

INNOVATE DURBAN

A person wearing a VR headset is shown interacting with a digital wireframe sphere. The person's hands are positioned as if they are touching or manipulating the sphere. The background is dark with a grid of small white dots. There are several colorful circles (yellow, red, green, purple) scattered around the person. The overall theme is technology and innovation.

THE STATE OF
INNOVATION
IN KWAZULU-NATAL

2022

ABOUT INNOVATE DURBAN

Innovate Durban was initially established in 2013 as the Innovation Programme of the eThekweni Municipality, and subsequently set up as a separate Non-Profit entity in 2016. The organisation was set up as a special purpose vehicle to support innovation, innovators and associated ecosystems through programmes, research, capacity building and skills development. The programmes and activities of the organisation are implemented through virtual and physical platforms.



VISION

To be a leading innovation agency that transforms the region into a dynamic and inclusive innovation ecosystem.



MISSION

Nurture, coordinate and facilitate an inclusive innovation ecosystem through utilising the 4th Industrial Revolution for economic growth and job creation, with a focus on industry, spatially excluded or marginalised persons, the public sector and small, medium and micro enterprises.

The mission is expanded into the following objectives:

Create momentum for, and drive projects and programs in the city that innovatively tackle social, system and structure issues that hinder growth and perpetuate poverty.

Collaborate with and connect stakeholders from all spheres to work together to ‘disrupt’ thinking and practice and create new opportunities for active participation by all in growth and renewal.

Connect those in need with real opportunity, by providing, inter alia, practical tools and training, access to resources and support for self-improvement, business start-ups and community-building and upliftment.

Celebrate the city of Durban, promote all that it has done and will do for its citizens, to attract, retain and support the business and investors needed to underpin growth and development. Therefore, the four key objectives adopted by the organisation to spark innovation within the region are:

CREATE | COLLABORATE | CONNECT | CELEBRATE

ABOUT THE INNOVATION PUBLICATION

The Innovation Publication is developed and published annually by Innovate Durban with the objective to celebrate innovation, as well as to provide information to all stakeholders, including innovators and investors, on the state of innovation in KwaZulu-Natal (KZN), and to keep them abreast of the latest thinking and trends within the innovation space. Furthermore, it is an opportunity to celebrate and showcase the success of innovators within our province.

The publication will be hosted on the Innovate Durban Innovation Dashboard, a living mechanism aimed at showcasing the data, celebrating innovation, connecting stakeholders, enabling collaboration, and creating new partnerships and possibilities. We, as Innovate Durban, are proud to present the third edition of the Innovation Publication, The State of Innovation in KZN, and look forward to celebrating innovation in Durban and beyond.

*Every effort made to ensure that all information was accurate at time of print.

FOREWORD

The Innovation Publication (IP) is Innovate Durban's primary research offering. The publication provides knowledge to strengthen and enhance the innovation ecosystem in KwaZulu-Natal. The research provides information to innovators on where they can access support, opportunities for stakeholders to connect, and critical information to investors and other key stakeholders. Innovate Durban continues to expand its research area towards achieving the following outcomes:

- Increase proven, sustainable partnerships formed
- Increase funding, incubation, and other support accessed by innovators
- Increase investment and other resources being committed to the innovation ecosystem

The 2022 Innovation Publication is the fourth edition of the annual provincial 'State of Innovation' report. This year's report expands on the research provided in previous years and introduces five new indicators and sub-indicators:

- Provincial GDP (2016-2020)
- National GDP
- Number of active innovation funds by type (2022)
- Human Development Index (2013-2020)
- Gini Index

The information and data used in this study has been sourced through secondary data collection channels. In this year's offering, a mapping of some of the key innovation support institutions that are active in the province is provided. These institutions offer support to start-ups through providing programmes, prototyping infrastructure, financial assistance and/or advisory services.

The results from the state of innovation indicators reveal the impact that the COVID-19 pandemic, civil unrest and flooding catastrophes have had on the innovation ecosystem. The KZN Innovation Growth Index, the core indicator for the state of innovation in the province, showed a decrease for the year 2020. This is a result of a significant decline in the doctoral graduates, one of the four index matrices.

The report clearly demonstrates KwaZulu-Natal's potential to become an innovation friendly environment. The province is a key player in the national economy and has the potential to grow its innovator community through direct interventions from the state and private sector. Innovate Durban is proud to present this publication. We are excited to create a platform that encourages and celebrates innovative entrepreneurship to improve KZN's economic competitiveness.

We look forward to building a unified strategy to stimulate an effective innovation ecosystem in KZN.

WHAT THE STUDY COVERS



PEOPLE

Relates to the human capital and knowledge generated that enables and accelerates innovation and creativity.



INVESTMENT

Describes the amount of investment in terms of rand value that is directed towards innovation, research and development in various sectors.



INFRASTRUCTURE

Measures internet access in KZN in comparison to other provinces in South Africa.



ECOSYSTEM

Relates to the environment within which innovation takes place and includes events and funding instruments.



IMPACT

Measures the benefits of innovation across various areas including revenue, employment and economy.

The table below is a summary of all indicators used to measure innovation:

Category	Sub-category	Indicator
People	High school education	National Senior Certificate Performance in Mathematics (2017-2021)
		National Senior Certificate Performance in Physical Sciences (2017-2021)
		Matric completion rate (2017-2021)
	TVET Education	Students who completed N3 Engineering Studies (2017-2020)
		Students who completed N6 Engineering Studies (2017-2020)
	Public university education	Higher Education institutions enrolment (2017-2019), SET
		Higher Education institutions graduates (2017-2019), SET
		Ranking of 26 universities in South Africa for SET enrolment and graduation
		Doctoral enrolment (2017-2019) All graduates
		Doctoral graduates (2017-2019) All graduates
		Ranking of 26 universities in South Africa for Doctoral enrolment and graduation
		UKZN enrolment (2017-2019), SET & Doctoral degrees
		UKZN graduates (2017-2019), SET & Doctoral degrees
	Knowledge generation	Overall publication output units (2016-2019)
		Ranking of 26 universities in South Africa for research publications
		Patents lodged in South Africa (2016/17-2019/20)
		Patent grants in South Africa (2010-2020)
		Design patents lodged in South Africa (2015/16-2019/20)
		Film copyrights lodged in South Africa (2015/16-2019/20)
	Social	Trademark applications in South Africa (2016-2019)
Investment	Research & development expenditure	Human development index
		R&D expenditure by province (2008/9-2019/20)
		KZN R&D expenditure by source (2008/9-2019/20)
		GERD as a % of GDP by province (2009/10-2019/20)
	Venture capital	Value contribution by type of fund (2018-2020)
		Number of investments (2010-2020)
		Value of investments (2009-2020)
		Value contribution by stage of deal (2017-2020)
Infrastructure	Value contribution by location of investee head office (2017-2020)	
Internet access	Internet access by province (2018-2020)	
Ecosystem	Innovation Support Mechanisms	STI institutions
		Innovation Support Mechanisms
Impact		Employment in the telecommunications sector (2015-2020)
		Company registrations in South Africa (2015/16-2019/20)
		Registered businesses with taxable earnings in SA (2016-2020)
		Overall (growth) innovation index (2018-2019)
		KZN Innovation Growth Index (2018-2019)
		Gender Gap in ICT Sector South Africa

ABBREVIATIONS & ACRONYMS

BERD	Business Enterprise Expenditure on R&D
CIT	Company Income Tax
CIPC	Companies Intellectual Property Commission
DBE	Department of Basic Education
DSI	Department of Science and Innovation
DTIC	Department of Trade, Industry and Competition
DUT	Durban University of Technology
EC	Eastern Cape
FS	Free State
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GP	Gauteng Province
HDI	Human Development Index
HEI	Higher Education Institution
HSRC	Human Sciences Research Council
ICASA	Independent Communications Authority of South Africa
IDP	Integrated Development Plan
KZN	KwaZulu-Natal
LP	Limpopo Province
MP	Mpumalanga Province
MUT	Mangosuthu University of Technology
NC	Northern Cape
NDP	National Development Plan
NGO	Non-governmental Organisation
NSC	National Senior Certificate
NW	North West
NWU	North West University
PCT	Patent Cooperation Treaty
R&D	Research & Development
SARS	South African Revenue Service
SAVCA	South African Venture Capital & Private Equity Association
SDG	Sustainable Development Goal
SET	Science, Engineering & Technology
SEZ	Special Economic Zones
STEL	Stellenbosch University
STEM	Science, Technology, Engineering & Mathematics
TVET	Technical Vocational Education & Training
UCT	University of Cape Town
UFS	University of Free State
UJ	University of Johannesburg
UKZN	University of KwaZulu-Natal
UNISA	University of South Africa
UniZulu	University of Zululand
UP	University of Pretoria
URAP	University Ranking by Academic Performance
UWC	University of Western Cape
VC	Venture Capital
WC	Western Cape
Wits	University of Witwaterstrand

HIGHLIGHTS

- Mapping of KZN entrepreneurial and innovation support mechanisms with institutions
- In 2021, KZN recorded the highest number of Mathematics and Physical Science passes in the country
- The KZN Innovation growth index declines in 2020. This was mainly due to the decrease in the total doctoral graduates and expenditure on R&D
- Numerous indicators declined in 2019/20
- In 2021, there was an increase in matric enrolments and an increase in the number of pupils to sit for the grade 12 NSC examinations, since its inception in 2008
- KwaZulu-Natal HEI's leading in Doctoral degree enrolment ranking
- The value and number of venture capital investments has experience growth since 2013. This includes the total amount of capital allocated to businesses and the sum of investment deals made
- Internet Access in the province reaches the 76% of the population mark
- In 2020, research outputs from KwaZulu-Natal HEI's increases
- KwaZulu-Natal has the second largest economy in the country. It contributes 16% towards the country's GDP
- In 2021, there is a substantial decline in the employment gender gap. However, the total employment of men in the sector is still disproportionately higher than that of women

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1. INTRODUCTION

The Innovation Publication is an annual offering of Innovate Durban which provides information to all stakeholders, including innovators and investors, on the state of innovation in KwaZulu-Natal (KZN). The publication is a tool which provides key information on the innovation ecosystems including:

- The innovation and investment potential of the region
- Information on the latest thinking and trends in the regional innovation space
- Profiling successful innovators and their innovations within our province
- The current status quo of the innovation ecosystem in KZN
- Entrepreneurial and innovation data and statistics showcasing the level of innovation in the province



The Innovation Publication is one of several research outputs published by Innovate Durban in order to achieve our desired impact to increase employment, create businesses and ignite investment through growing the innovation ecosystem in KZN. The indicators in this publication are also hosted on a digital Innovation dashboard, as a living mechanism aimed at showcasing the data, celebrating innovation, connecting stakeholders, enabling collaboration, and creating new partnerships and possibilities. The dashboard can be accessed via the **Innovate Durban website**.

^a Innovate Durban Dashboard: <https://www.innovate.durban>

1.1 DEFINING INNOVATION

There are numerous ways to define innovation, however, the definition offered by Gault (2016) ¹ appears to encompass a more holistic view of innovation citing that: **“An innovation is the implementation of a new or significantly changed product or process. A product is a good or a service. Process includes production or delivery, organisation, or marketing processes”**. Gault (2016) goes on to say that a product has been implemented when potential users are able to access it, and a process has been implemented when it has been operationalised. There are different types of innovation (not mutually exclusive):



Innovation goes beyond science, technology, engineering and mathematics (STEM). Isaacson (2014) ² argues that **“the next phase of the digital revolution will bring a true fusion of technology with the creative industries, such as media, fashion, music, entertainment, education, literature and the arts...this innovation will come from people who are able to link beauty to engineering, humanity to technology, and poetry to processors.”**

1.2 MEASURING INNOVATION

Innovation is extremely difficult to measure due to both its diverse nature and the lack of quantifiable data available at a provincial level. Essential indicators, such the number of start-up businesses and the number of patents registered are not available for KZN.

For the purpose of this report, we have drawn on various publications and organisations that have been working on measuring innovation, and are continuously working to improve indicators each year.

1.3 REPORT STRUCTURE

This report overviews innovation indicators which provide an understanding of the state of innovation in the province. The indicators are provided under the categories of people, investment, infrastructure, ecosystem and impact. The report also showcases five local innovators and their innovations. The innovators profiled this year are; **Zamokuhle Thwala, Isaac Mongali, Bathabile Mpofu, Landile Mabele and Thulisile Machi**. The conclusion provides recommendations for future research, and is followed by the acknowledgements.

This report and its data are freely available and we encourage it to be used and shared widely.



Jochen Faber CA (SA)



Congratulations Innovate Durban on your 5th year of leading innovation in our city.

1

Strategise

Let me help you understand your business of the future, how that translates into financial goals and, most importantly, how to define the steps that will allow you to achieve them.

2

Design

With your financial goals and stakeholders in mind, I will work with your team to define your future organisation and financial needs.

3

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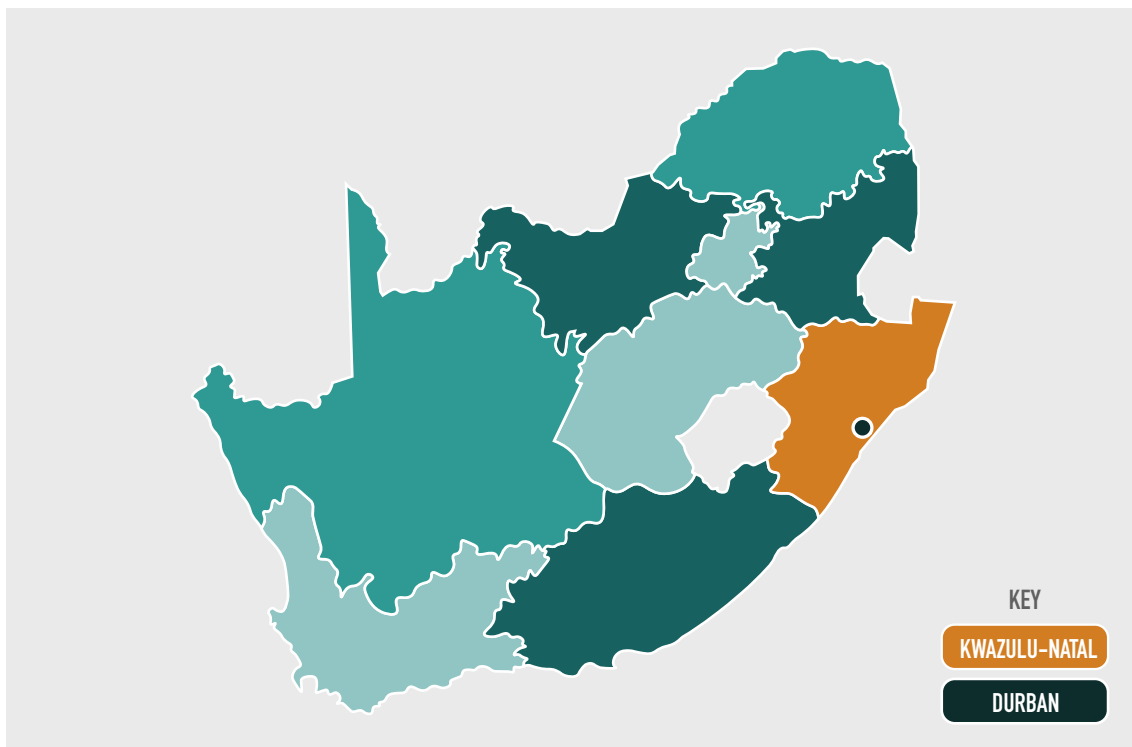
2. ABOUT KWAZULU-NATAL

2.1 GENERAL OVERVIEW

KwaZulu-Natal (KZN) province (see **Figure 1**) occupies the south-eastern portion of South Africa. It is the third smallest province by land size but the most populous – approximately 11.5 million according to the 2022 mid-year population estimates – and second largest contributor to the country’s gross domestic product (GDP) after Gauteng Province (GP). The large number of young people in the populous can yield a demographic dividend in the long run. This can be achieved by intensifying the implementation of quality early childhood development, basic education, technical and vocational education and training, as well as higher education. The long-term result of quality education is an increase in productive citizens, which is anticipated to improve the average income per capita in the country.

KwaZulu-Natal is bounded to the north by the countries of Mozambique and Kingdom of Eswatini (Swaziland) and to the west by Lesotho. The province has vast tracts of indigenous land under the traditional authorities - the land is 2.8 million hectares which amounts to approximately one third of the province. The provincial capital is Pietermaritzburg, while eThekweni Metropolitan Municipality is home to the city of Durban.

Figure 1. Map of South Africa highlighting KwaZulu-Natal



KwaZulu-Natal's major economic sectors are manufacturing, exports, tourism and agriculture. There has been a rapid industrialisation in the province in recent years thanks to its abundant water supply and labour resources. The provincial government has prioritised investment for sectors such as agri-processing, healthcare, manufacturing, renewable energy, tourism, property development, aloe processing, bio-ethanol fuel, fish processing and the ocean economy. Some of the major industries are found in the following cities/towns: Durban, Pinetown, Richards Bay, Pietermaritzburg, Richmond, Newcastle and Mandeni, amongst others. There are major infrastructure projects planned, that will help the province build back better, after the COVID-19 pandemic. The Special Economic Zones (SEZs) at Richards Bay (Richards Bay Industrial Development Zone - RBIDZ) and King Shaka International Airport (Dube TradePort) are key components of the strategy of attracting investors to the province. There are plans to establish a clothing and textiles SEZ in the province to build on the province's established strength in the sector, and an automotive supplier park will soon be in operation. The province already has significant capacity in heavy and light manufacturing, agri-processing and mineral beneficiation, all of which is supported by South Africa's two busiest ports (Richards Bay and Durban).

Sources: KZN Business and Investment Guide Report (2021/22 Edition)³; Stats SA (2022)⁴; Department of Treasury (2022)⁵



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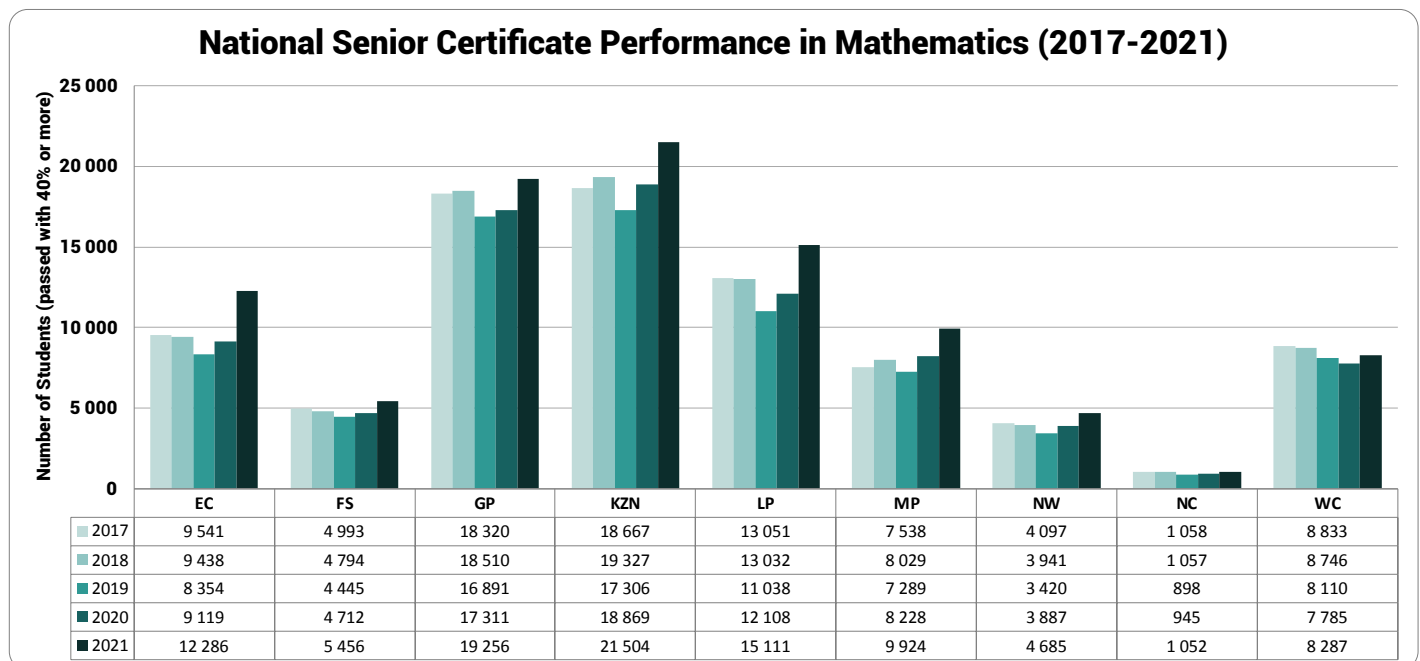
3 THE STATE OF INNOVATION IN KZN

3.1 PEOPLE

3.1.1 HIGH SCHOOL EDUCATION

The charts below show the performance of National Senior Certificate (NSC) matriculants in Mathematics and Physical Sciences, from the Department of Basic Education (DBE). These subjects have been identified as being a catalyst for science, technology, engineering and math (STEM) related innovation and thus impacting the future health of the innovation ecosystem. The Maths and Science have been identified as priority subjects by the government to equip South African learners with relevant skills and knowledge for a changing world. Given the special importance of building skills needed for mathematically-oriented and scientific professions, the Department of Planning, Monitoring and Evaluation has set national targets for the number of learners achieving marks in mathematics and physical sciences required by university faculties such as engineering, commerce and medicine (DBE NSC examination report, 2021). It should be noted that pure mathematics was used as the basis only, and not mathematical literacy.

