cannot be used in any extrapolation to the rest of the economy, as any change in numbers within those bins would reflect as a disproportionate change in comparison to other bins. Inaccuracies can also occur when using a small percentage of the population to make inferences about the rest of the country. Due to the above reasons, the decision was made to exclude bins that had averaged of less than a hundred people for the time period considered. This meant that 16 bins were removed and 10 remained.

### Binning CESM

The CESM categories had to be matched to the occupation bins created to determine the differences in demand and supply in these bins. The second order CESM data is considered as the supply side. The second order was used because the first order was considered too broad and the third order too specific. To match the CESM data to the bins they were manually went through the fields of study and matched any fields that we had a high degree of confidence (e.g. mapping ‘Accounting And Related Services’ and ‘Taxation’ to the Accounting bin). Fields of study that could not easily be matched to a bin were evaluated using the LMDSA data. Using the fields of study variables in the LMDSA data, it became possible to view what sectors the people that study these fields worked in. For example, most people that graduated with ‘Afrikaans Language And Literature’ worked in the education sector and therefore fell into the ‘Education’ bin. Similarity to ‘Afrikaans Language And Literature’, most people that studied ‘Public Administration’, work in education and were therefore mapped to the education bin. The second order CESM data originally had 245 categories and 156, of the original categories, were matched to our 10 bins.

 The combining of the datasets is done with the aim of comparing and contrasting the two datasets in order to better understand the difference between the demand for skills in the labour market (LMDSA) and the supply of skills to the labour market (CESM). This comparison was considered best when making use of annual proportions - more specifically the number of workers/graduates that fell within a bin as a proportion of that year’s total professional workforce (LMDSA) or that year’s total graduates for the bins considered (CESM). Proportions were used in order to normalise across the data sets. This is necessary as the size of the data sets differs considerably in that LMDSA data represents a sample of the South African population (and is therefore relatively small), whereas CESM data represents the South African graduate population as a whole (and is therefore relatively large). For example, for the year 2010, the number of workers within the ‘Education’ bin as a proportion of the total professional workforce was 25.16%, and the number of graduates within the ‘Education’ bin as a proportion of the total graduates for the bins considered was 32.57%.

To further understand and analyse what was being seen in the mismatch graphs, more graphs were created. The graphs look at the unemployment within a specific bin for each of the years considered. For example, the accounting unemployment was calculated by making unemployed accountants a proportion of the total people within the accounting bin.

# Analysis & Results

The following section represent the analysis of all data considered and will be conducted on both an individual basis for *CESM* and *LMDSA,* before in combination to establish any proceeding Skill Mismatches, in addition, the yearly unemployment rates will be incorporated to reveal any misleading information present between the two datasets. Moreover, sub-sections have been divided between Oversupply and Undersupply, and are determined by the difference between a occupations demand and supply; hence occupations where the *CESM* observations are higher than that of *LMDSA*, the occupation will be understood to be an oversupply, and vice-versa. Lastly, a section denoting yearly, and total unemployment rates will be incorporated for an overview of each occupation as opposed to trends as seen in the yearly graph.

## Overview of Data Considered

The first corresponding graph in sections 4.2 and 4.3 represent both datasets comparatively for each occupation, grouped by either an oversupply or undersupply, in addition, the categories selected for visual representation are those both above the *HE* threshold and containing more than 100 participants on average throughout the years considered. Moreover, the proportioned data contained within *CESM* is represented by an orange line, and all proportioned data contained within *LMDSA* is represented by a blue line. Lastly, all dataset observations have been normalized by using a proportion basis aggregate, allowing for comparison.

The second corresponding graph within sections 4.2 and 4.3 represents the yearly unemployment rate for each category considered. This is representative of the unemployment within each category, compared as a proportion to it’s employed proportion. Therefore, this considers for example, the unemployed accountants as a proportion to the employed accountants.

## Oversupply

The corresponding relations are categorized as having a skill mismatch, tending strongly toward an oversupply of graduates within the economy, compared with a demand for employment. This is highlighted by a larger proportion of students graduating from tertiary institutions, than those working within occupations requiring that degree, across only those categories analysed. In addition, the visual representation, shows the proportioned labour force as a blue dotted line, and the red dotted line as the proportioned graduates; both across only the categories considered.