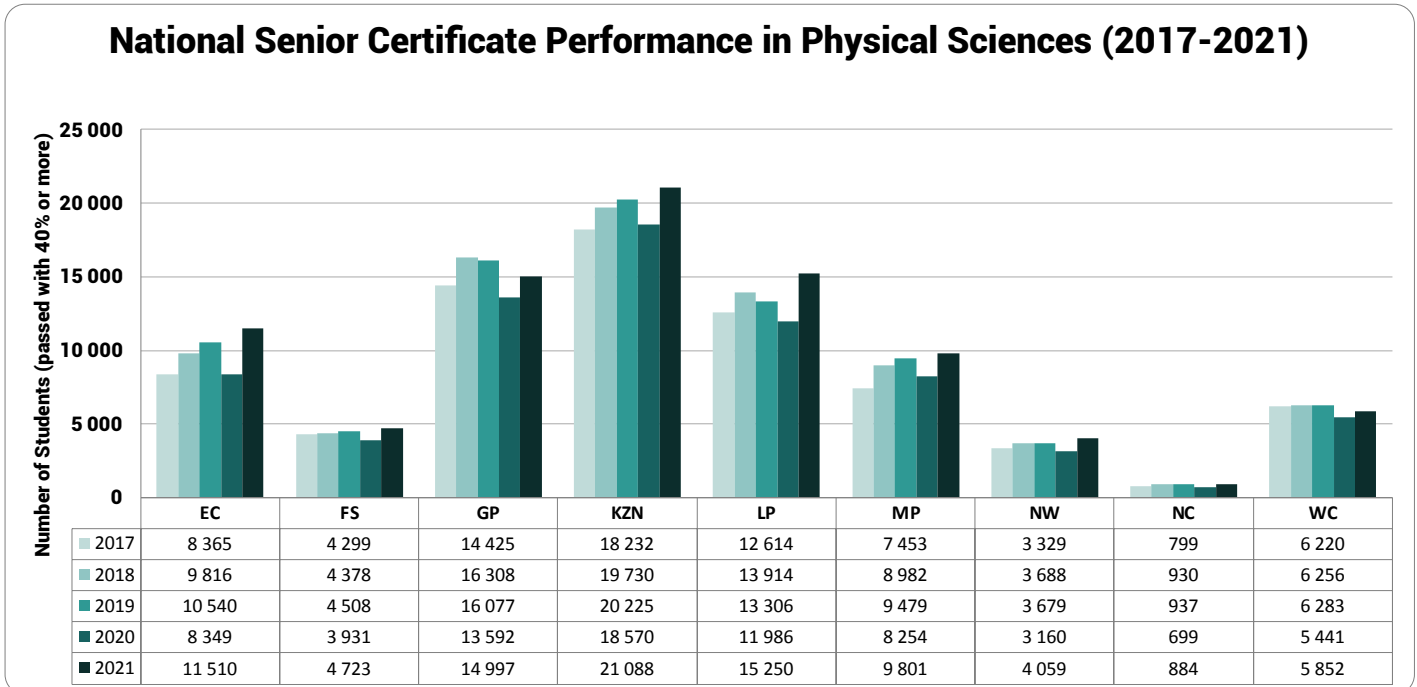
Figure 2. National Senior Certificate Performance in Mathematics (2017-2021)



Source: Department of Basic Education reporting (2017 – 2021) ⁶

Figure 2 above illustrates a continuous increase in the number of matriculants who passed the maths subject with a pass mark of 40% and above, between 2017 and 2021. However, in 2019 all the provinces show a slight decline in the math passes. Despite the challenges experienced in the region, KZN had the highest number of matriculants passing mathematics, closely followed by GP and third being LP.

Figure 3. National Senior Certificate Performance in Physical Sciences (2017-2021)



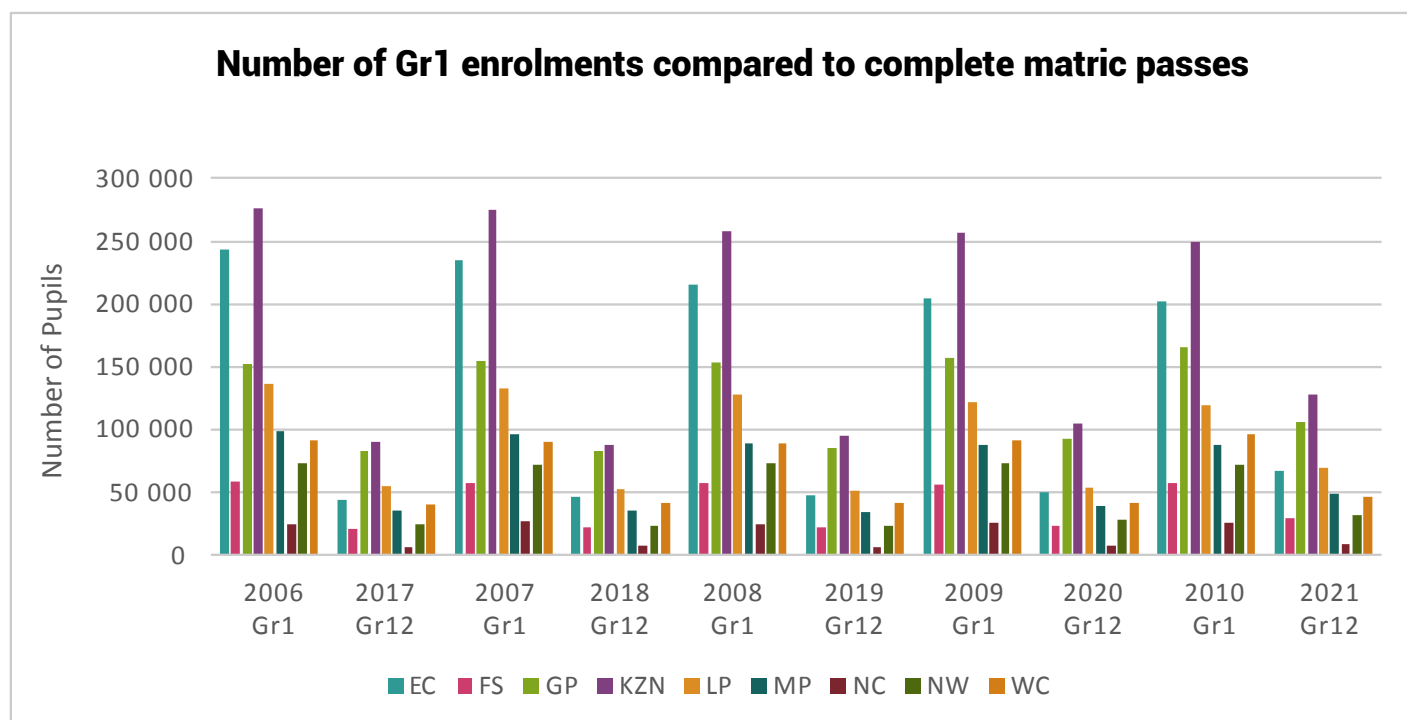
Source: Department of Basic Education reporting (2017 – 2021) ⁶

The physical sciences pass rates yielded similar results (**Figure 3**), with KZN taking the top spot, but this time followed by LP and third being GP. In general, KZN was ranked fifth out of the nine provinces with a 76.8% pass rate (in terms of completion rate^b), which represents a 0.8% decline from the previous year. The classes of 2020 and 2021 produced the best results of quality in the history of the NSC exams. It can be argued had it not been for the COVID-19 pandemic, these two classes could have been the best performers, since the inception of the NSC exams.

^b Completion rate is the number of students who finish and pass a specific subject per matric year, as a percentage of the total number of students enrolled in the same subject.

For the 2017 - 2021 matriculants, they would have entered grade one^c in 2006 - 2010, respectively (**Table 1**). The completion rate data shows the number of matrics who wrote and passed (achieved a pass) the NSC examinations, compared to grade 1's that entered the system (**Figure 4**). There is no one document that has all these figures together for this range of years, thus these figures will be extrapolated and calculated from various official DBE reports.

Figure 4. Number of Gr1 enrolments compared to matric passes, per province



Source: Department of Basic Education reporting (2006 - 2010) ⁷

Table 1. Completion rate for Grade 12 Learners (2017 - 2021) that entered Grade one in 2006 - 2010

Province	2017-CR	2018-CR	2019-CR	2020-CR	2021-CR
EC	18%	20%	22%	24%	33%
FS	37%	38%	39%	42%	52%
GP	54%	54%	55%	59%	64%
KZN	33%	32%	37%	41%	51%
LP	40%	40%	41%	44%	58%
MP	37%	37%	39%	45%	56%
NC	27%	27%	28%	30%	35%
NW	33%	33%	32%	39%	45%
WC	44%	46%	46%	45%	48%

Source: Department of Basic Education reporting (2006 - 2010) ⁷

^c Note: assuming the age the pupil is in grade one is 7 years old, and 18 years old in matric, although there are age discrepancies due to repeating grades or entering school early.

Figure 4 shows how there is a decline in the number of enrolled grade ones, compared to when the same group of students should have achieved a pass in matric 12 years later, across all provinces. In 2021, there was an increase in matric enrolments and an increase in the number of pupils to sit for the grade 12 NSC examinations, since its inception in 2008. The completion of Grade 12, as well as higher education, is directly related to employment outcomes. In **Table 1**, we can see that GP had a higher completion rate, followed by WC, third being LP and KZN falling in fourth place (looking at the general trend). The fact that under a half of youths, across all provinces, do not obtain the NSC, and thus leave the schooling system without a formal qualification with which to navigate post-school education and the labour market, is a concern that is often raised. There are a number of reasons that could account for this decline: learners moving from a specific province, drop outs, repeating grades, etc. Another reason for the decline in numbers, that may account for the ‘missing’ pupils, is them leaving the formal school system and enrolling in technical and vocational colleges.

3.1.2 TVET EDUCATION

The charts below show performance in Engineering Studies for students in Technical Vocational Education and Training (TVET) colleges. TVET colleges are administered in terms of the Continuing Education and Training Act, No. 16 of 2006, as amended. provide technical and vocational education and training qualifications and programmes which can be accessed at entry levels with a Grade 9 or Grade 12 certificate. The vision and objective for the public TVET colleges sector as articulated in the national Post-School Education and Training plan is an expanded and strengthened TVET sub-system that provides quality technical and vocational education and training to prepare students for the world of work (DHET, 2020). The exit points which are reported below are N3 level, which is a Grade 12 equivalent, and N6, which is a post-matriculation qualification. The information is displayed per province.

Figure 5. Number of Students who Completed N3 Engineering Studies (2018-2020)

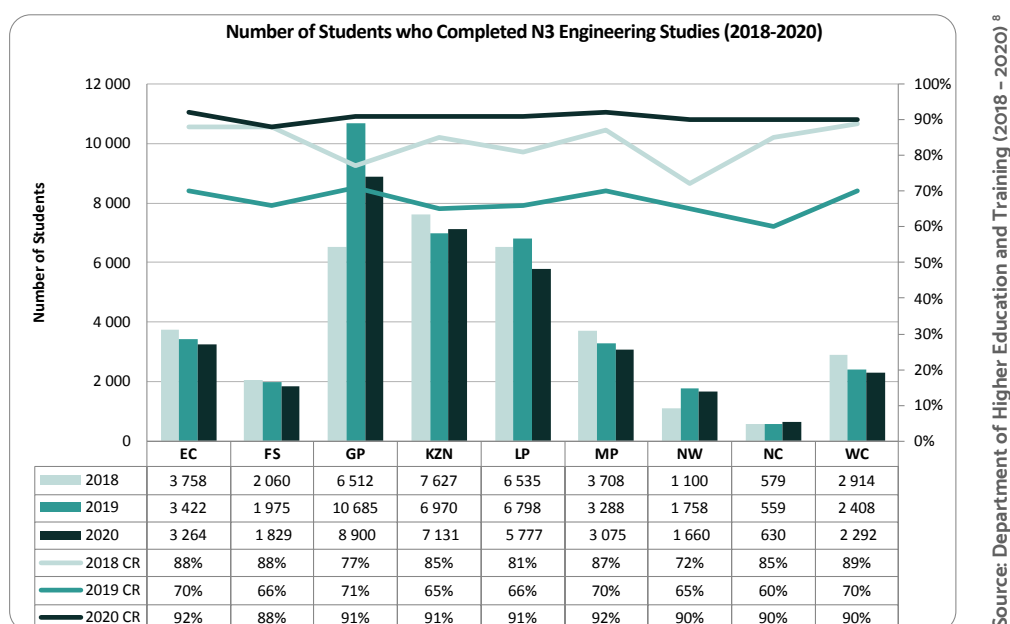
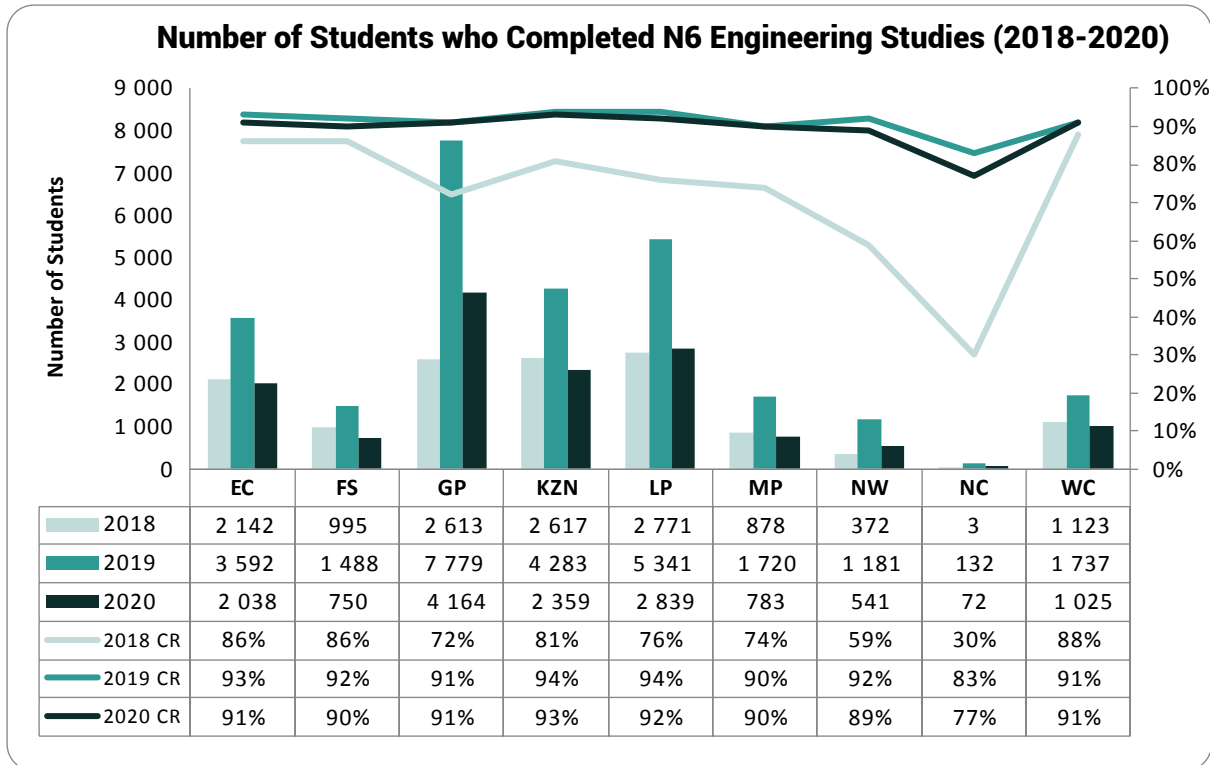


Figure 5 shows that GP TVET colleges had the highest number of students (8900) who completed N3 Engineering Studies in 2020, followed by KZN (7131) and LP (5777). In terms of completion rate, students in MP experienced the highest completion rate (92.4%) (although they had some of the lowest number of completed students), followed by EC at 91.6% and KZN at 91.4%.

Figure 6. Students who Completed N6 Engineering Studies (2018-2020)



Source: Department of Higher Education and Training (2018 - 2020) ⁸

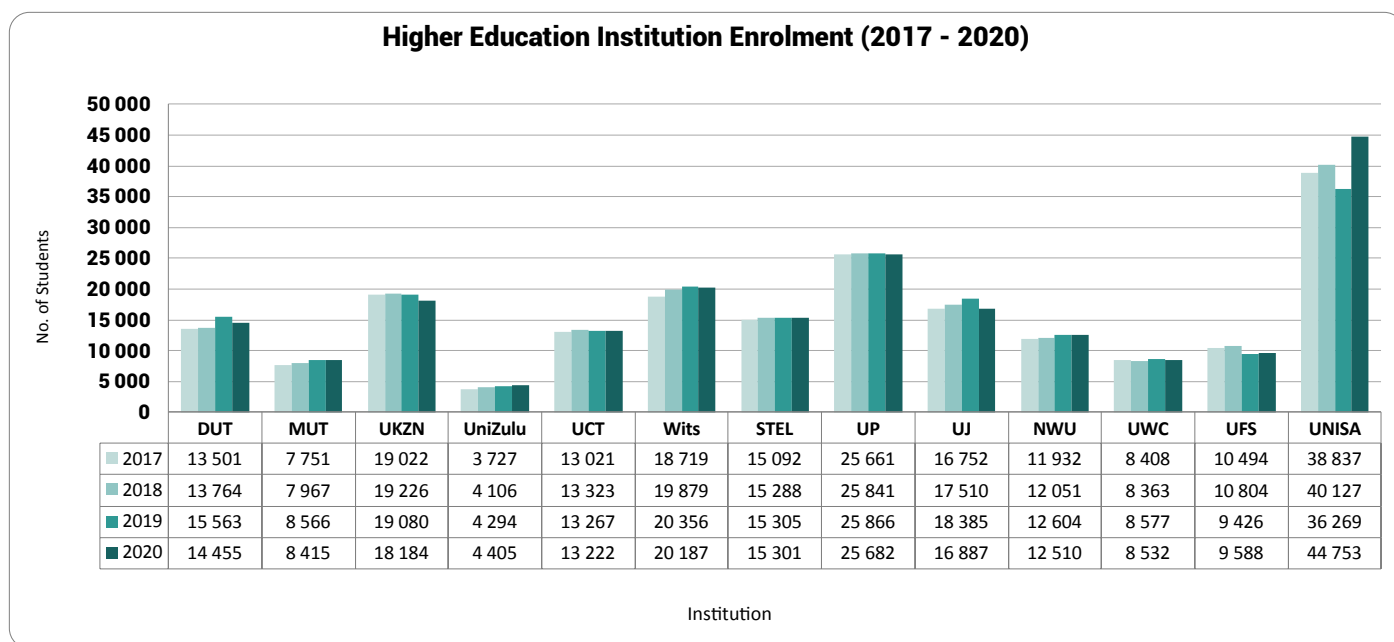
For students who completed their N6 qualification in Engineering Studies (**Figure 6**), the numbers are much lower compared to N3 students, for 2020. GP had the highest number of completed students, at 4164, followed by LP (2839) and KZN (2359). In terms of completion rate, students in KZN experienced the highest completion rate (92.6%), followed by LP at 91.8% and GP at 91.2%.

3.1.3 PUBLIC UNIVERSITY EDUCATION

In this section, only the public higher education institutions (HEI) will be discussed as there is more entry in these systems compared to private institutions, according to the numbers in the DHET reports. The following figures (6 -12) and tables (1 - 5) explore enrolment and graduation from HEIs in KZN - namely Durban University of Technology , Mangosuthu University of Technology, University of KwaZulu and University of Zululand, - Science, Engineering and Technology courses, as well as all Doctoral degrees, in comparison to selected universities in South Africa.

These universities were selected as they were in the top 10^d performing university's in South Africa for 2022 (5 of which are ranked within the top 500 in the world), according to the University Ranking by Academic Performance. The ranking was performed by the Informatics Institute at the Middle East Technical University, in Turkey^e. The overall score of each HEI is based on its performance over several indicators, including current scientific productivity, research impact, research quality, and international acceptance, thus making it acceptable for this publication.

Figure 7. Higher Education Institutions Enrolment (2017-2020)



Source: Department of Higher Education and Training (2017 - 2020) ⁸

In **Figure 7** we see the number of students enrolled at the HEIs for the period 2017 to 2020, particularly for SET courses. Student enrolment is a key measure of access to HEIs. For the 2020 intake, there was a decline in number of students, with UNISA having the highest enrolment (44 753), followed by UP (25 682) and Wits (20 187). It should be noted that UNISA has the highest enrolment due to its distance mode of learning. The majority of students in public HEIs enrolled in the SET courses (319 902) and this number is broken down into the 26 HEIs surveyed. Between 2019 and 2020, enrolment for SET fields of study declined by 1.0%, which equates to 3 204 students.

^d Note that UKZN is one of the top 10 universities in South Africa

^e BusinessTech (2022):

<https://businesstech.co.za/news/lifestyle/555000/these-are-the-21-best-universities-in-south-africa/>

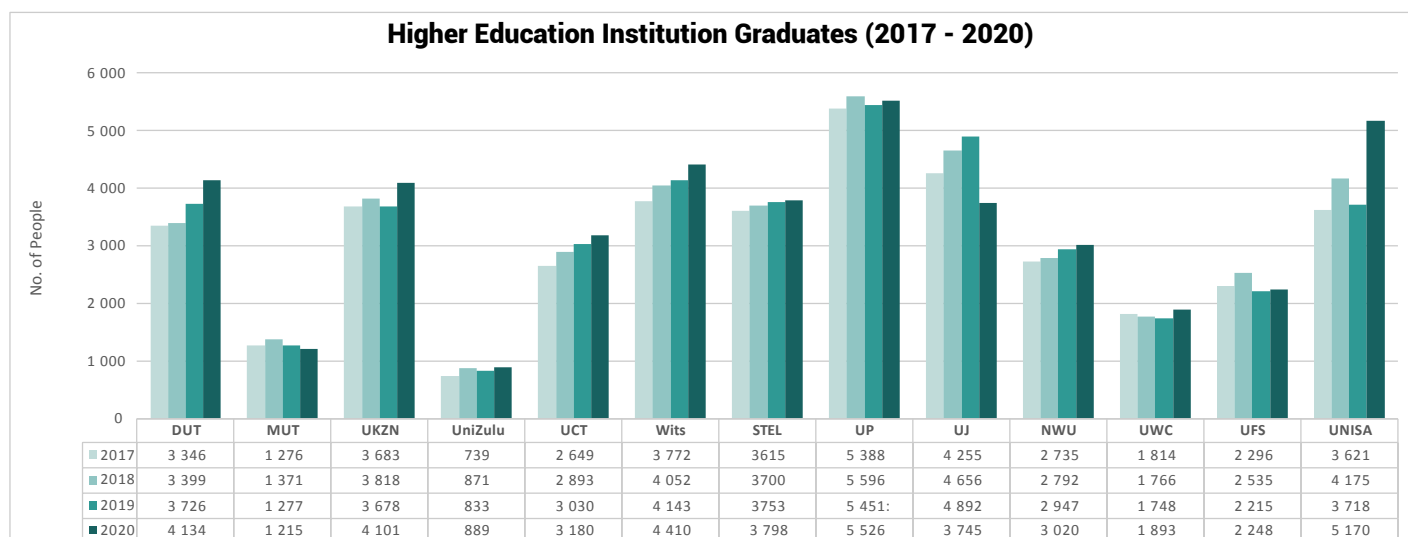
Table 2. Ranking out of 13 Universities in South Africa for SET enrolment

HEI	2017	2018	2019	2020	Movement
DUT	9	9	7	9	↓
MUT	19	19	19	18	–
UKZN	4	5	5	5	–
UniZulu	23	23	21	22	↓
UCT	10	10	10	10	–
Wits	5	4	4	4	–
STEL	8	8	9	7	↑
UP	2	2	3	2	↑
UJ	6	6	6	6	–
NWU	11	11	11	11	–
UWC	16	17	18	17	↑
UFS	12	14	15	14	↑
UNISA	1	1	1	1	–

Source: Department of Higher Education and Training (2017 – 2020) ⁸

In terms of the enrolment ranking, **Table 2** shows that UNISA maintained its number one position in terms of enrolment in 2020, while DUT and UniZulu dropped. MUT and UKZN also maintained their rankings in the eighteenth and fifth positions, respectively. The institutions that improved their rankings in 2020 were Stellenbosch, UP, UWC and UFS.

Figure 8. Higher Education Institution Graduates (2017 – 2020)



Source: Department of Higher Education and Training (2017 – 2020) ⁸

In the chart above (**Figure 8**), we see the number of students who graduated from HEIs, for SET courses. Student completion is a key measure of success. The overall number of students who obtained the qualifications in SET were 27.2% or 64 721. The chart shows that UP had the highest number of graduates across all four years.

Table 3 Ranking of 13 Universities in South Africa for SET graduation

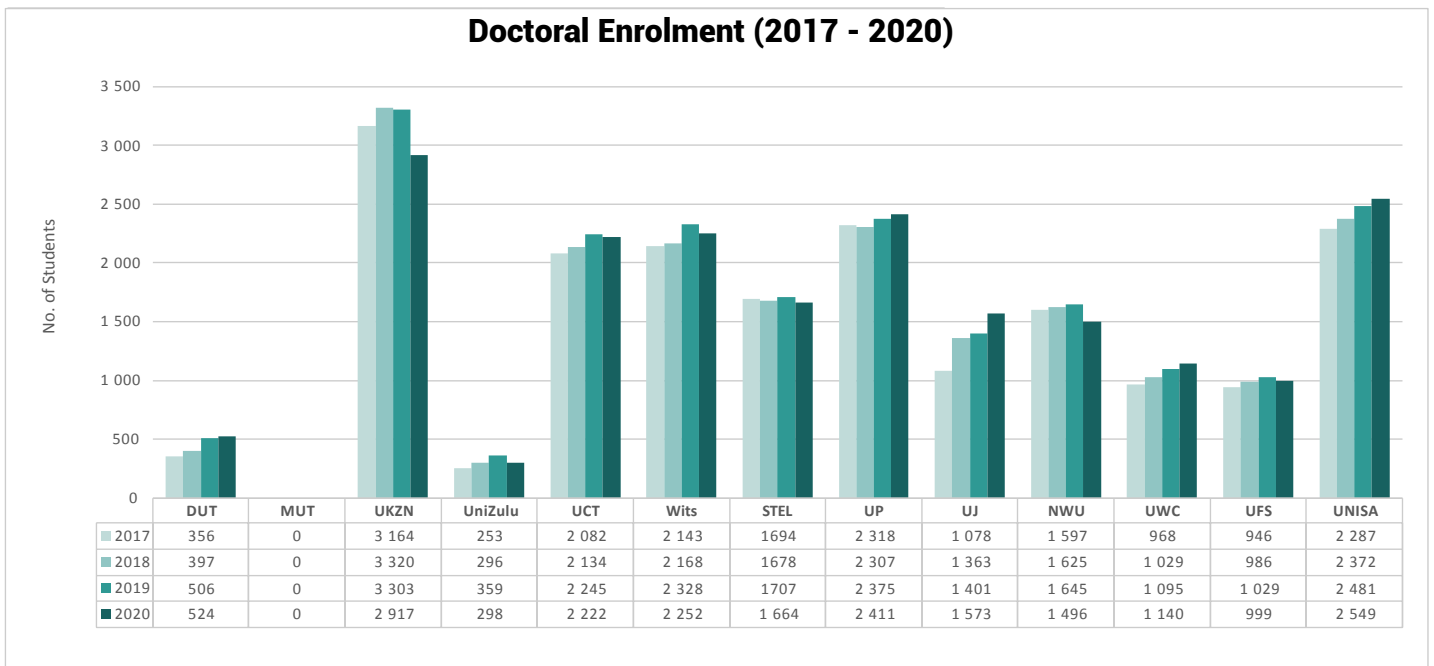
HEI	2017	2018	2019	2020	Movement
DUT	9	9	6	5	↑
MUT	19	19	19	20	↓
UKZN	6	7	9	6	↑
UniZulu	24	23	21	22	↓
UCT	11	10	10	10	–
Wits	4	5	4	4	–
STEL	8	8	5	7	↓
UP	1	1	2	1	↑
UJ	3	3	3	8	↓
NWU	10	12	11	11	–
UWC	15	16	16	15	↑
UFS	12	13	13	13	–
UNISA	7	4	8	2	↑

Source: Department of Higher Education and Training (2017 – 2020) ⁸

In terms of SET graduates, **Table 3** shows that improvement in overall rankings can be seen for DUT, which moved from ninth to sixth place in 2019, and was in fifth place in 2020. UKZN also improved in 2020, but the other two KZN institutions dropped in ranking with MUT moving to the twentieth spot and UniZulu moving to twenty-second. UNISA experienced the biggest improvement, going from eighth to second place in 2020.

The need to produce doctoral graduates is highlighted in the National Development Plan (NDP) 2030. It explicitly states “Increase the participation rate in higher education to more than 30%, double the number of scientists, and increase the numbers of African men and women postgraduates, especially PhD, to improve research and innovation capacity.” One of the strategies that have been implemented to achieve this goal is the increase in funding through organisations such as the National Research Foundation. The government provides the funding to the students through HEIs. Please note that for doctoral enrolment, MUT has been removed from the charts due to lack of information.

Figure 9. Doctoral Enrolment (2017-2020)



Source: Department of Higher Education and Training (2017 – 2020) ⁸

Figure 9 depicts the doctoral degree enrolment (across all fields) for the period 2017 to 2020. Generally, there has been a decline in number of doctoral degree enrolments in 2020, apart from UNISA and the Gauteng institutions. MUT still had no enrolments in 2020, while UKZN had the highest enrolment.

Please note that for doctoral graduates, MUT has been removed from the charts due to lack of information.

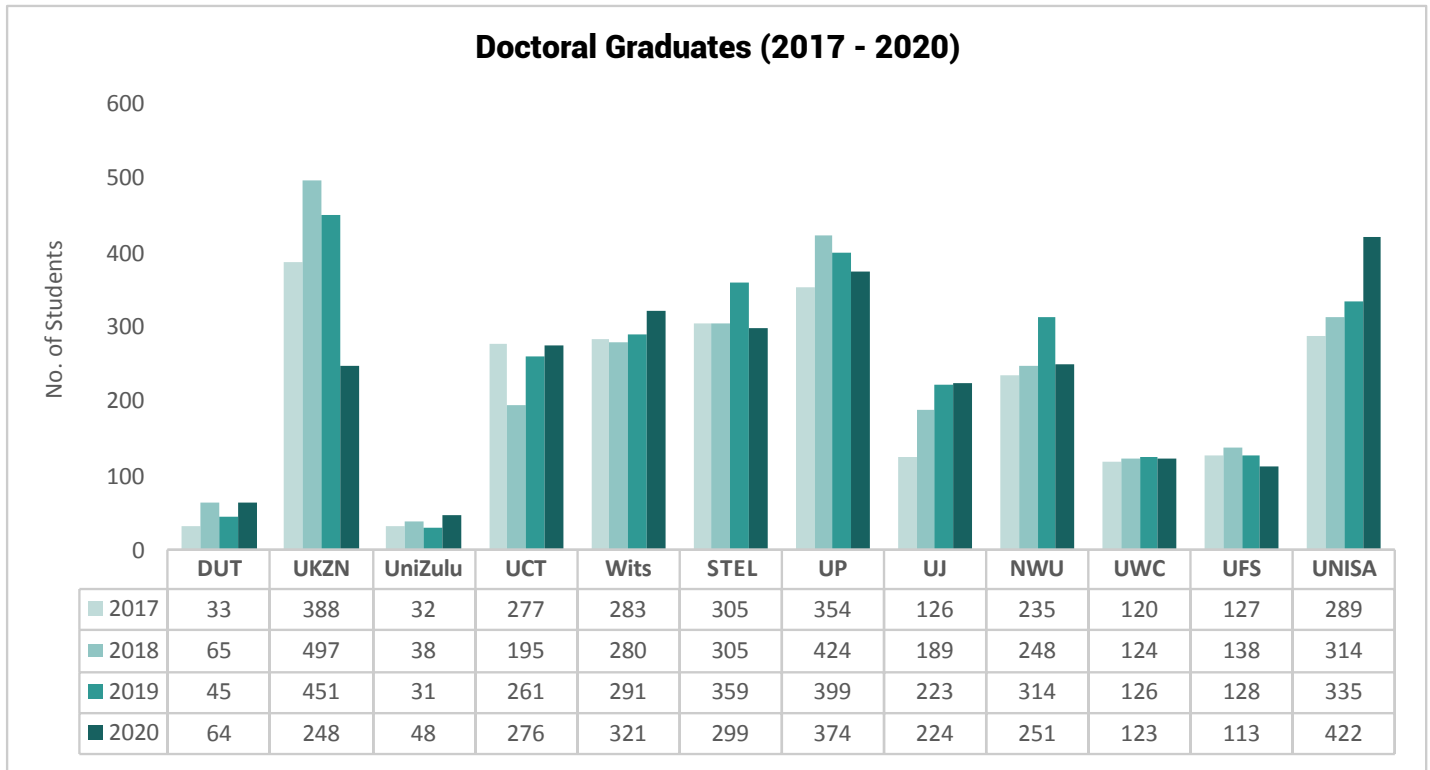
Table 4. Ranking of 13 Universities in South Africa for Doctoral enrolment

HEI	2017	2018	2019	2020	Movement
DUT	15	16	14	14	–
UKZN	1	1	1	1	–
UniZulu	19	18	17	16	↑
UCT	5	5	5	5	–
Wits	4	4	4	4	–
STEL	6	6	6	6	–
UP	2	3	3	3	–
UJ	8	8	8	7	↑
NWU	7	7	7	8	↓
UWC	9	9	9	9	–
UFS	10	10	10	10	–
UNISA	3	2	2	2	–

Source: Department of Higher Education and Training (2017 – 2020) ⁸

Table 4 is linked to **Figure 8** in that it shows the ranking of the HEIs for doctoral degree enrolment. For the selected HEIs to be compared, only 2 improved their ranking, UniZulu and UJ, which were sixteenth and seventh place, respectively. The only decline was from NWU, whilst the rest kept their place in the rank.

Figure 10. Doctoral Degree Graduates



Source: Department of Higher Education and Training (2017 - 2020) ⁸

The number of doctoral degree graduates is shown in **Figure 10**, and it is expected for this number to be lower than the enrolments as the length taken for students to complete their degree varies. There was a general decline in number of graduates in 2020 compared to the previous year, but with some increases. In the KZN institutions, DUT had the most noticeable increase in number of doctoral graduates, from 45 to 64. UniZulu also increased while UKZN declined in numbers, from 451 to 248 in 2020.

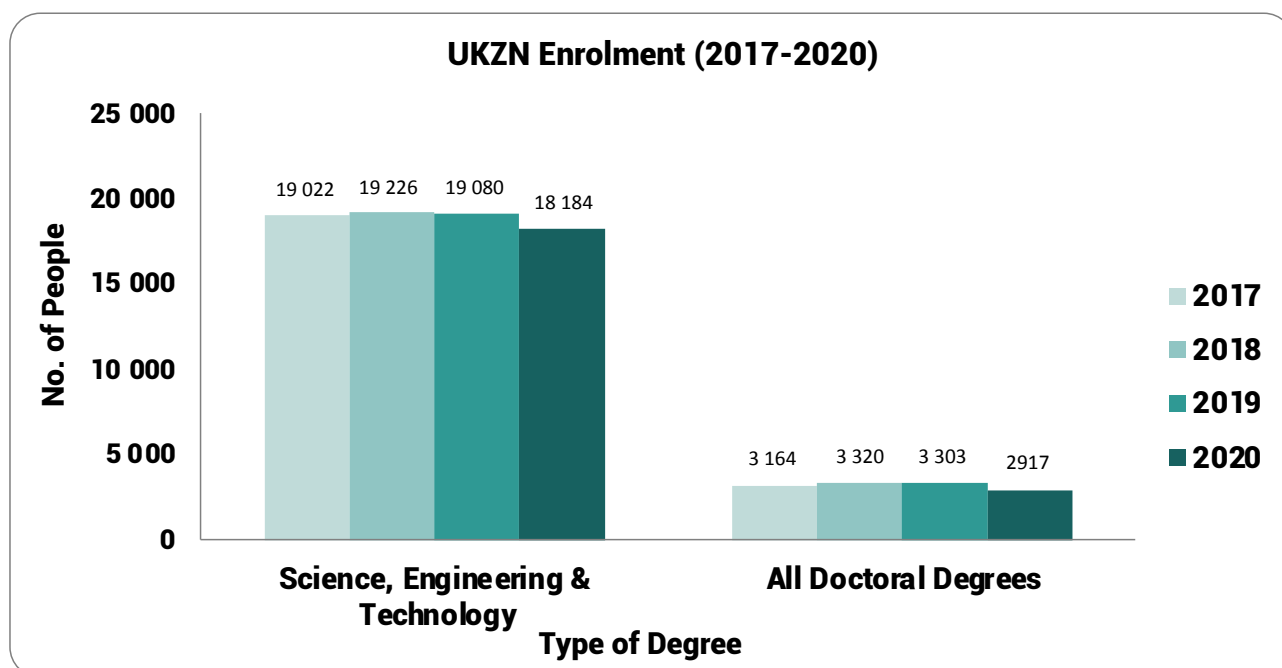
Table 5. Ranking of 13 Universities in South Africa for Doctoral graduates

HEI	2017	2018	2019	2020	Movement
DUT	13	14	15	15	–
UKZN	1	1	1	1	–
UniZulu	17	17	19	18	↑
UCT	6	7	7	6	↑
Wits	5	5	6	4	↑
STEL	3	4	3	5	↓
UP	2	2	2	3	↓
UJ	9	8	8	8	–
NWU	7	6	5	7	↓
UWC	10	11	10	9	↑
UFS	8	9	9	10	↓
UNISA	4	3	4	2	↑

Source: Department of Higher Education and Training (2017 – 2020) ⁸

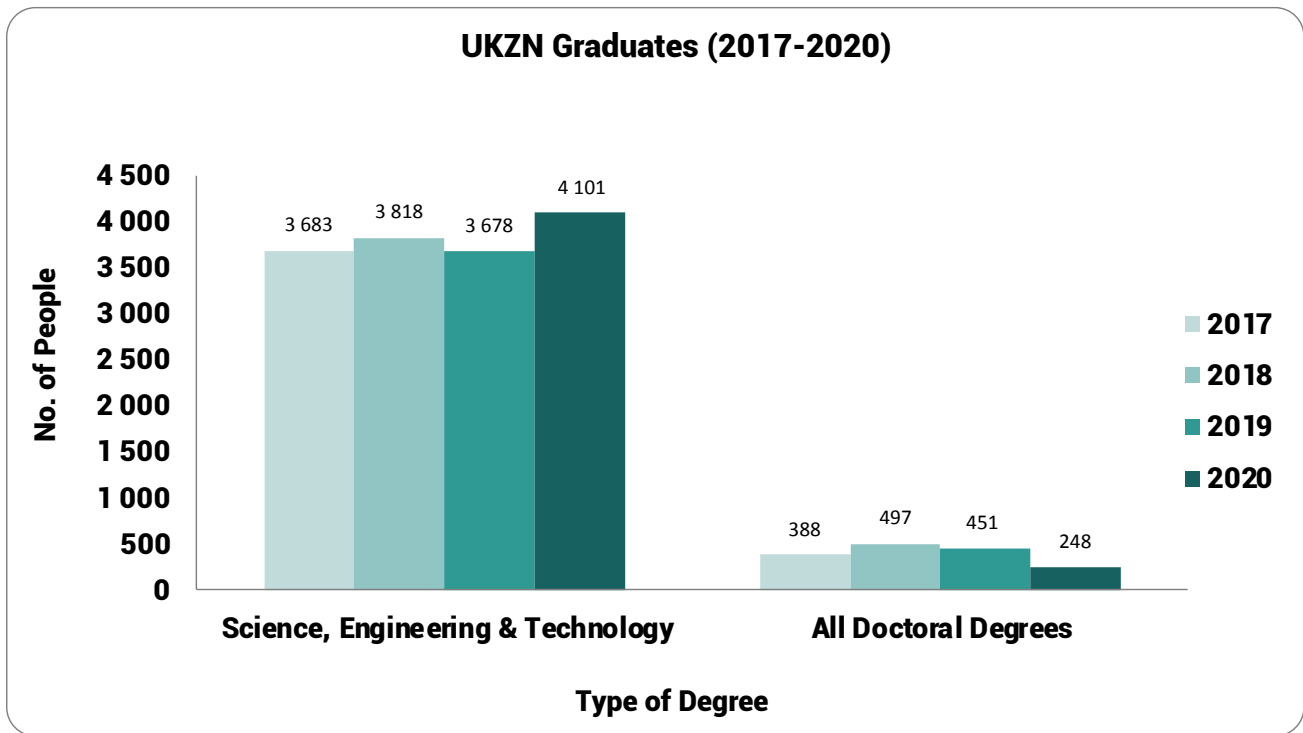
UKZN remains in first place for Doctoral degree enrolment ranking (**Table 5**) in the chosen HEIs, for 2020. DUT, MUT and UKZN retained their ranking, while UniZulu improved. Rankings for Doctoral degree graduations declined for DUT, UniZulu, Wits and UNISA in 2019.

Figure 11. UKZN enrolment (2017 – 2020)



Source: Department of Higher Education and Training (2017 – 2020) ⁸

Figure 12. UKZN Graduates (2017-2020)



Source: Department of Higher Education and Training (2017 - 2020) ⁸

Figure 11 and **12** take a closer look at the UKZN statistics for number of enrolments and graduates for SET courses and doctoral degrees, as the university outperformed KZN’s other institutions in almost all undergraduate and postgraduate categories. In the University Ranking by Academic Performance (URAP) 2021/22 review period, UZKN came 358 in the world, whilst DUT came 1256 and UniZulu came 2736 making them fall in the top 21 in local rankings^f. There was no data for MUT.

UKZN has an international reputation for academic excellence, outstanding research output and African scholarship. The university has links with over 250 international institutions, which facilitate ongoing collaborative academic partnerships⁹.