### Accounting

The *CESM* data is representative of a downward sloping trend, decreasing from 22% in 2010 to 20% in 2017. In addition, there is specifically a downward trend experienced from 2010 to 2014; however, interestingly enough the figure in 2017 is still above it’s all time low experienced in 2013 and 2014. Throughout the *LMDSA* data, a more turbulent trend exists between the years considered. An upward trend is observed between 2010 and 2012, a downward trend between 2012 and 2014, and lastly an upward and downward between 2015 and 2017; although it is interesting to note that the last data point is representative of an upward movement in the job market, and is in fact the highest point experienced across all the years considered. Comparatively, the *LMDSA* and *CESM* data, point to an oversupply of accounting graduates, with a convergence occurring between the datasets in 2017, with a difference of 11 percentage points. Furthermore, it is interesting to note that the highest different in proportion tending towards an oversupply, in our data, appears within the accounting category. Lastly, according to the yearly unemployment rates, a relatively small upward trend is experienced in 2015, however, this decreases back down to 0% within the category itself thereafter and for all other years considered.

### Computing

The *CESM* data remains fairly constant throughout the years considered, tapering off towards the end, with a low experienced in 2016, however, a proceeding upward trend is observed thereafter. Throughout the *LMDSA* data, a downward trend is observed until 2013, whereby an exponential increase is observed before tapering off from 2015, however, the convergence between 2015 and 2016 is stronger than all other years, with a divergence experienced by both data sets in 2017. Comparatively, theaverage between both the demand and supply within the economy is 4,1 percentage points, however, the category is still categorized by a mismatch tending toward an oversupply of graduates. Lastly, according to the yearly unemployment, there exist two spikes in unemployment, both in 2014, the larger of the two, and in 2016. In 2015, the unemployment rate within the category is 15%, and 4% in 2016. It is also interesting to note that the unemployment rate in 2013, 2015 and 2017 is 0% within the occupation itself.

### Law

The *CESM* remains constant until 2014, before experiencing an upward trend till 2016 with no difference between that and 2017. Within the *LMDSA* data, an overall upward trend is experienced through increasing and constant movements between all years considered, with the highest constant points observed from 2015 throughout. Comparatively, the largest gap between demand and supply is experienced in 2010, 2011, 2016 and 2017, by 8 percentage points. Lastly, according to the yearly unemployment graphs, in the year 2015 unemployment within Law dropped to 0%, before increasing back to 1.3% for all preceding years.

### Medical

The *CESM* data is constant throughout the years considered, with two movement experienced overall. The first, an increase between 2012 and 2013, and the second a decrease in similar margin between 2016 and 2017, however, the difference between the maximum and minimum points is still only 1%. According to the *LMDSA* data though, the difference between maximum and minimum points is 4%, with an increasing trend experienced between 2010 and 2012, and a decreasing trend until 2016, before a sharp incline in 2017.Comparitvely, in 2017 convergence is occurring, with a decrease in the amount of graduates, with an increase in the demand for such labour in the job market. Lastly, according to the yearly unemployment graphs, medicine experiences a spike in 2015 of just over 2.5 before moving back down to 0% in the preceding year. There is also an upward trend experienced in 2017 to its high of 6.33%.

## Undersupply

### Education

The *CESM* data is initially increasing at a decreasing rate until 2014, before a sharp decline in 2015. Although, fluctuations appear as minimal movements with a change of only 3 percentage points, where in comparison the *LMDSA*data experienced movements of 11 percentage points between its high in 2011 and low in 2016. In addition, the *LMDSA* data has an overall downward trend whilst the *CESM* data is relatively constant, indicating both a decrease in the amount of employment within the category indictive of the *LMDSA* data, and a convergence between both datasets. Moreover, the yearly unemployment within the category remains fairly low and constant, and although there is a large initial difference indicating a large skill gap of an undersupply, narrowing from 2016 (on the employment side), there is still very little movement in unemployment for educators within the economy.