^f BusinessTech (2022):

<https://businesstech.co.za/news/lifestyle/555000/these-are-the-21-best-universities-in-south-africa/>

⁹ Times Higher Education (2022):

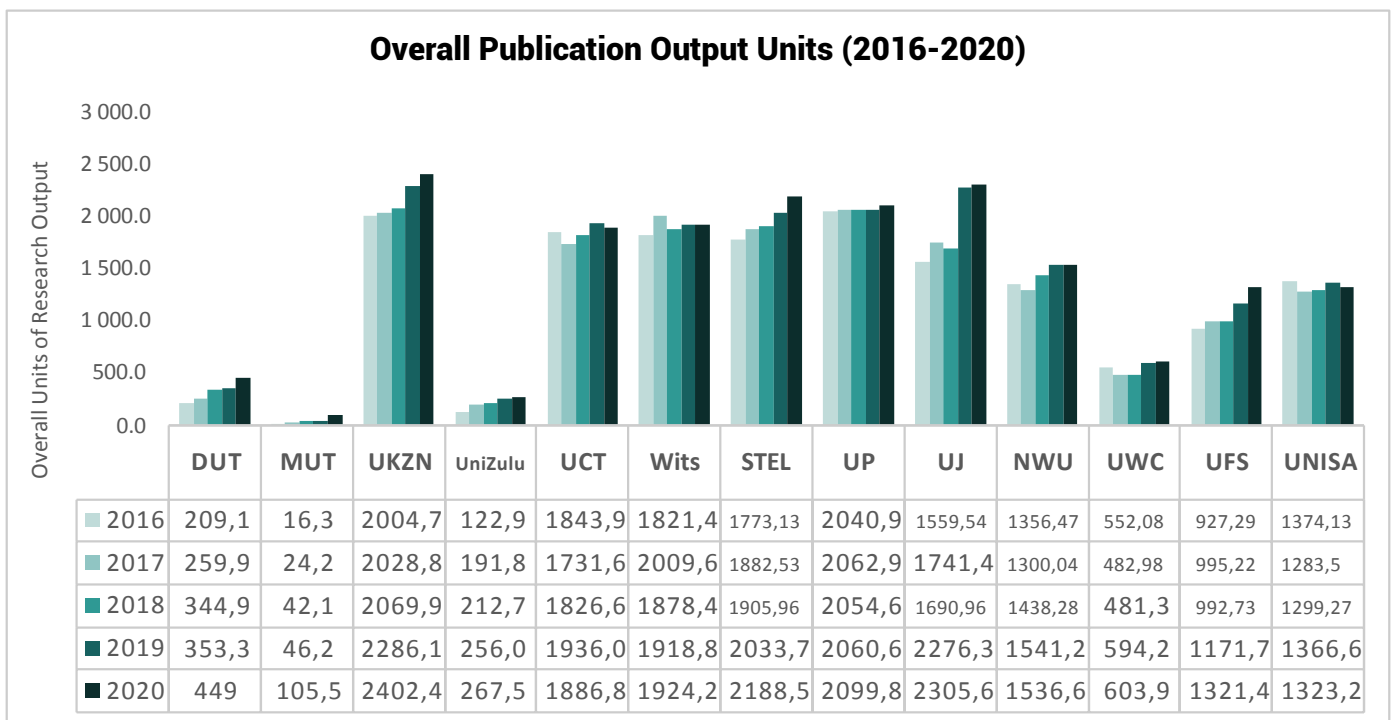
<https://www.timeshighereducation.com/world-university-rankings/university-kwazulu-natal>

3.1.4 KNOWLEDGE GENERATION

Since the implementation of the Research Outputs Policy, the South African higher education sector has witnessed an increase in the number of research publications produced by universities and across all publication types, and is the basis of this section. The values are sourced from Books, Conference Proceedings and Journal articles.

The URAP looks specifically at academic quality and performance, assessing the output of scientific data, published and cited works, as well as the impact of these works on academia. In this publication, and for South Africa, Publication units refers to the subsidy units awarded for each approved publication (according to the criteria set out in the DHET Research Outputs Policy) based on the submissions made in a particular year. The policy provides a framework for the evaluation and subsidy allocation for research outputs produced by South African public higher education institutions (universities).

Figure 13. Overall Publication Output Units (2016-2020) ⁹



Source: Department of Higher Education and Training (2016 – 2020) ⁹

Figure 13 shows the overall publication output units, for the selected HEIs. UKZN took the top spot in 2020 with 2 402.1 units, with second and third place being taken by UJ and UP, respectively. In the KZN institutions, MUT had the lowest units at 46.2. Although the sector as a whole has recorded consistent growth in research publication outputs for all the universities over the past sixteen years, the fact remains that the proportional contribution of institutions has remained almost the same.

Table 6. Ranking of 13 Universities in South Africa for Research Publications

HEI	2016	2017	2018	2019	2020	Movement
DUT	17	16	13	16	13	↑
MUT	25	24	25	25	24	↑
UKZN	2	2	1	1	1	–
UniZulu	19	18	18	17	17	–
UCT	3	6	5	5	6	↓
Wits	4	3	4	6	5	↑
STEL	5	4	3	4	3	↑
UP	1	1	2	3	4	↓
UJ	6	5	6	2	2	–
NWU	8	7	7	7	7	–
UWC	10	11	11	10	10	–
UFS	9	9	9	9	9	–
UNISA	7	8	8	8	8	–

Source: Department of Higher Education and Training (2016 – 2020) ⁹

Table 6 above depicts the ranking of the 26 HEIs in terms of the research units. DUT, MUT, Wits and Stellenbosch improved their places in the ranking, while UCT and UP showed a decline in the ranking. The other universities managed to keep their positions. The six most productive universities (UKZN, UJ, SU, UP, WITS and UCT) contributed nearly 59% to the sector’s total research publication outputs. The next three universities (NWU, UNISA and UFS) contributed a further 20%.

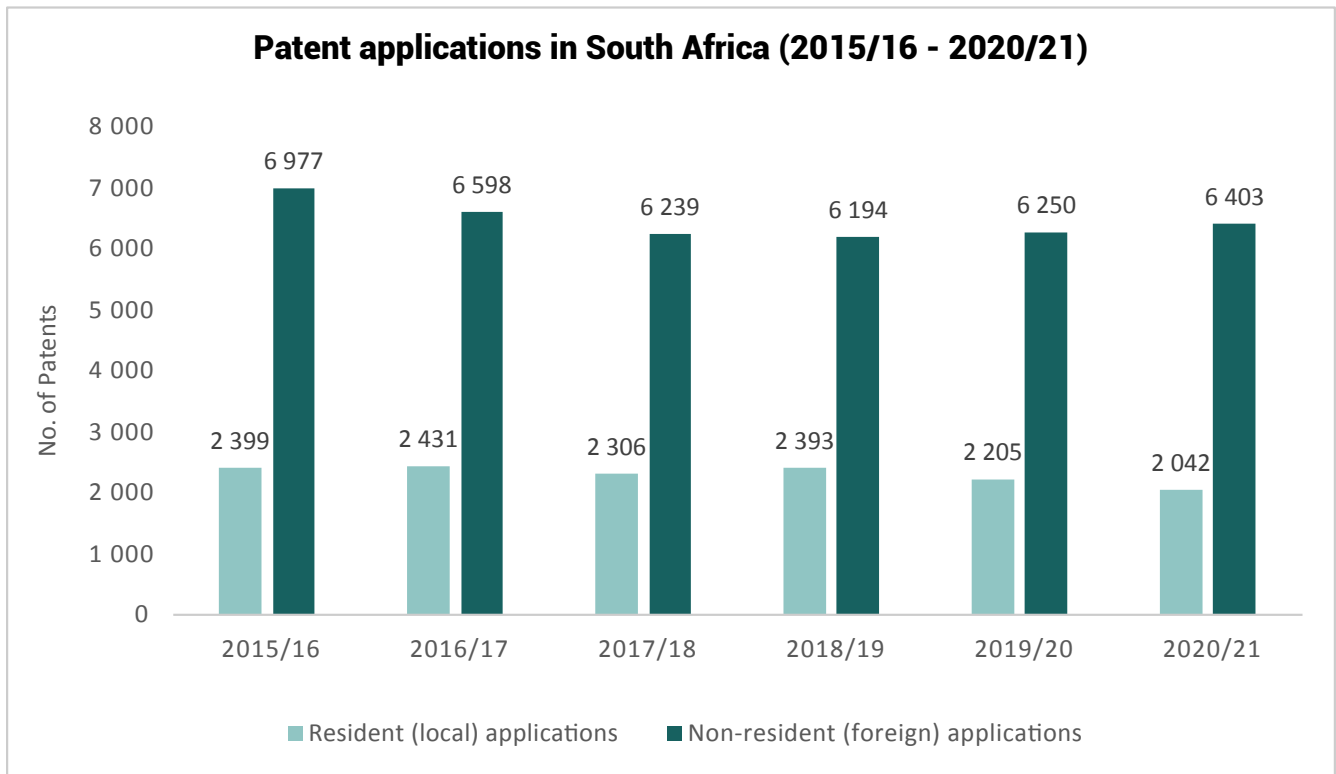
3.1.5 INTELLECTUAL PROPERTY

The following few graphs (**Figure 13 – 18**) focus on intellectual property in the form of patents, patent designs, film copyrights and trademarks lodged and granted annually over the period of five years. The Department of Trade, Industry and Competition (DTIC) is the department of the South African government with the responsibility for commercial policy and industrial policy. The Companies Intellectual Property Commission (CIPC) publishes an annual report detailing the performance information, governance report, human resources and financial information for the past financial year for various public and private companies or institutions. For the purpose of this publication, focus will be on the performance information by key services (i.e., patents, trademarks, designs and film copyrights) offered by the CIPC.

It is worth noting that an application filed in the country by its own resident is referred to as a local filing, whereas a non-resident filing refers to one filed by a foreign applicant. An abroad filing refers to an application filed by this country’s resident at a foreign office. Provisional patent and complete patent applications constitute the total local (resident) patent applications submitted. Convention patent and patent cooperation treaty (PCT) patent applications constitute the total foreign (non-resident) patent applications filed (CIPC annual report, 2020/21) ¹⁰.

A patent is an exclusive right granted for an invention. The invention must be a product or process that provides a new way of doing something, or that offers a new technical solution to a problem. Patent applications prevents others from making, using, exercising, disposing of or importing the patent protected invention for a limited period of twenty years.

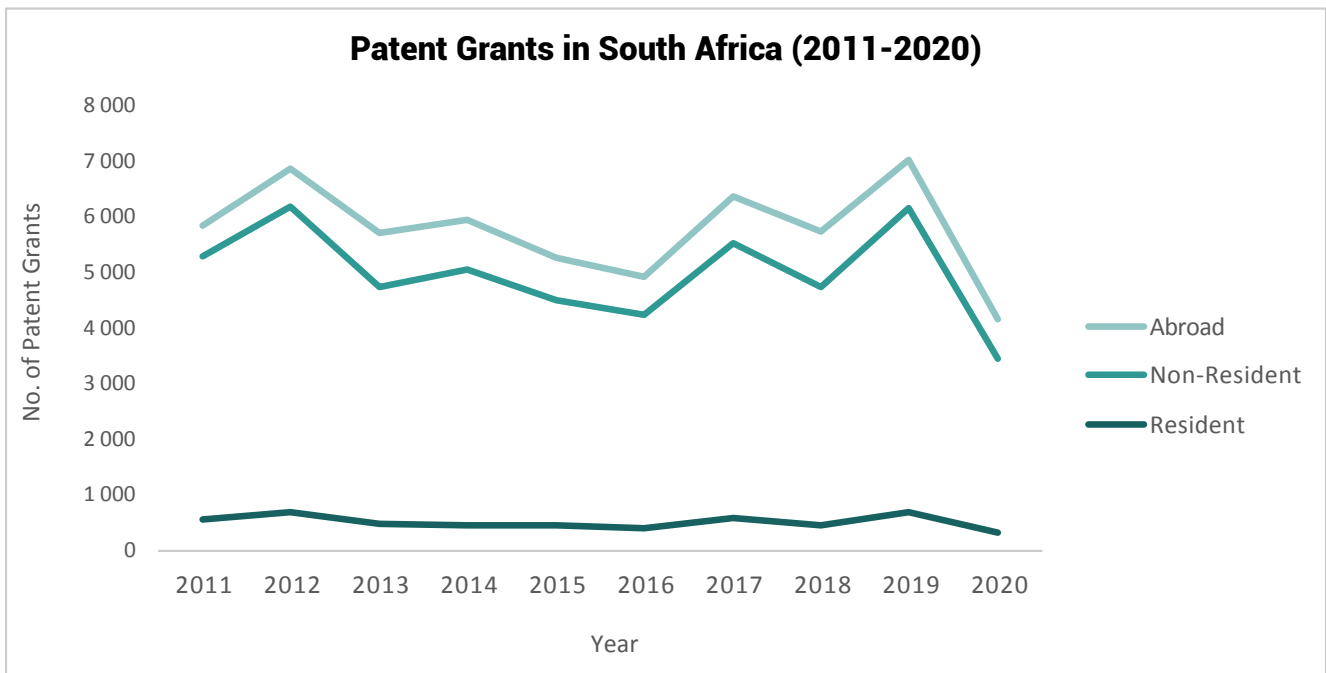
Figure 14. Patents Lodged in South Africa (2015/16 - 2020/21)



Source: SA Gov and CIPC (2015/16 - 2020/21) ¹¹

The number of patent applications filed at the CIPC has remained steady over the five years with an average of 8 500 patent applications filed year on year as shown in **Figure 14**. In the 2020/21 fiscal year 8 455 patent were filed, of these, 2 042 were resident (local) filings and 6 403 non-resident (foreign) filings. The graph shows a decline in patent filings since 2016/17 (from 9 027 filed patent applications) to 2020/21 (8 445 filed patent applications). Overall, local applications have continued to be significantly lower compared to foreign applications.

Figure 15. Patent Grants in South Africa (2011-2020)

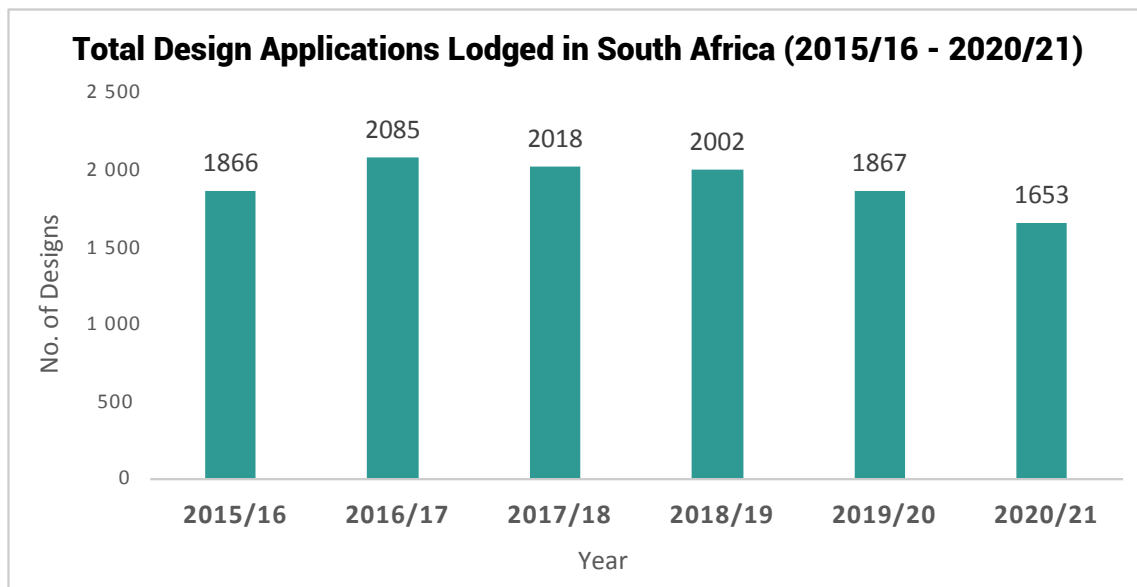


Source: SA Gov and CIPC (2010/11 – 2020/21) ¹¹

The number of abroad and foreign patent grant applications lodged have shown fluctuations over the years. Whereas resident applications have remained steady from 2011 to 2020. Resident and abroad patent grants declined by 313 and 710 respectively from 2019 to 2020. Non-residents grant holders experienced a fall by nearly 3 153 in the same fiscal period as illustrated in **Figure 15**.

The registration of design patents provides an exclusive right to use a specific design and prevent others from manufacturing, importing or using it. There are two types of designs that can be registered, namely, aesthetic design which is legally protected for fifteen years, and a functional design protected for ten years. An aesthetic refers to any design with a unique shape or configuration appealing to the eye, whereas functional designs shapes or configurations that are necessitated by its function.

Figure 16. Design Patents Lodged in South Africa (2015/16 – 2020/21)

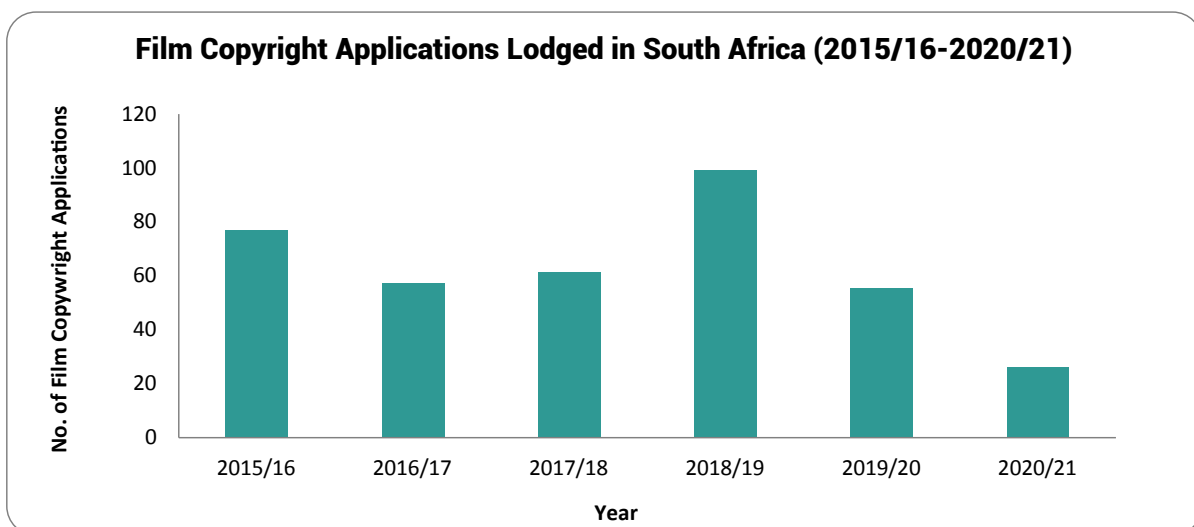


Source: SA Gov and CIPC (2015/16 – 2020/21) ¹²

The design patent application trends illustrated in **Figure 16** above, show that there has been a gradual decline in local patent design applications lodged with the CIPC since 2016/17. Though this financial year remains one with the highest volume of design applications accounting for 2 085. In 2020/21, a total of 1 653 design patent applications were lodged, a decrease from the 1 867 in 2019/20.

Copyright protection is important across all industries, particularly in the Arts sector. This serves as a secure right to protect any original work that can be seen or heard such as books, painting or music which are all automatically eligible for copyright without registration. However, copyrights in cinematograph film must be applied for through a Registrar of Copyright.

Figure 17. Film Copyright Applications Lodged in South Africa (2015/16-2020/21)

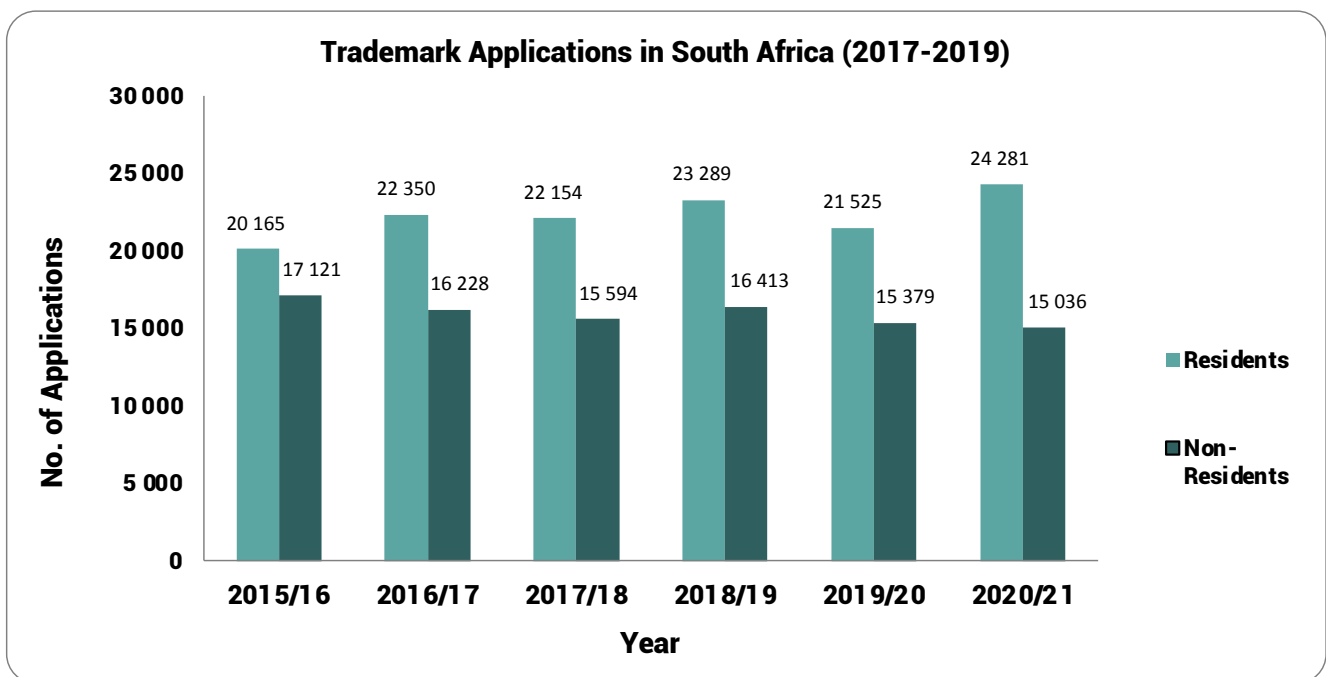


Source: SA Gov and CIPC (2015/16 – 2020/21) ¹³

The above **Figure 17** shows the number of film copyright applications lodged from 2015/16 to 2020/21. Copyright in film applications filed were only 26 in 2020/21 compared to 55 in 2019/20, a 52% decline in one year. During Quarter 1, which fell under levels 4 and 5 of the national lock-down - only one application was received. Over the past five years, copyright in film applications have been declining with the 2017/18 year still holding the highest volume (99) of applications lodged.

Trademark applications and registrations are done to prevent competitors from using a trademark for a specific good or service. The trademark protection can be indefinite so long as its registration is renewed every ten years.

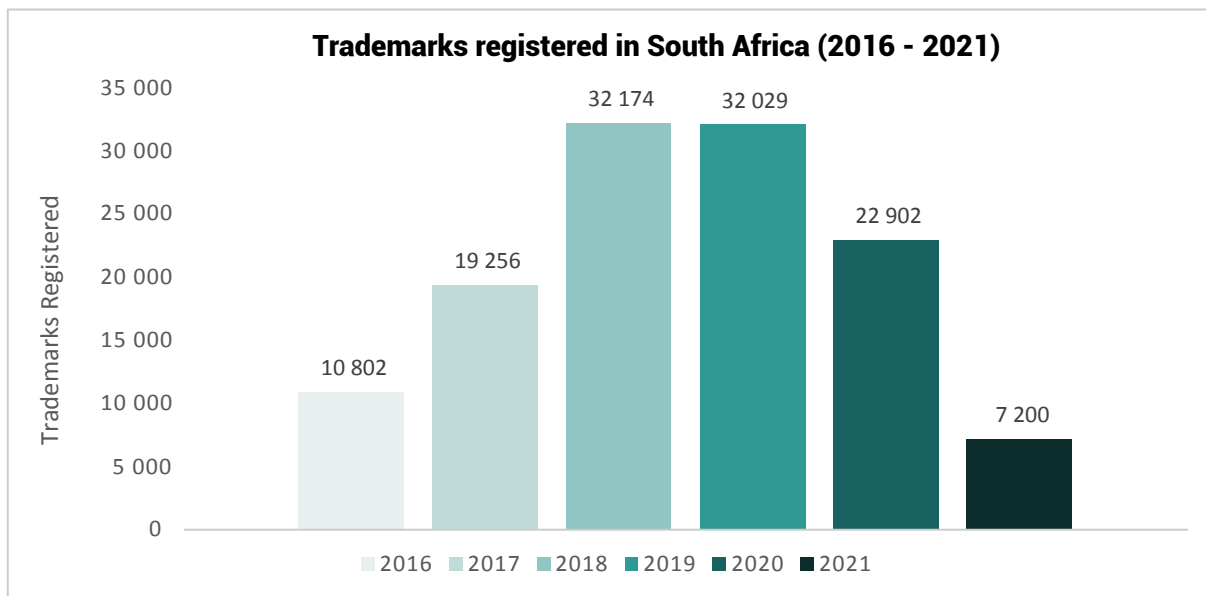
Figure 18. Trademark Applications in South Africa (2015/16-2019/20)



Source: SA Gov and CIPC (2016/17 - 2019/20) ¹⁴

As shown in **Figure 18** above, trademarks applications in South Africa by residents have shown a fluctuation over the last five years. In the 2020/21 financial year, there was an increase in the lodging of new applications when compared to the previous year in 2019/20. In 2020/21, trademark applications lodged totalled to 39 317. Of these, 24 281 were resident and 15 036 were non-resident. This showed an increase from the previous years (2019/20) total number of 36 904 applications, where resident applications amounted to 21 525 and 15 379 for non-residents. Local applications remain significantly high from 2015/16 to 2020/21 compared to non-resident applications.

Figure 19. Trade marks registered in South Africa (2016 - 2021)



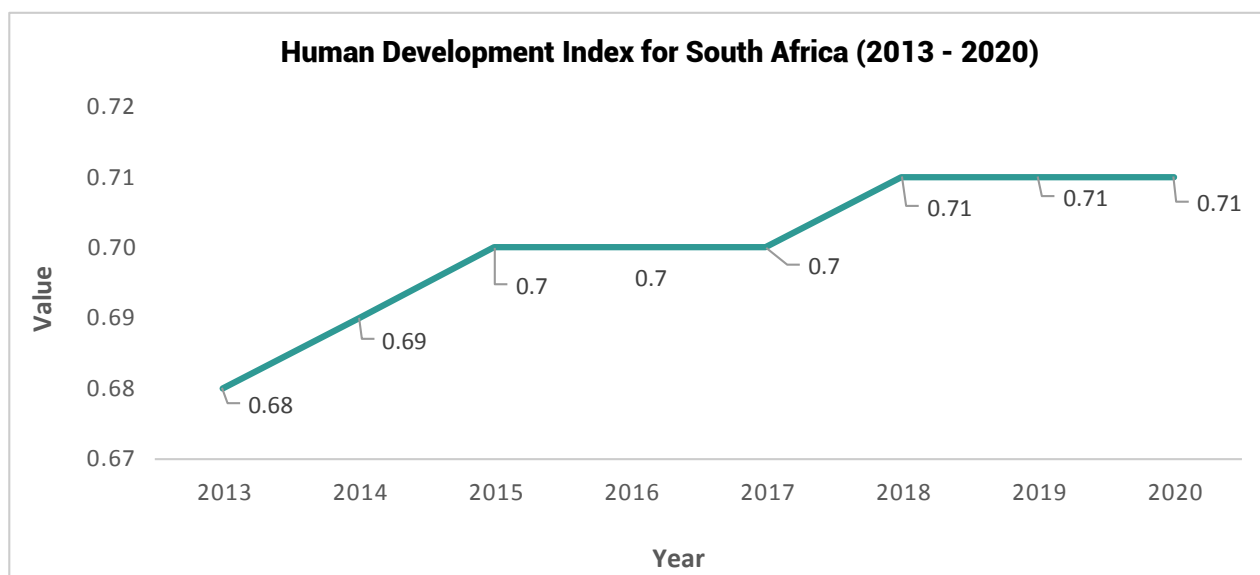
Source: CIPC (2015/16 - 2020/21) ¹⁴

As shown in **Figure 19**, there was a significant decline of 7 200 (ending April 2021) trademark registrations in 2021 compared to a total of 22 902 registrations the previous year in 2020. Prior to 2019 registrations had increased gradually year on year with 2018 still holding the highest volume of registrations totalling a record of 32 174. In 2020, there was a decline in trademark registrations which continued further into 2021.

3.1.6 SOCIAL INDICATORS

The Human Development Index (HDI) is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. The HDI is metric valued from 0 – 1 with 0 representing very low human development and 1 representing very high human development. This metric was first introduced in 1990 and has been used to measure country's development by the United Nations Development Program. The metric has been measured and released annually since, except in 2012 (South Africa HDI Report, 2020) ¹¹

Figure 20. Human Development Index for South Africa (2013 - 2020)



Source: SA HDI report in The Global Economy Webpage (2020) ¹⁵

South Africa's HDI value was reported at a high of 0.709 points in 2019/20 compared to the world average of 0.723 based on 185 countries in the HDI category. Between 2013 and 2020, there has been a steady growth in the country's HDI values which increased from 0.68 to the latest value of 0.709, an increase of 16% as shown in **Figure 20**. The HDI values and projections were sourced from the HDI report 2020.

Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality. It should be noted that the World Bank, which publishes global Gini coefficient ratings, does not have data for all of the world's 195 countries. Additionally, those countries that provided data to the World Bank did so over a period from 1992 to 2018 and South Africa's data was last submitted in 2015.

Table 7. Top 10 Countries with the Highest Gini Coefficients (%)

Country (Year)	Gini Index Value
South Africa (2014)	63.0
Namibia (2015)	59.1
Suriname (1999)	57.9
Zambia (2015)	57.1
Sao Tome & Principe (2017)	56.3
Central African Republic (2008)	56.2
Eswatini (2016)	64.6
Mozambique (2014)	54.0
Brazil (2019)	53.4
Belize (1999)	53.3

Source: World Population Review ¹⁶

The Gini index in South Africa was reported at 63 in 2014 (**Table 7**), according to the World Bank collection of development indicators, compiled from officially recognised sources. And according to this Fig/Table, South Africa has the highest inequality in income distribution.

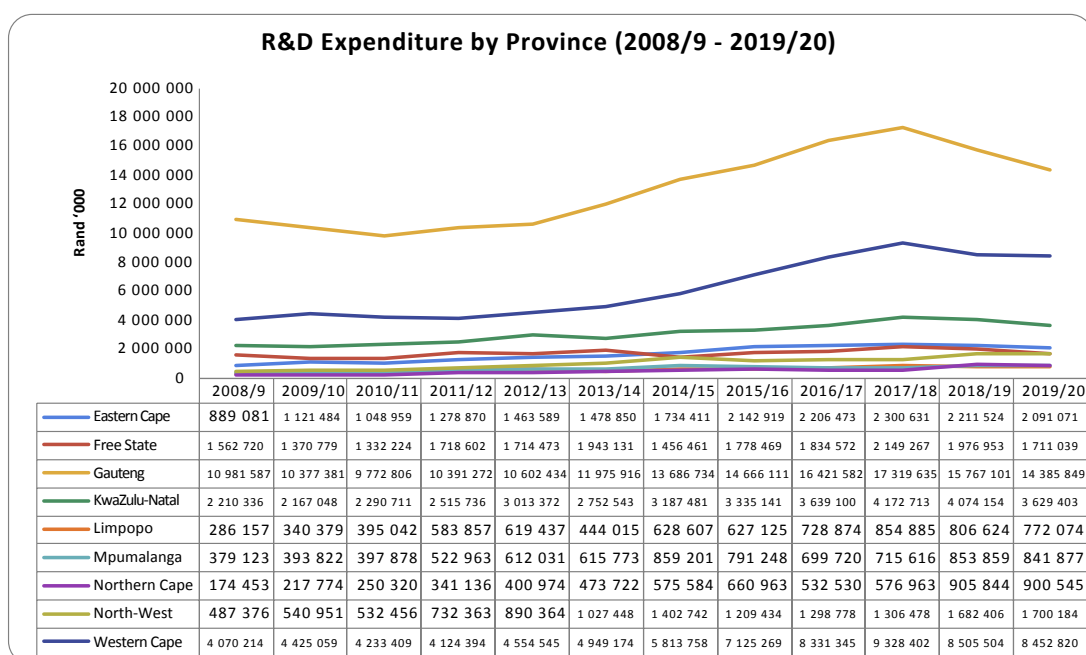
According to the South African Human Sciences Research Council (HSRC) 2014 report^h, the definition of “income” for Gini index reporting purposes excludes earnings from the informal sector, which is a major factor in developing countries. The HSRC report also states that it is also possible that two countries could have different income distributions but the same Gini coefficient, showing that simplifying a complex issue like inequality into a single number does not give the full picture. However, as this is the most recent information to use for South Africa, it is clear that the index needs improvement or more recent information needs to be supplied to the World Bank to capture the current socio-economic status of the country’s income distribution.

3.2 INVESTMENT

This section focuses on investments into research and development (R&D) as well as investment made to support innovation. The main indicators to be outlined in the section include National R&D expenditure by province, provincial R&D expenditure by source, Gross Expenditure on R&D (GERD) and Business Expenditure on R&D (BERD) as a percentage of Gross Domestic Product (GDP) (Department of Science and Innovation, 2021)¹⁷, as well as the venture capital (VC) value and number of investments made.

3.2.1 RESEARCH & DEVELOPMENT EXPENDITURE

Figure 21. R&D Expenditure by Province (2008/9-2019/20)



Source: Department of Science and Innovation (2021)¹⁷

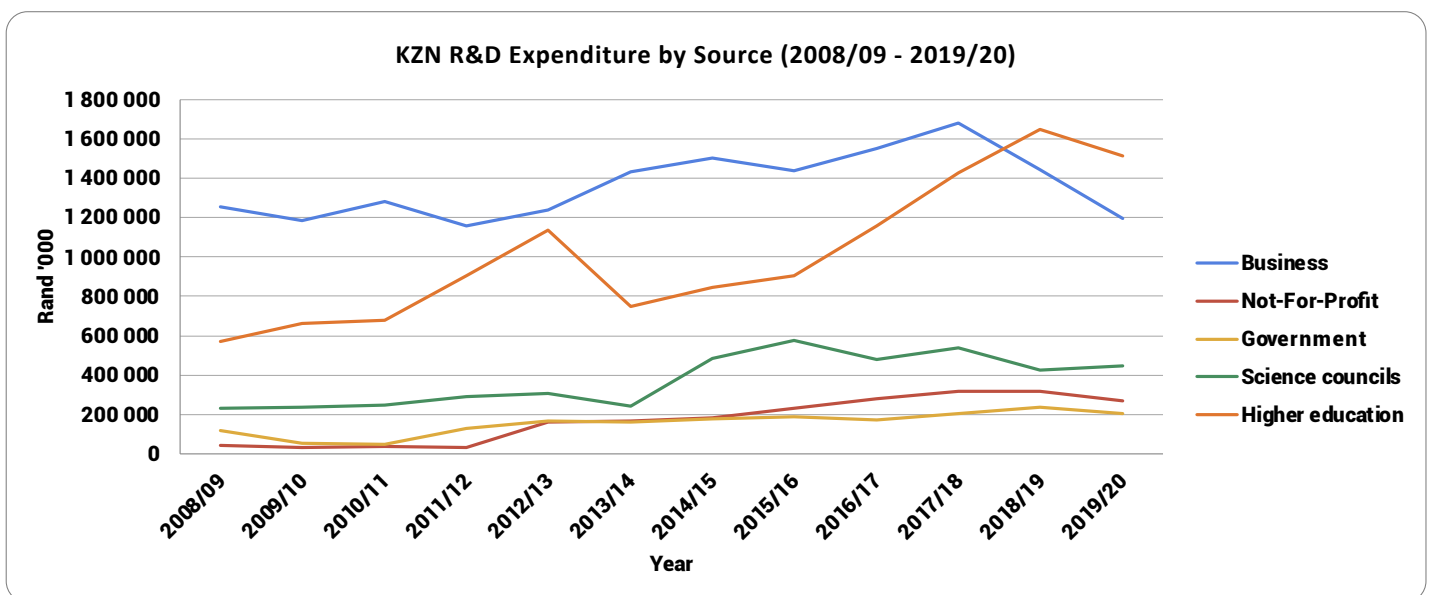
^h URL: <http://www.hsrb.ac.za/uploads/pageNews/182/12204%20HSRC%20Review%20OctNov%20LR.pdf>

The above graph in **Figure 21** shows R&D expenditure by province in value (rands – R’000) for each province from 2008/9 to 2019/20. There was an overall decline in R&D expenditure across most provinces in the country, with only North-West showing a slight increase of 1 700 184 in 2019/20 compared to R 1 682 406 reported in 2018/19. Gauteng, Western Cape and KwaZulu Natal (KZN) account for the highest R&D expenditures in the country. However, all three have shown a decline in the R&D expenditure in 2019/20. Gauteng’s R&D expenditure decreased to 1 711 039 in 2019/21 compared to 15 767 101 the previous year but remains the highest of all the provinces. Western Cape with the second highest also decreased from 8 505 504 in 2018/19 to R 8 452 820 in 2019/20. KZN with the third highest R&D expenditure compared to other provinces in the country also dropped to 3 629 403 in 2019/20 from 4 074 154 in the 2018/19 fiscal year.

R&D expenditure in KZN consists of five major sources of R&D funds from key sectors in the country. These include:

- Government
- Business
- Not-for-profit
- Science councils
- Higher education

Figure 22. KZN R&D Expenditure by Source (2008/9-2019/20)



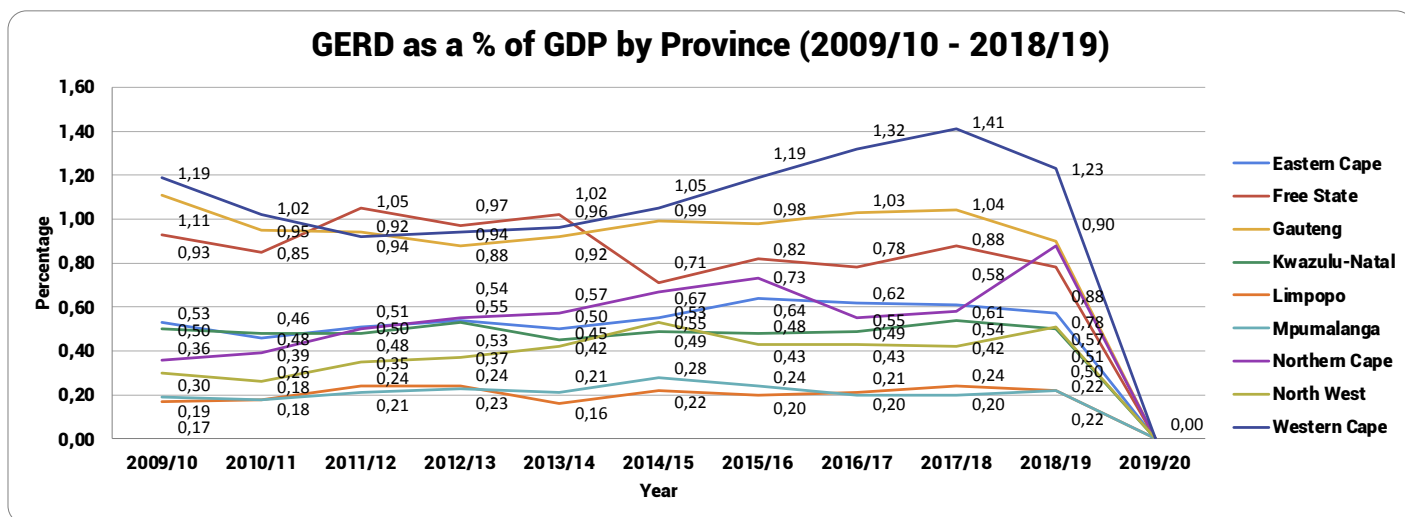
Source: Department of Science and Innovation (2019/20) ¹⁷

Figure 22 shows the KZN R&D expenditure by source. The business sector is one of the major contributors in KZN’s R&D expenditure but has shown a decrease to 1 193 914 in 2019/20 from 1 446 281 the previous year. Higher education sector accounted for 1 646 915 R&D expenditure for KZN in 2018/19 which surpassed the business sector contributions in

the same year. It showed a decline in 2019/20 to 1 514 301 but remains the majority share of the R&D expenditure across all sectors in the province. Science council R&D expenditure contributions saw an increase from 427 585 in 2018/19 to 448 070 in 2019/20, but 2015/16 remains the year with the highest total R&D expenditure reported at R 575 016. The government and not-for-profit sectors both have the lowest share of R&D expenditure in the province.

GERD measures all national expenditure on research and development for a particular year.

Figure 23. GERD as a % of GDP by Province (2009/10 – 2018/19)

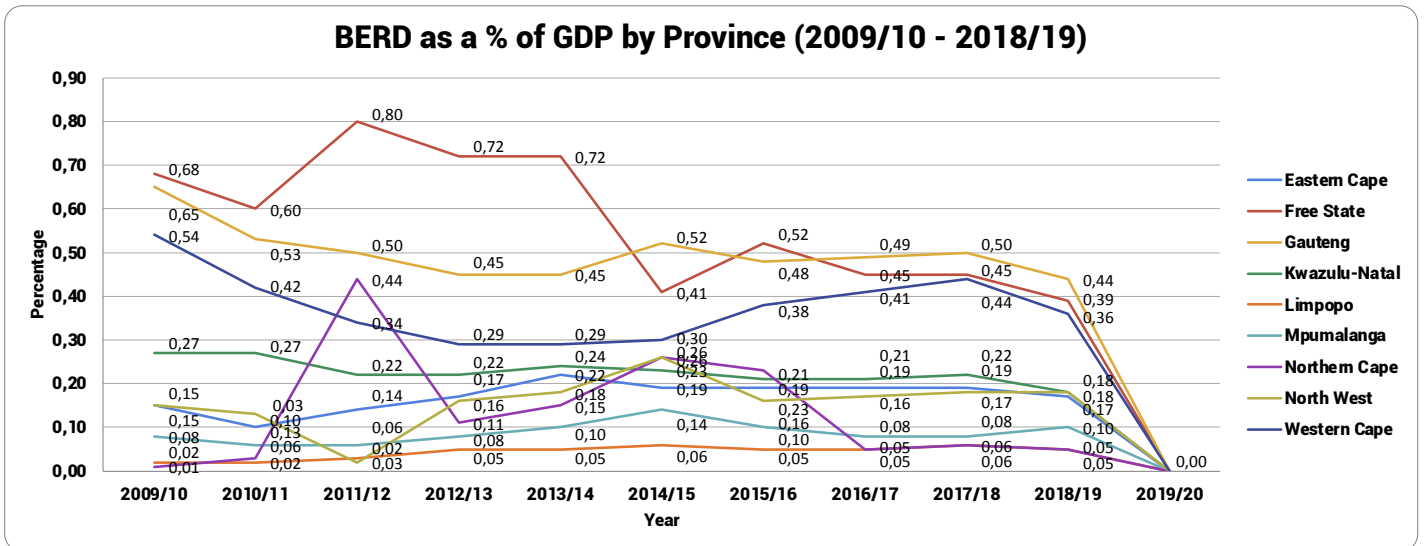


Source: Department of Science and Innovation (2018/19) ¹⁷

Figure 23 shows GERD as a percentage of GDP by province. The national target for GERD as a percentage of GDP is 1.5%, which is in line with other upper-middle income countries. In 2017/18, South Africa’s GERD as a percentage of GDP was under the target at 0.83% and in 2018/19 it fell even further to 0.75%. In 2018/19, KZN GERD as a percentage of GDP was 0.50%, a decrease of 0.04% from 2017/18, and is currently the 7th out of the nine provinces (down from 6th position in 2017/18). GERD as a percentage of GDP was highest in the Western Cape at 1.23%, however this is a decrease of 0.18% from the previous year. Gauteng follows with 0.9% in 2018/19, which is a decline of 0.14% from 2017/18.

BERD measures all national expenditure on the business sector for a particular year.

Figure 24. BERD as a % of GDP by Province (2009/10 - 2019/20)



Source: Department of Science and Innovation (2018/19) ¹⁷

BERD as a percentage of GDP (Figure 24) was 0.27% for KZN in 2009/10 and has decreased to 0.18% in 2018/19. Gauteng’s BERD as a percentage of GDP was the highest at 0.44% (down from 0.50% in 2017/18), followed by the Free State at 0.39% (down from 0.45% in 2017/18) and Western Cape at 0.36% (down from 0.44% in 2017/18). There is an overall trend of decreasing business expenditure on R&D in South Africa, which is concerning.