### Insurance/Finance

The *CESM* data remains constant throughout all years considered, with 1% movement both upward and downward throughout. The *LMDSA* data has an initial downward trend, moving to its low in 2012 of 8% of the overall proportion. In addition, another interesting artefact within the *LMDSA* data, is the sudden increase from 2015 to 2016, indicating a sudden increase in demand from an increase in employment (of 4%) whilst graduates remain constant; this however tapers off in 2017.  Moreover, a downward trend is observed in the yearly unemployment rates, however, the total movement from 2013 to 2017 is only a decrease of 1 percentage point.

### Nursing

There is little movement within the *CESM* data, with a fluctuation of 1% in various years; however, comparatively, there is little movement in *LMDSA* data, with fluctuations of 3%. Although *CESM* is constant until year 2013, *LMDSA* starts off with a downward trend. In addition, whilst *CESM* remains constant from 2016, another downward trend is experienced within the *LMDSA* dataset, indicative convergence through a decrease in employment and thus a decrease in demand.

## Equilibrium

### Management/Logistics

The *CESM* data experiences an upward trend, increasing from 17% in 2010, to 20% in 2017. However, although observing fluctuations within the *LMDSA* data, the convergence of both datasets indicates equilibrium, with the category experiencing fluctuations general economic cycles. This may also be an artefact experienced only by the *LMDSA* data (employment may be more elastic to cyclic changes than tertiary output, which may also experience a higher impact lag), and hence why fluctuations are more turbulent within this dataset; justifying to a further extent an equilibrium between job supply and demand within Management/Logistics. Moreover, unemployment within this category is 0% between 2014 and 2016 with a small trend upward in 2017.

### Social Work

Both the *CESM* and *LMDSA* data are comparatively similar and hence indicative of an equilibrium within the demand and supply of skilled labour within this category. Within the *CESM* dataset, there is a small trend upward in 2014 by 1%, and thereafter remains constant. Within the *LMDSA* dataset, there are several fluctuations throughout the years considered, however concludes at a higher percentage proportion in 2017 than every other year than 2011.

### Human Resources

The *CESM* data is representative of an upward trend to a high in 2012 of 7% of the proportion, before declining to a low of 4% in 2017, with a sharp upward movement in 2012, and a strong convergence thereafter. However, the *LMDSA* data is relatively consistent, and converges after 2014. Moreover, it is interesting to note that the data also declines in 2017, in the same proportion as that of the *CESM* data. However, in all years considered (excluding that of 2012), there is a difference of 2% or less, indicating an equilibrium between skills demanded and skills supplied. Although, according to the unemployment graphs, relatively high unemployment is experienced within the occupation; an increasing movement to 2014 is experienced, before a decline is experienced till 2016  and then a sharp increase to its highest point in 2017 of 14%.

## Total Unemployment Per Bin

Similarly to the graphs that show unemployment per bin by year, the current figure denotes  total unemployment per bin from 2013 to 2017. This graph needs to be interpreted in conjunction with skills mismatch graphs, as confusion may occur. Primarily, unemployment is not a sufficient indication of a skill mismatch, for example, higher unemployment may not be indicative of an undersupply within the occupation.

From Total Unemployment Per Bin graph we can see that between 2013 and 2017 the Insurance/Finance bin had an unemployment rate of over 40%, the highest of our bins. The lowest unemployment rate of our bins came from the Accounting bin with an unemployment rate of lower than 5%.

# Discussion

## Overview of Discussion

### Medical

As discussed above, a mismatch appears to exist within the medical bin. At first, this mismatch seems unlikely, as there is a known shortage of medical practitioners in South Africa. However, upon further investigation, according to(ENCA: No jobs for trainee pharmacists, doctors despite shortage, 2017), “experts believe there has been an increase in the number of trainees but the public health system simply can’t absorb them- despite a critical shortage of staff at public health facilities.” It is stated that this is not so much a problem of oversupply, but rather an issue of scheduling. In other words, there is indeed a number of medical workers being supplied to the labour market, however this supply simply cannot be absorbed by the market itself, leading to the shortage that we observe. Minister of Health Dr Zweli Mkhize has cited a lack of funding as a cause (Business Tech: South African healthcare workers say they are emigrating because of the NHI, 2019). This shortage is likely compounded by the fact that the emmigration of healthcare professionals is a problem often cited. This emigration however appears to be decreasing in recent years, perhaps contributing to the convergence that we see towards the latter stages of the graph (Labonté et al., 2015).