3.2.2 VENTURE CAPITAL

The deal activity of Venture Capital (VC) and early-stage investments into South African businesses are analysed annually by the South African Venture Capital and Private Equity Association (SAVCA). The following graphs will focus on venture capital investments that include value contribution by type of fund; number of investments; value by stage deal contribution; and value percentage contribution by location of investee head office (SAVCA, 2021) ¹⁸

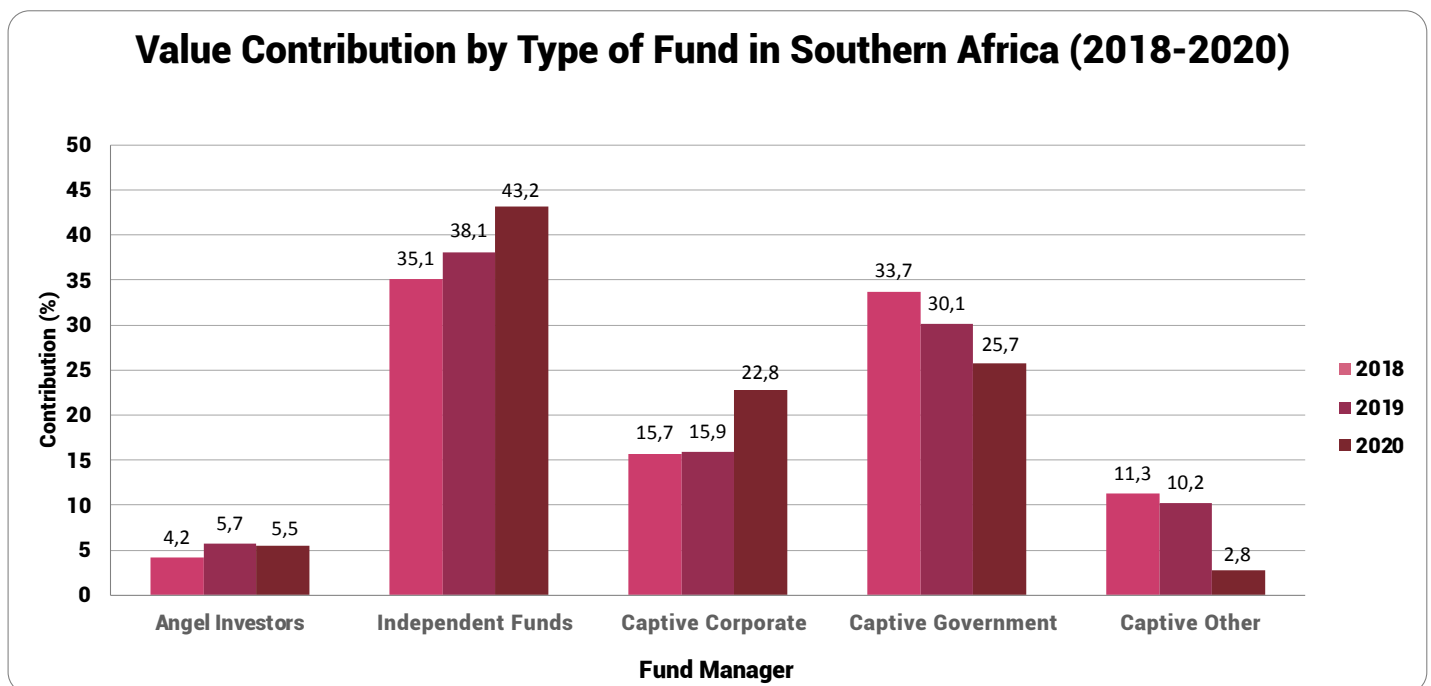
VC is classified into six fund manager types, which include (SAVCA, 2021: 11):

- **Angel investors:** High net-worth individuals who invest funding for start-up businesses in return for ownership equity or convertible debt.
- **Independent funds:** Funds managed by fund managers in which third party investors are the main source of capital and no one investor holds a majority stake.
- **Captive corporate:** Funds primarily sourced from a corporate entity such as a listed company.

- **Captive government:** Funds mainly sourced from government agencies or public body.
- **Captive other:** Funds sourced from other sources such as family offices.
- **Captive funds:** Funds in which one shareholder contributes most of the funding, typically where a corporate or parent organisation allocates funds to the Captive Fund from its own internal resources. Captive Funds may be subsidiaries of, or divisions within, financial institutions or industrial companies.

For the purpose of this publication, only five of the six fund managers will be analysed and discussed.

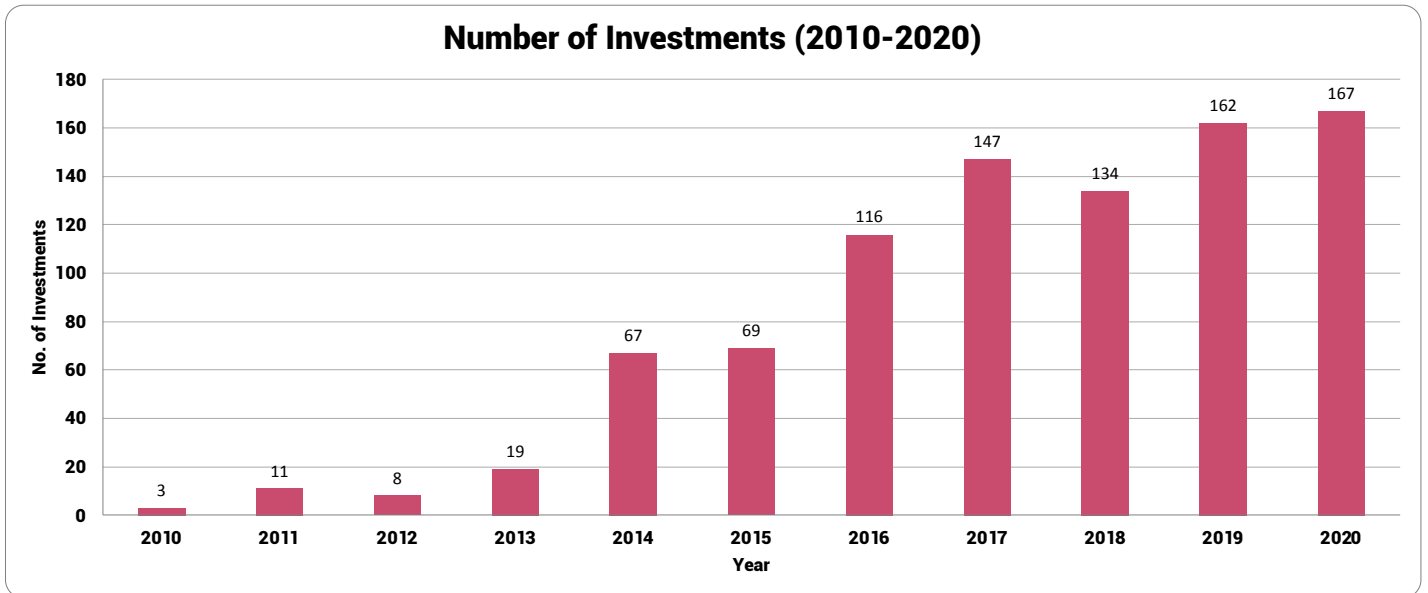
Figure 25. Value Contribution by Type of Fund (2018 - 2020)



Source: SAVCA (2021) ¹⁸

Figure 25 above illustrates the value contribution of venture capital investments by fund manager type from 2018 to 2020. The independent funds fund type remained with the largest value contribution of VC investment at 43.5% in 2020 an increase from 38.1 % in 2019 and 35.1% in 2018. Captive government fund manager type is the second largest VC investor; however, it saw a decreased 25.7% of fund contributions in 2020 compared to 30.1 % in 2019. The value contribution of funds by captive corporate in 2020 reached 22.8% an increase from 15.9% and 15.7% fund contributions in 2019 and 2018, respectively. Other captive funds had a decline of 2.8% in 2020 and most early-stage investments by angel investors made up 5.5% in 2020 a slight decrease from the 5.7% in 2019. Overall, the country’s investors concluded another year in 2020 despite the negative impact on the economy due to the global COVID-19 pandemic. Three of the top five large and established fund managers made no new investments in 2020 due to the pandemic and opted to rather set aside capital for assistance to existing portfolios (SAVCA, 2021).

Figure 26. Number of Venture Capital Investments (2010-2020)

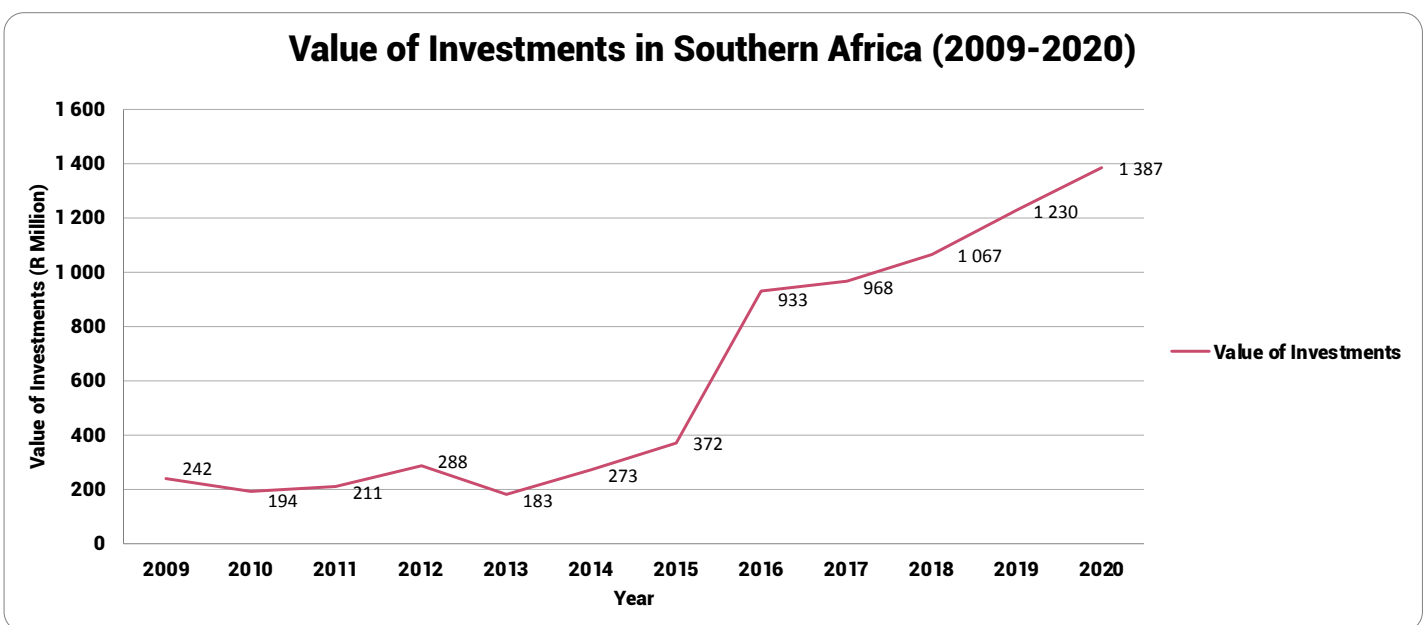


Source: SAVCA (2021)¹⁷

The graph in **Figure 26** provides the number of investments by venture capital between 2010 and 2020. There has been an upward trend in investment by VC in this period. In 2020, there were 167 investment deals, a significant increase from only 3 investment deals 10 years prior. It also showed an improvement from 2019 that had 162 investments by venture capital. This suggests an increased level of investor confidence and interest in Southern African markets or industries.

The scale and rate at which the South African VC asset class is growing is evident when comparing investment activity for the last five years.

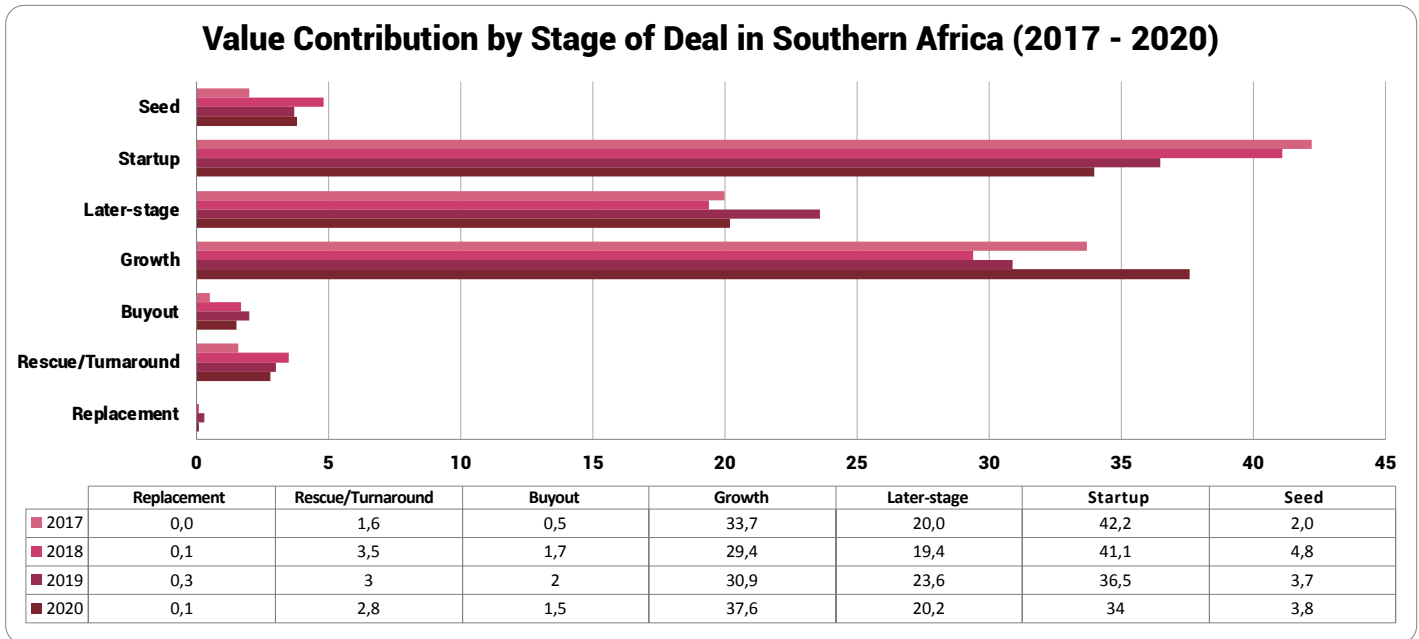
Figure 27. Total Rand Value of Investments in South Africa (2009-2020)



Source: SAVCA¹⁸

The investments per year, by value has experienced year-on-year growth since 2013 in the total amount of capital allocated to businesses as illustrated in **Figure 27** above. In 2020, the total value of investments in Southern Africa amounted to 1 387 million a significant increase compared to 183 million in 2013. 2020 investment amounts were 48.7% higher than investments in 2016 that totalled 933 million. It is also worth noting that the food and beverage sector attracted the largest Rand value investments resulting in it surpassing the manufacturing sector.

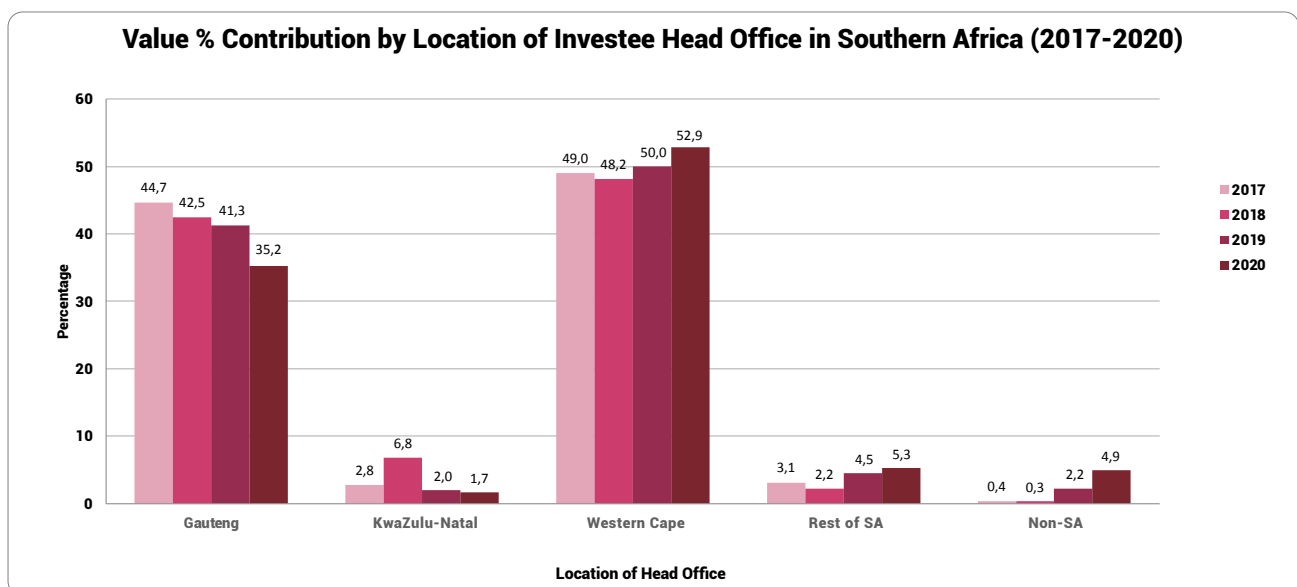
Figure 28. Value Contribution by Stage of Deal, 2017 - 2020



Source: SAVCA¹⁸

The chart on **Figure 28** above shows the value of contribution by stage of the deal since 2017. 53.5% of all active deals involved seed or start-up stage businesses, by number of deals still invested. Start-ups accounted for 34 % by value of deals where all deals still invested in 2020, a decline from 36.5% the previous year in 2019. Growth capital had the largest share of contribution by stage of the deal with 37.6% value deals in 2020 an increase from 30,9% in 2019. The later-stage financing also experienced a decline to 20.2% in 2020 compared to 23.6% the previous year. Overall, other contributions through seed, buyout, rescue investments remained relatively low in 2020 compared to the major three contributors mentioned before.

Figure 29. Value Contribution by Location of Investee Head Office (2017 - 2020)



Source: SAVCA (2021) ¹⁸

The graph in **Figure 29** shows the value contribution by location of investee head office. All active venture capital (VC) deals still invested are mainly prevalent in Gauteng and the Western Cape, with 35.2% of VC rands invested in Gauteng and 52.9% in Western Cape during 2020. Western Cape based businesses accounted for the largest share of transactions in the value contribution by business in comparison to other provinces with all deals still invested in 2020. Which was followed by Gauteng, though it experienced a slight decrease from the previous year of 2019. Investments in non-South African based companies by South African fund managers doubled in 2020 by value 4.9% in comparison to 2.2% by value in 2019, by remains the lowest value contribution by business location. KwaZulu Natal based businesses had a significant decrease in value of contributions by business location at 1.7% in 2020 compared to 2% in 2019, making a province with the lowest value contribution by business location.

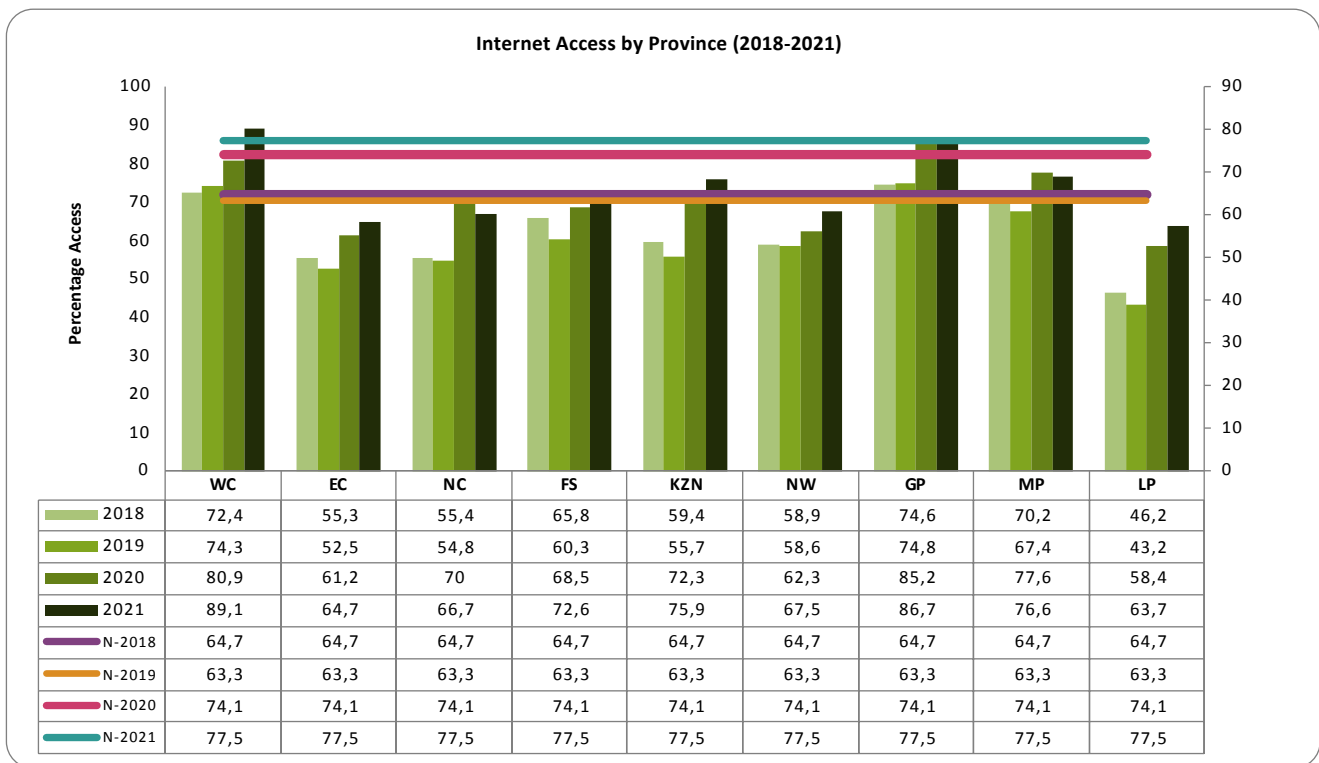
3.3 INFRASTRUCTURE

3.2.1 INTERNET ACCESS

Internet access is the indicator used to measure infrastructure that enables innovation. Internet access includes access at home, at work, through a mobile phone and via an internet café or educational facility. The data was obtained from Stats SA General Household Survey (2022).

According to Stats SA, communication plays an important role in the fundamental operation of a society. It links people and businesses, facilitating communication and the flow of ideas and information, and coordinating economic activities and development.

Figure 30. Internet Access (anywhere) by Province and for the Country (2018-2021)



Source: Stats SA (2018 - 2021) ⁴

Figure 30 shows the levels of population’s access to internet according to provinces. The chart illustrates that Western Cape citizens have the most access to internet connectivity at 89.1%, followed by the Gauteng Province (86.7%) and Mpumalanga Province (76.6%). Only WC and GP exceeded the national average in all four years profiled. Internet access for KZN citizens (75.9%) place the province in fourth place. The Northern Cape and Mpumalanga Province showed a slight decline in internet access period 2020 to 2021. The Northern Cape and Mpumalanga Province showed a slight decline in internet access in the period 2020 to 2021. The factors resulting in the decline are unclear.

3.4 ECOSYSTEM

3.4.1 INNOVATION SUPPORT INSTITUTIONS

The table below shows the science, technology and innovation organisations which offer support to entrepreneurs and innovators in KZN. Various types of business and entrepreneurial support are made available through key institutions. Commercialisation support involves services that assist innovators, entrepreneurs, and researchers with converting innovations into commercially viable products or services for financial gain. Financial support is provided through funding programmes, incentives, investments, application and grant support, and scholarships. Partnerships and collaborations are facilitated through networking opportunities and events. Where expert advice and guidance is dispensed on business, industry, and finance topics. Details on the science, technology and innovation organisations listed are provided in Section 5.

Table 8: Innovation Support Services in KZN

Institution	Commercialisation	Financial Support	Partnerships and Collaborations	Advisory
CSIR	X		X	X
DSBD		X	X	X
DSI	X	X	X	
DTIC	X	X		
DTP		X		
DUT	X	X		X
ID	X		X	X
Ithala		X	X	X
MKI	X			X
MUT	X			X
NEF		X		X
NRF		X		
RBIDZ	X	X		X
SAMRC	X	X	X	X
SASRI		X		X
Seda	X			X
Sefa		X	X	X
SmartXchange	X	X		X
TIA	X	X		X
TIKZN	X	X	X	X
UKZN	X	X		X
UNISA	X			X

The table below shows science, technology and innovation organisations which offer infrastructure support to entrepreneurs and innovators in KZN. Infrastructure support is provided through various structures. Facilities, laboratories, equipment, internet and computers, and machinery are accessible through specific institutions. Special zones, hubs, and incubators have been developed to promote innovation.

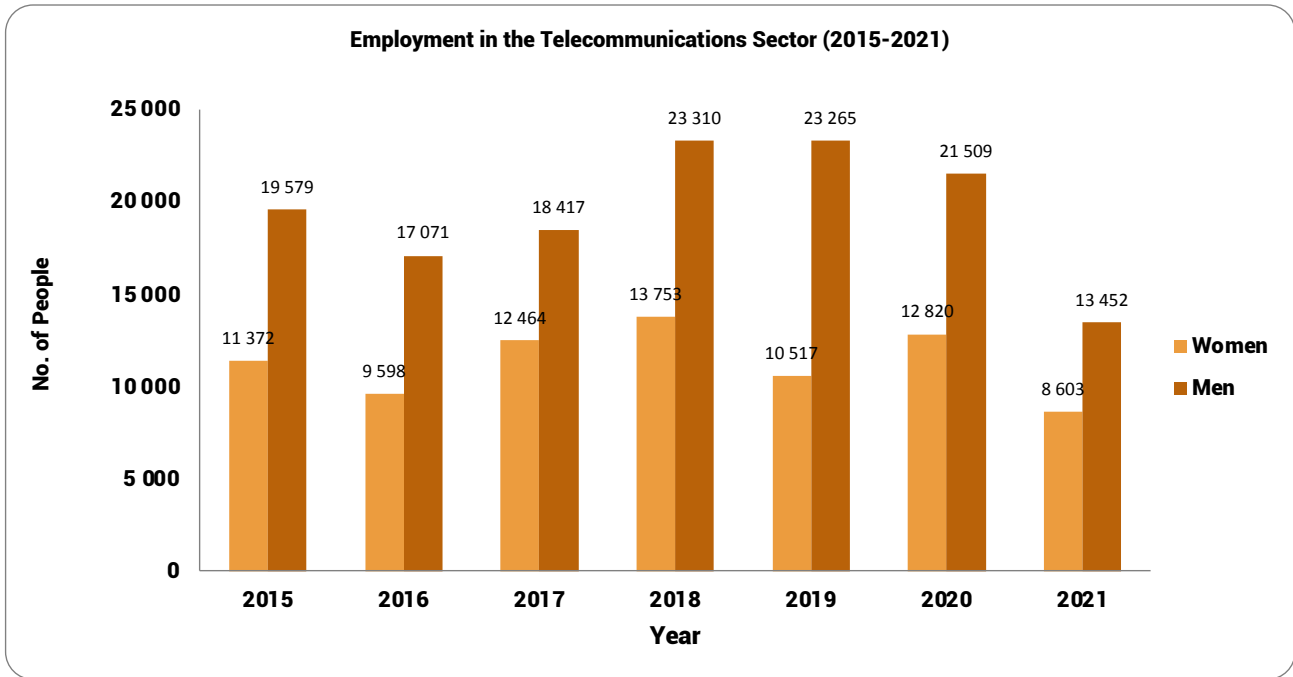
Table 9: Types of Infrastructure Support by Institution

Institution	Facilities and Equipment	Zones, Hubs and Incubators
CSIR	X	
DSBD		X
DSI		
DTIC		
DTP	X	X
DUT	X	X
ID	X	X
Ithala		
MKI	X	
MUT	X	
NEF		
NRF	X	
RBIDZ	X	X
SAMRC	X	
SASRI	X	
Seda		
Sefa	X	X
SmartXchange		X
TIA	X	X
TIKZN		
UKZN	X	X
UNISA		

3.5 IMPACT

3.5.1 IMPACT INDICATORS

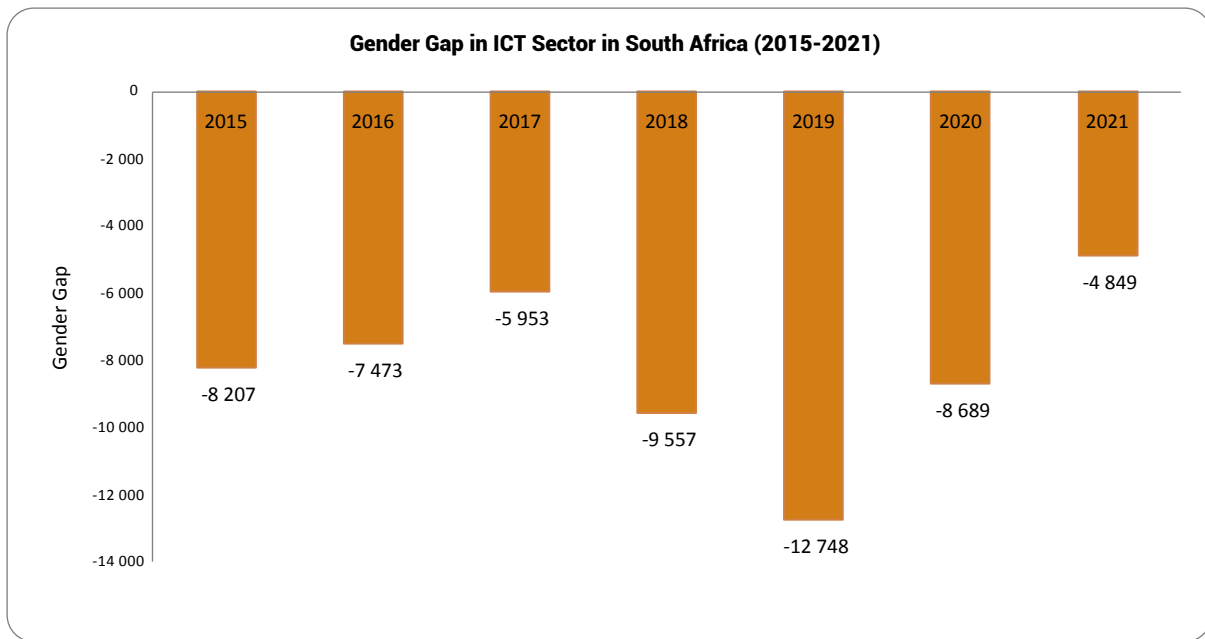
Figure 31. Employment in the Telecommunications Sector in South Africa (2015-2021)



Source: ICASA (2022) ¹⁹

The employment in the telecommunications sector is presented in **Figure 31** above shows the number of employment opportunities created in the telecommunications sector, received from the Independent Communications Authority of South Africa (ICASA). The chart shows the employment in the sector according to gender. In 2018, the sector recorded its highest employment figures. The data illustrates how total employment for women remains significantly lower across all the years profiled. In 2021, there was a decline in total employment in the sector. However, the decline in employment for women was relatively lower than the decline in employment for males in the same period. This can be interpreted as the sector responding to need to create more employment for women.

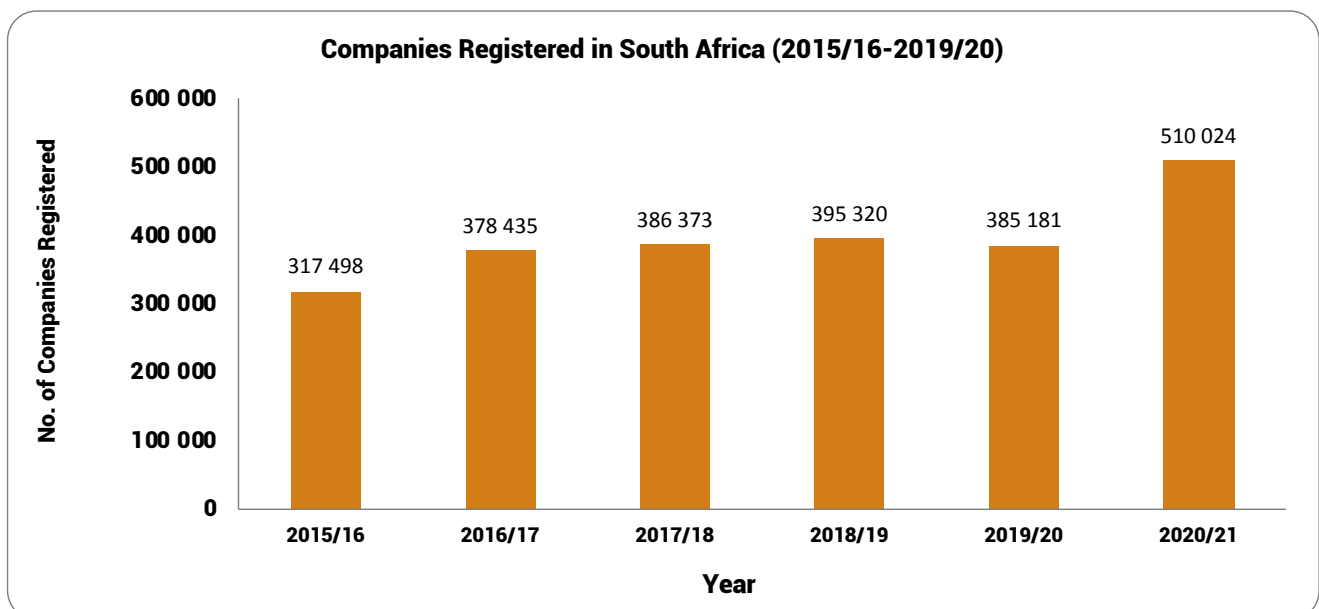
Figure 32. Employment Gender Gap in the Telecommunications Sector in South Africa (2015 – 2021)



Source: ICASA (2022) ¹⁹

Figure 32 illustrates the gender gap in the telecommunications sector in South Africa. There has been a significant gap in employment between males and females in the telecommunications sector over the past seven years. In 2019, the gap grew to reach a record high of 12 748. In 2021, there is a substantial decline in the employment gender gap. However, the total employment of men in the sector is still disproportionately higher than that of women.

Figure 33. Companies Registered in South Africa (2015/16 - 2020/21)

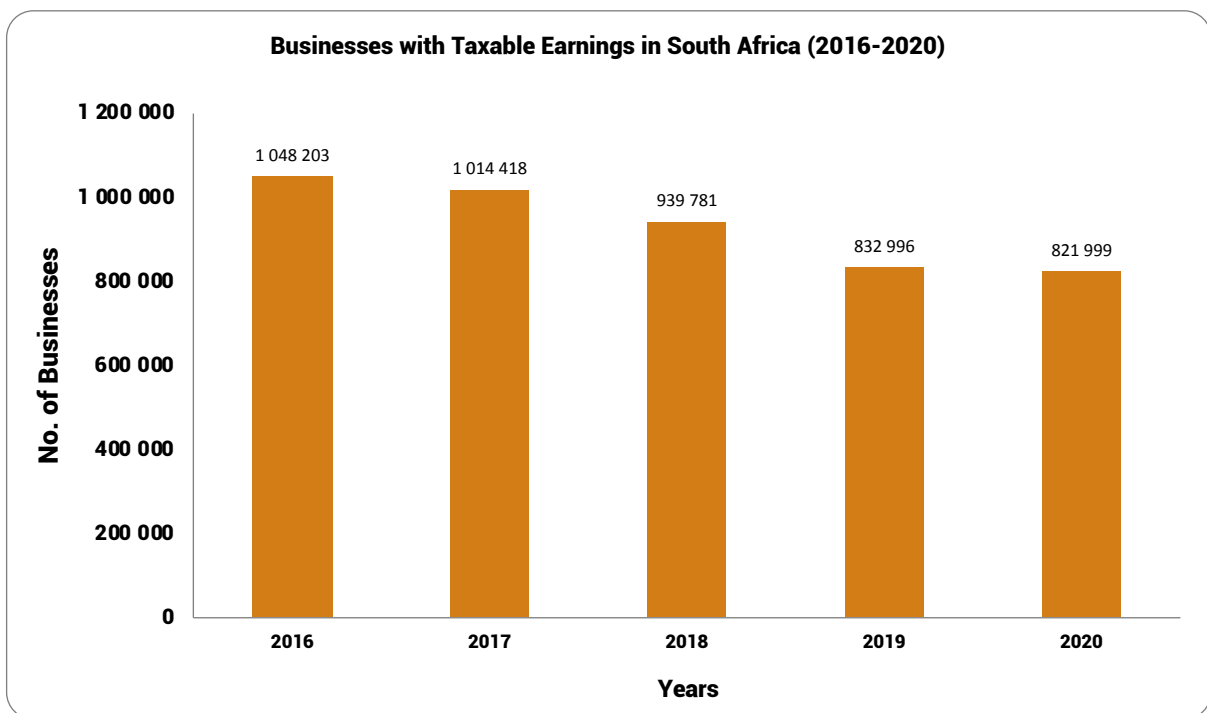


Source: CIPC (2020/21) ¹⁰

The number of new company registrations in South Africa increased from 317 498 in 2015/16 to 385 181 in 2019/20 as shown in **Figure 33**. Company registration volumes filed for the year 2020/21 on the above graph were 510 024. This was much higher than the previous years because registration of external companies is included, which was not included between the 2015/16 and 2019/20 financial years. This could also be due to the impact the COVID-19 pandemic had as more people registered more companies.

Any company that is incorporated in or effectively managed from South Africa is a South African resident for income tax purposes, thus it is liable to pay tax. Company income tax (CIT) is a tax levied on the taxable income of companies as well as close corporations. After personal income tax and value added tax, CIT remains the third largest contributor to the total tax revenue collection in the country (SARS, 2021). It is worth noting that 'Years' refers to South African tax years, not calendar years. Furthermore, the number of returns expected for a particular tax year is determined by the number of companies that have been assessed for that tax year, plus the number of companies with an "active" status that were assessed in respect of the two tax years prior to the relevant tax year, but have not yet been assessed for the tax year in question.

Figure 34. Businesses with Taxable Earnings in South Africa (2016 - 2020)

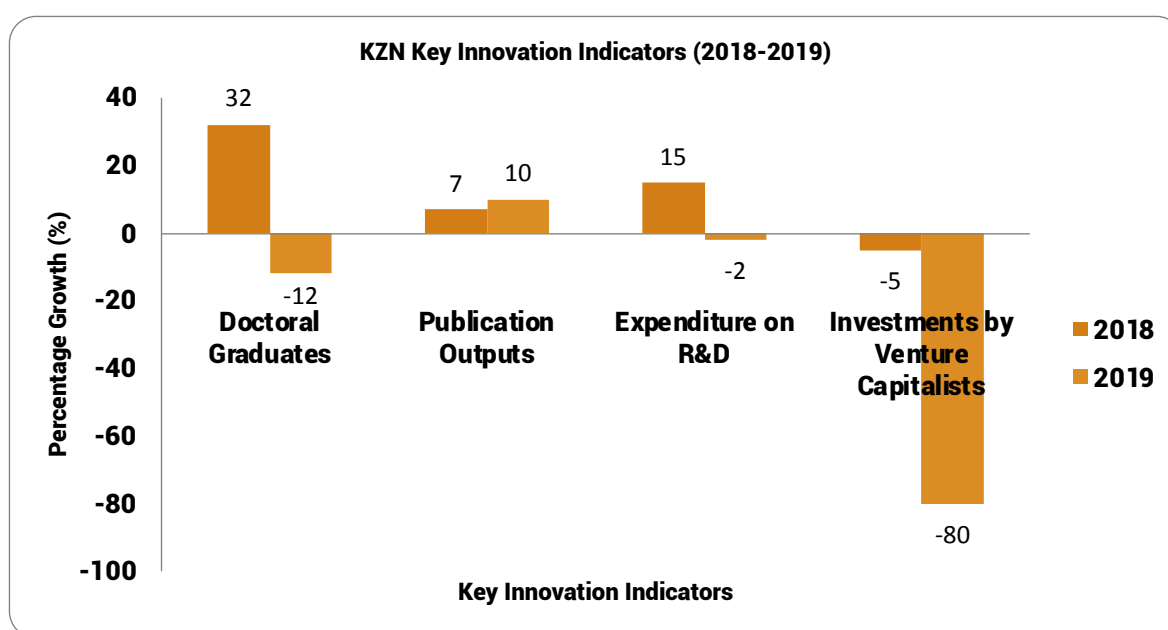


Source: SARS and National Treasury (2021) ²⁰

The above graph in **Figure 34** provides an overview of the number of registered businesses with taxable earnings. In 2020, 3.1 million companies were on the register for CIT with some being inactive or dormant. Of these, 821 999 were expected to submit income tax returns for the year 2020, a decline from 832 996 in the 2019 tax year. Companies that had no business activity from 2017 to 2020 were all removed from the CIT register resulting in a decline in the number of companies year by year (SARS, 2021). This could have been due to the negative impact of that the COVID-19 pandemic had on the country's economy.

Only indicators within the 'people' and 'investment' categories met these requirements (**Figure 35**). The two highest impact indicators from each category were selected. The limited number of indicators used in the index is a limitation, however, the index will grow and improve as data quality and availability improves each year.

Figure 35. KZN Key Innovation Indicators (2018-2019)

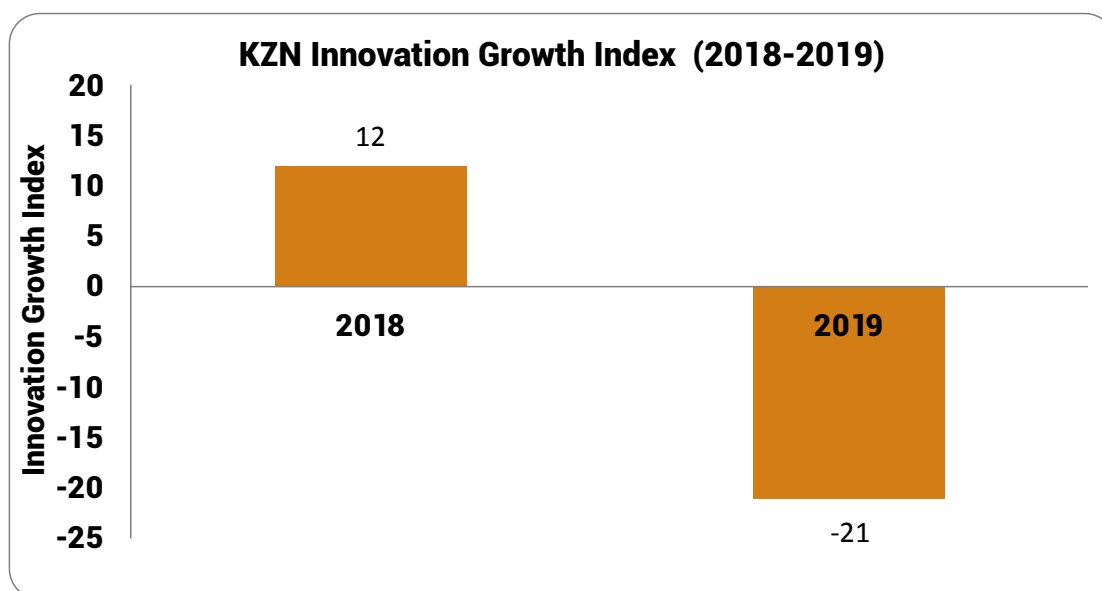


Source: DHET ^{8,9}, DSI ¹⁷, SAVCA ¹⁸

Three out of the four indicators used to determine the index declined in 2019, with only publication outputs at KZN universities increasing. This results in a negative growth index, as elected in **Figure 36**.