### Social Work

The findings for social work are interesting, as when researching the current state of social workers within the South African context, there appears to be a shortage, with acting director of the Department of Social Development Nelisiwe Vilakazi stating that “3000 social graduates who received scholarships from the department” were unable to be employed (Nkosi, 2018). This suggests that a similar issue to that of the medical field exists, in that there is in fact a need for more social workers, but an inability of the labour market to absorb them, with lack of funding cited as the reason for this inability (SA news: Hope for unemployed social workers, 2019).

### Accounting

The mismatch that exists for the Accounting bin an interesting observation. There exists less demand in the labour market than there is supply i.e. there is an oversupply of skills. In other words, there are less jobs that require accounting related skills in the labour market than there are number of people that are studying accounting related skills. This is interesting as, according to de Jager & van der Spuy (2017:1), the South African Institute of Chartered Accountants (SAICA) frequently reports that there is a shortage of CA(SA)’s in South Africa. This is not a universal view however, with Van Wyk (2014) investigating the phenomenon of newly qualified CA(SA)’s struggling to find jobs, stating that “the current state of the labour market, the role of audit firms, having sufficient experience, as well as personal choice and perceptions” have an impact. This view is supported by Jager & van der Spuy (2017:6) concluding in their article that “South Africa seems likely to have an oversupply of newly qualified CAs(SA).” This could explain the oversupply of Accounting related skills that is suggested by our data.

### Nursing

As previously stated, a shortage of graduates in the nursing bin exists. This finding is supported through Comiskey, C.M. et al. (2015:647), stating that “within South Africa nursing education outputs do not meet demands.” According to Geyer (2016) there has been an increase in the urgency to generate nurses in South Africa in order to address the issue of an increasing burden of disease, with a number of policy changes reflecting this. However, the labour market is unable to absorb graduates, with an article in News24 addressing the issue of qualified nurses unable to find work, stating that the government is funding studies, however there exists no funding for posting graduates (Mkize, 2019).

### Management/Logistics

The equilibrium observed could be due to a variety of factors, such as the natural fluctuation of the Management/Logistics related labour market. This volatility could be exaggerated by the fact that the Management/Logistics bin likely consists of professionals with a wide variety of skills that can be applied across many of our bins considered, consequently professionals from other bins could apply their skills in the Management/Logistics bin. Therefore, the natural fluctuation that occurs could see many individuals both leaving and entering this Management/Logistics bin throughout the years considered, resulting in the volatile trend observed.

### Law

While the data and graphs imply that there is a high oversupply of lawyers in South Africa, this might not be the case. Many law graduates may not be employed in the market due to law firms believing they do not meet their skill quality requirements or do not possess certain required skills [(Gravett, 2018)](https://www.zotero.org/google-docs/?cRWYgy). This problem lead to Wits University removing their four-year straight LLB program and therefore requiring people to first finish a prior undergraduate degree to complete a postgraduate LLB program (Maseko, 2016).

### Education

While the graphs show a trend of convergence, between the supply the demand, this could be influenced by teachers leaving the South African labour market. The data shows that the number of people working within the education sector in South Africa has been on a steady decline since 2013. While a number of factors can be linked to this decline, much of it can be connected to the migration of South African educators. In October 2018, the New Zealand Minister of Education made a statement that they would be hiring teachers from a number of countries (South Africa included) to deal with their shortage of teachers (Gous, 2018). This is part of a well discussed trend of skilled South African’s leaving the country due to a number of push and pull factors.

The steady decline in the number of teachers can also be partly accredited to the violence against teachers. Teachers feel unsafe and vulnerable at work due to them being threatened by students that will even use weapons. The effects of these incidents are not isolated to the school or area where they occur but affect the whole education community. Eventually educators reach a point where they can no longer deal with violence or the feeling of the vulnerability and leave the profession (Masweneng, 2018). The violence against teachers has also exacerbated the emigration problem. Teachers feel unsafe in South Africa, and the opportunity to work in a safe environment, for a better salary, in a different country eventually leads to them emigrated. (Dlamini, 2019).

### Insurance/Finance

The graph shows that the insurance and finance skills are in undersupply and have been for the entire period considered. In 2014, Western Cape government worked together with UCT to conduct an assessment report on financial services sector. The report assessed the entire sector within the province, including skills deficits and difficulties in recruitment of skilled personnel. The report found that, within the financial services sector, there was a large list of skill deficits. Many of the skills on the list are deficits that many sectors or the economy as a whole are experiencing (e.g. IT skills). However, there are a large number of skill deficits that are specific to the sector and can only be developed through education or work experience (e.g. actuarial skills). Recruitment/retention of skilled personnel was also found to be a major problem within the sector. This was specifically seen in skills with high demand such as IT skills. Due to this demand, people with these skills have a wide variety of job options and the financial sector is often the least attractive of these options (“Financial Skills Shortage is Critical, Province Intervenes to Meet Demand,” 2014). While this report was specific to the Western Cape, it does DHET (2019) report of the supply and demand of skills in South Africa further supports has been found in the data. The report used 2016 data to analyse surplus and shortage of skills at an industry level. The Banking Sector Education and Training Authority (BANKSETA) and the Insurance Sector Education and Training Authority (INSETA), the sectors which best suit our finance/insurance bin, were found to have shortages.

### Computing

The computing bin was categorised as having an oversupply of graduates. This goes against what many believe and what is reported in much of the media. However, the MICT SETA (Media, Information and Communication Technologies Sector Education and Training Authority) published a Career Opportunity Guide in 2012. MICT SETA estimated an oversupply for the period of 2011 to 2013 in the “Information and Communications Technology” subsector (the sub sector that best matches our computing bin) (MICT SETA, 2012). The report’s findings support what is being seen in the computing graph where the mismatch occurs in 2011, 2012 and 2013. The graph shows a mismatch in 2014 but is also the year that convergence between the supply and demand begins.

The MICT SETA (2018) conducted the Sector Skills Plan 2019 to 2024. The findings show that emigration of workers is not a concern for the “Electronics, Information Technology and Telecommunications (ICT)” subsector, but highlight that many companies recruit people to be deployed in projects being run in other countries. These people are deployed in the country for the extent of the project. While these workers are still part of the South African labour force, they are not captured by the StatsSA labour market survey. Therefore, the computing profession may play a bigger role in the labour market than what is reflected in the data.

# Limitations

The dataset that is used to denote demand of skills is a representation of South Africa. As stated throughout the study, South Africa a relatively low skilled country with a high unemployment rate and an oversupply of low skilled workers. Due to the data being a sample used to represent the South African labour market, there are few skilled workers captured in the data. This means that there are limits to studying the movement of skilled personnel within the labour market. The limitations are part of the reason that many jobs could not be analysed and had to be removed from the study. The removal of the bins means that those fields were not analysed for a skills mismatch.

The lack of formal data being recorded on emigration of skilled workers creates another limitation. While much of the literature highlights the South African brain drain as major hindrance on the economy, the extent of the effects cannot be fully analysed. More research and better data are needed to know the full magnitude of the effects.

# Conclusion

The study set out to determine whether a skills mismatch existed within the South African economy, in which industries a mismatch is occurring and the extent of the mismatch within such industries. Before looking at the mismatches, a better understanding of the South African labour market and the concept of a skills mismatch was needed. As such, the literature review studied the South African economy, the labour market, skills supply, skills demand and explored the skills mismatch concept both through its external and internal factors. From the literature it could be seen that there was a strong body of evidence supporting that a skills mismatch existed in the country. Stemming from both historical concepts and a structural change in labour demand.

This study furthered the research by using the labour market survey data to represent demand and the graduate data to represent labour supply, whereby a skill mismatch may be determined The findings from the analysis and discussion was that a skills mismatch did exist within the country within certain bins, however also alluded to the complexity of the mechanisms governing the country. In particular, the discussion found certain anomalies which paved the way for further analysis into unemployment trends, to be used alongside the derived skills demand. The mismatches did not exist in all the jobs analysed and these were categorized as being in equilibrium. The remaining jobs were either considered to be in oversupply such as *Law, Accounting Computing and Medical*; or to be in undersupply such as *Education Insurance/Finance and Nursing*

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