The Innovation Growth Index measures the growth of key innovation indicators for the most recent years for which data is available (in this case, 2017-2018 and 2018-2019). The index requires KZN-specific data, data availability for the 2018 and 2019 years, and data that represents a raw number (as opposed to a ratio or percentage).

Figure 36. KZN Innovation Growth Index (2018-2019)



Source: DHET^{8,9}, DSI¹⁷, SAVCA¹⁸

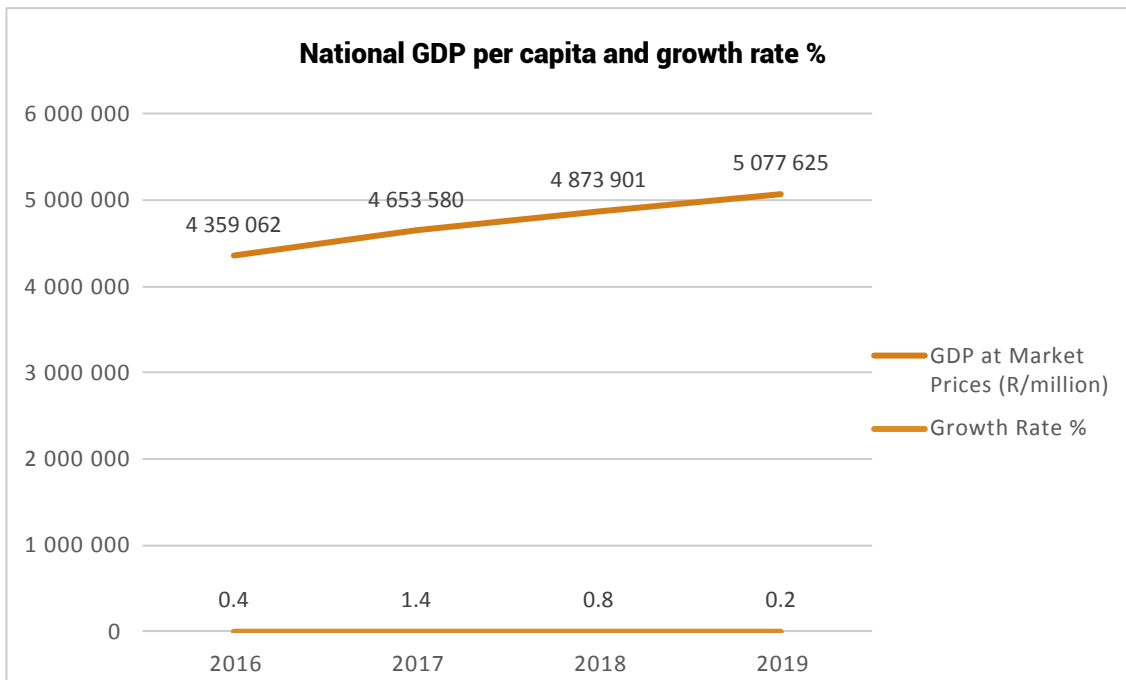
The Growth Index represents the average growth of the four selected indicators. The Growth Index for 2019 (-21) shows significant decline compared to 2018 (12). It should be noted that the 2018 index had to be adjusted from 50 to 12 due to a change in the base data relating to investments by venture capitalists in 2018.

Gross domestic product (GDP) is the single most important indicator to gauge economic activity and growth within a country. At national level, GDP refers to a measure the total market value of all goods and services produced within a country during a certain period. Economic activity varies across industries and across space (i.e. towns, cities and regions). Industries are clustered in different regions of the country. Key industries that drive the provincial economies include:

- Finance and business services
- Government
- Trade
- Manufacturing
- Mining
- Transport
- Other (i.e. agriculture, electricity, construction, personal services)

Therefore, going beyond the national value when considering economic growth can provide a more valuable or realistic picture of the whole economy. This section provides the South African national and provincial GDP per capita/at market prices for the years 2016 to 2019.

Figure 37. National GDP per capita and growth rate % (2016-2019)

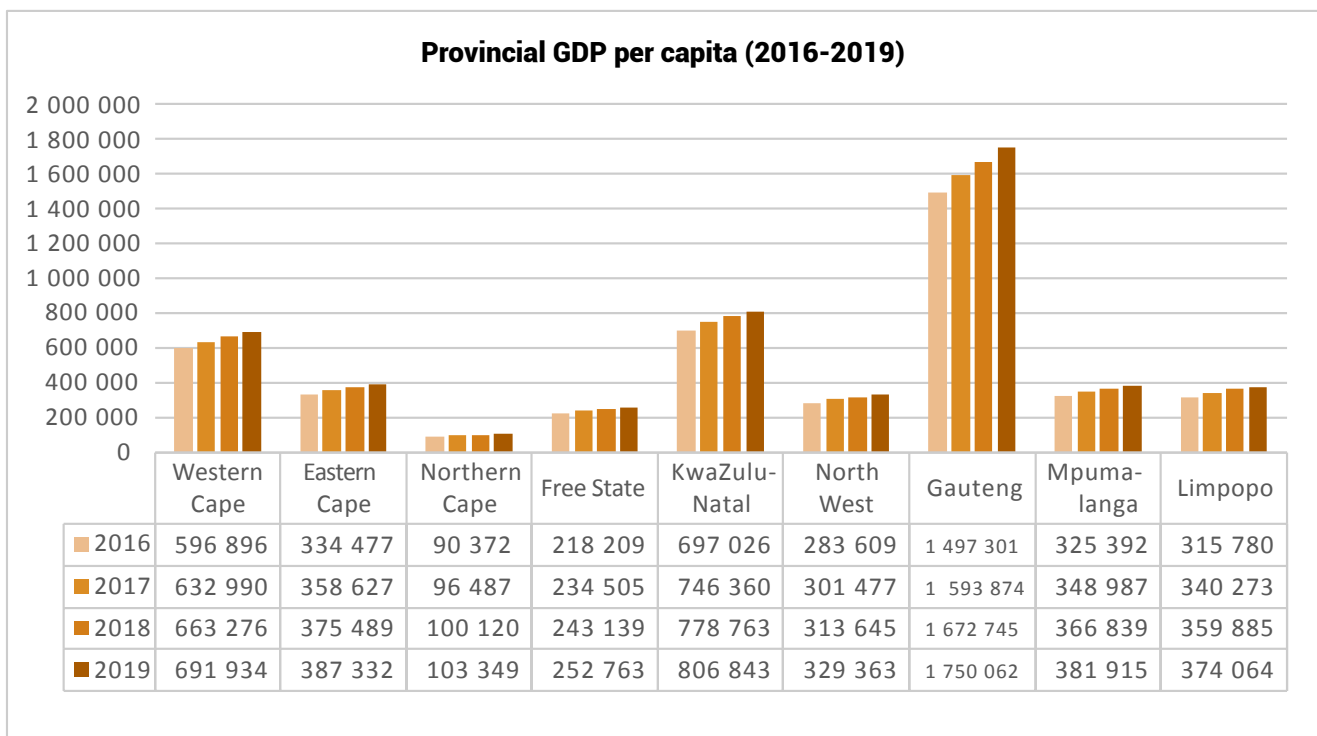


Source: Stats SA ^{21,22}

Figure 37 shows the South Africa GDP per capita and its growth over the last four years. Since 2016, the national GDP (at market prices) increased from R 4,35(R/million) to R 5, 077 (R/million) in 2019. A 0.2% growth in the country’s real GDP in 2019, was driven by the economic activity in various industries, notably, agriculture, construction, mining and manufacturing. Increased production in finance and business services, government and personal services assisted in keeping the GDP up. In 2018, it grew by 0.8 % with R4, 873 (R/million) contribution despite the country experiencing an economic recession. However, this was a decrease from the 1.4% GDP growth rate in 2017 but up from 0,4% in 2016 (Stats SA, 2019).

GDP per capita can be boosted if dominant industries in each province grow at a rate that outstrips population growth. Each province has its own unique industrial makeup. KwaZulu Natal, for instance, is dominated by the manufacturing, finance and business services, government, trade, other industries.

Figure 38. Provincial GDP per capita (2016-2019)



Source: Stats SA ²²

Figure 38 above, in rand values, shows that provincial GDP has increased from 2016 to 2019 across all provinces. There was economic expansion in three provinces with the largest contribution to the country's GDP year-on-year; In 2019, Gauteng, KwaZulu Natal and Western Cape accounted for the majority of the country's GDP. Gauteng recorded the highest provincial GDP at R1,750 (R/million) a 0.6% increase contribution to the national GDP. Whereas KwaZulu Natal with the second largest economy accounted for R 806 (R/million) and Western Cape with R691 (R/million). Northern Cape recorded the most significant decline in economic output, followed by Free State and North West. These economies were lower mainly by the poor performance of some industries mainly government, mining and/or agriculture. The Eastern Cape accounted for R387 (R/million) to the national GDP. Mpumalanga and Limpopo respectively contributed R381 (R/million) and 374 (R/million) to the country's GDP of R5, 077 (R/trillion) in 2019. A slight increase from the previous year.

As music is the space between notes,
we believe science is the space
between data points.



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4 INNOVATION ALIGNMENT TO NATIONAL AND INTERNATIONAL POLICIES

4.1 INTEGRATED DEVELOPMENT PLANNING FOR KZN

An Integrated Development Plan (IDP) is a super plan for an area that gives an overall framework for development. It aims to co-ordinate the work of local and other spheres of government in a coherent plan to improve the quality of life for all the people living in an area. The purpose of integrated development planning is faster and more appropriate delivery of services and providing a framework for economic and social development in a municipality. In practice the IDP is a comprehensive strategic business plan for the Municipality over the short and medium termⁱ.

KZN does not have an IDP that is focussed on the whole province. Each municipality does its own planning. However, for the provinces strategic planning, KZN has a draft IDP Framework Guide and IDP Assessment Criteria document^j, from KZN Cooperative Governance and Traditional Affairs. The purpose of IDP Framework Guide and IDP Assessment Criteria is to guide and advise on the formulation and annual review of the Integrated Development Plan.

4.2 NATIONAL DEVELOPMENT PLAN 2030

“THE SINGLE MOST IMPORTANT INVESTMENT ANY COUNTRY CAN MAKE IS IN ITS PEOPLE.”

The National Development Plan^k (NDP) 2030 offers a long-term perspective. It defines a desired destination and identifies the role different sectors of society need to play in reaching that goal. The NDP aims to eliminate poverty and reduce inequality by 2030. According to the plan, South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society.

ⁱ URL: <https://www.westerncape.gov.za/text/2013/April/integrated-development-planning-template.pdf>

^j URL: <http://www.kzncogta.gov.za/wp-content/uploads/2020/11/9.1%20IDP%20FRAMEWORK%20GUIDE%20AND%20IDP%20ASSESSMENT%20CRITERIA.290120.docx>

^k URL: <https://www.gov.za/documents/national-development-plan-2030-our-future-make-it-work>

For this publication, chapter nine (pg. 295) “Improving education, training and innovation” is most relevant. Key points to mention are:

- Further Education and Training colleges, public adult learning centres, sector education and training authorities, professional colleges and Community Education and Training Centres are important elements of the post-school system that provide diverse learning opportunities.
- Further education should expand moderately, and as quality improves/expands rapidly, higher education should incorporate a range of different institutions that work together to serve different priorities, including effective regulatory and advisory institutions.
- Research and innovation by universities, science councils, departments, NGOs and the private sector have a key role to play in improving South Africa’s global competitiveness. Coordination between the different role-players is important.

This chapter offers a vision, discusses challenges, and presents proposals in each of these sub-sectors. The work done by the Department of Basic Education and Department of Higher Education and Training in developing plans, strategies, programmes and policy initiatives has informed this chapter. By 2030, South Africans should have access to education and training of the highest quality, leading to significantly improved learning outcomes. The education, training and innovation system should cater for different needs and produce highly skilled individuals. The graduates of South Africa’s universities and colleges should have the skills and knowledge to meet the present and future needs of the economy and society.

Innovation is critical for introducing new products into the market and producing goods and services more efficiently. Research and development should be significantly expanded. Collaboration across the South African education system and with internationally accredited institutions should lead to higher levels of innovation. According to the NDP, in comparison to its population, South Africa’s science and innovation system is small by international standards. Overall, South Africa’s global competitiveness needs to be improved, and the system of innovation has a key role to play. It is the principal tool for creating new knowledge, applying knowledge in production processes, and disseminating knowledge through teaching and research collaboration. Continued advances in technological innovation and the production of new knowledge are critical to growth and development.

This has an overall impact on the “People” category in the indicators.

4.3 UN SUSTAINABLE DEVELOPMENT GOALS

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs)^l, which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognise that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

Relevant to this publication is the following goals^m:

GOAL 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Education liberates the intellect, unlocks the imagination and is fundamental for self-respect. It is the key to prosperity and opens a world of opportunities, making it possible for each of us to contribute to a progressive, healthy society. Learning benefits every human being and should be available to all.

GOAL 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. Economic growth should be a positive force for the whole planet. This is why we must make sure that financial progress creates decent and fulfilling jobs while not harming the environment. We must protect labour rights and once and for all put a stop to modern slavery and child labour. If we promote job creation with expanded access to banking and financial services, we can make sure that everybody gets the benefits of entrepreneurship and innovation.

GOAL 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. A functioning and resilient infrastructure is the foundation of every successful community. To meet future challenges, our industries and infrastructure must be upgraded. For this, we need to promote innovative sustainable technologies and ensure equal and universal access to information and financial markets. This will bring prosperity, create jobs and make sure that we build stable and prosperous societies across the globe.

GOAL 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development. The Global Goals can only be met if we work together. International investments and support is needed to ensure innovative technological development, fair trade and market access, especially for developing countries. To build a better world, we need to be supportive, empathetic, inventive, passionate, and above all, cooperative.

^l URL: <https://sdgs.un.org/goals>

^m URL: <https://www.globalgoals.org/goals/>

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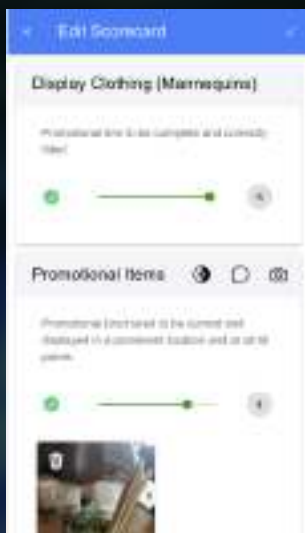
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- Provide and uphold a base level of standards at each business location

5 SCIENCE TECHNOLOGY AND INNOVATION INSTITUTIONS

5.1.1 NATIONAL STI INSTITUTIONS

The following Institutions have been identified as key national level stakeholders who are role players in the KZN innovation and entrepreneurial ecosystem.

Table 2 National Stakeholders

NATIONAL GOVERNMENT AND RELATED ENTITIES		
Name of Institution	Location	Key Sectors
Department of Science and Innovation (DSI)	Pretoria, (GP)	Science and Technology
South African Medical Research Council (SAMRC)	Cape Town, (WC)	Healthcare
Department of Trade, Industry and Competition (DTIC)	Pretoria, (GP)	Industry and Commerce
Department of Small Business Development (DSBD)	Pretoria, (GP)	Industry, Commerce, Technology
Technology Innovation Agency (TIA)	Musgrave, (KZN)	Science and Technology
Small Enterprise Development Agency (Seda)	Pretoria, (GP)	All
National Empowerment Fund (NEF)	Durban, (KZN)	All (entrepreneurial)
Development Bank of Southern Africa (DBSA)	Midrand, (GP)	All
National Research Foundation (NRF)	Pretoria, (GP)	Science
Small Enterprise Finance Agency (Sefa)	Durban, (KZN)	Manufacturing, Agriculture, Construction, Mining, Green industries
Innovation Bridge Portal (by the DSI)	National (Online)	All
National Science, Technology, and Innovation Information Portal (NSTIIP)	National (Online)	Science and Technology
National Advisory Council on Innovation (NACI)	Pretoria, (GP)	All

5.1.2 PROVINCIAL STI INSTITUTIONS

The following Institutions have been identified as the key stakeholders on a provincial and regional level that influence the state of innovation in KZN, via resource provision, funding, support initiatives and advisory.

Table 3 Provincial STI Stakeholders

PROVINCIAL GOVERNMENT AND REGIONAL ENTITIES		
Name of Institution	Location	Key sectors
KZN Economic Development, Tourism and Environmental Affairs (KZNEDTEA)	KZN	All
KZN Treasury (KZN Industrial Hubs)	KZN	All
KZN Department of Agriculture and Rural Development (DARD)	KZN	Agriculture
Trade & Investment KwaZulu-Natal (TIKZN)	KZN	All (agriculture, textiles, business, energy, water, health, manufacturing, mining, tourism, property)
Dube TradePort Corporation (DTPC)	KZN	Agriculture, Manufacturing, Commodities, Technology, Pharmaceuticals, Hospitality, Telecommunications, Electronics.
Richards Bay Industrial Development Zone (RBIDZ)	KZN	Agro-processing, Technology, ICT, Metals, Marine, Renewable Energy
Moses Kotane Institute (MKI)	KZN	Research, Academic, ICT, Digital, Tech, Marine
KwaZulu-Natal Regional Office of Technology Transfer (KZNR-OTT)	KZN	Technology
Ithala Development Finance Corporation	KZN	All
KwaZulu-Natal Sharks Board Maritime Centre of Excellence	KZN	Marine
KZN Growth Fund	KZN	All
Local Government (Local, District and Metropolitan Municipalities)	KZN	All
District Development Agencies (DDAs)	KZN	All
Innovate Durban (ID)	KZN	Government, Academia, Research, Business
SmartXchange	KZN	Media, ICT, Electronics

5.1.3 ACADEMIC STI INSTITUTIONS

The following STI Institutions have been identified as the key stakeholders within the academic sphere that influence the state of innovation in KZN, via resource provision, funding, support initiatives, facilitation, and research and development.

Table 4 Academic Stakeholders

ACADEMIC INSTITUTIONS		
Name of Institution	Location	Key Sectors
Durban University of Technology (DUT)	KZN	Research, Academia
InvoTech Incubator (DUT)	KZN	Green economy, Digital creative industry, Food technology and Agricultural impacting technologies
Urban Futures Centre (DUT)	KZN	Built environment, Construction, Engineering, Architecture
Technology Transfer and Innovation (TTI at DUT)	KZN	Technology
Mangosuthu University of Technology (MUT)	KZN	Research, Academia
Centre for Algal Biotechnology (CAB - MUT)	KZN	Science
Technology Station in Chemicals (TSC - MUT)	KZN	Science
University of KwaZulu Natal (UKZN)	KZN	Research, Academia
Kwazulu-Natal Research Innovation and Sequencing Platform (KRISP)	KZN	Biomedical Science
UKZN InQubate	KZN	Science and Technology
UKZN HEARD	KZN	Healthcare and Government
WASH R&D Centre (UKZN)	KZN	Water and Sanitation
University of Zululand	KZN	Research, Academia
UNISA	KZN	Research, Academia
Enterprise and Supplier Development (ESD) at UNISA	KZN	All
Human Sciences Research Council (HSRC)	KZN	Healthcare, Medical
Council for Scientific and Industrial Research (CSIR)	KZN	Science and Technology, Research and Academia
African Health Research Institute (AHRI)	KZN	Healthcare, Medical
Sugar Milling Research Institute (SMRI)	KZN	Agriculture
South African Sugarcane Research Institute (SASRI)	KZN	Agriculture

6. KZN INNOVATORS



AGRIKOOOL
INNOVATOR: ZAMOKUHLE THWALA



Zamokuhle Thwala is a serial entrepreneur and a builder of useful things. He co-founded two tech start-ups, **AgriKool** and Thumela. AgriKool is an e-trading platform that connects producers and fresh produce buyers. The Agri-tech start-up is on a mission of transforming Africa's agri-food systems. Thumela on a mission to unlock Africa's e-commerce potential is a last-mile delivery solution that helps individuals and e-commerce to send and collect parcels with ease.

Q. What problem/s are you trying to address with your innovation?

A. AgriKool is solving the problems of intermediary and fragmentation that drives food prices high by directly connecting producers and buyers of fresh produce.

Q. What has been the toughest challenge/s to overcome in your innovation journey?

A. The agricultural value chain is a highly fragmented and multi-disciplinary industry, in the early days, I had to learn and juggle many things at the same time. While building the company, I needed to work on having a good understanding of the logistics and retail sector.

Q. Where do you see yourself and your innovation in 5 years' time?

A. In 5-years' time I see AgriKool as Africa's sourcing hub for food and Agri-products, and as an impactful start-up that has helped with driving food prices low and making fresh produce accessible to all, at good prices.

Q. What has been the biggest lesson so far?

A. Execution is everything.

Q. Advice to other innovators?

A. Ideas are cheap and execution is gold. I'd advise them to start working on their ideas.



ORINGO TECHNOLOGIES INNOVATOR: ISAAC MONGALI



ORINGO

WE MAKE IT POSSIBLE

Innovation and Passion are the two words that describe Isaac. His life's mission is to impact and influence as many lives as possible. He enjoys coming up with logical solutions and ideas to critical problems which plague our continent. Isaac's strengths lay in growing strong social connections with various people on his journey to making Africa a production. He believes in an Africa which is producing its own solutions and products, a continent where we are exporting our products and services not our raw minerals.

His experience includes the following:

Isaac studied Electrical Engineering at The University of KwaZulu Natal. His degree includes modules such as Electromagnetic Theory, Electrical Machines, Power Systems, Electronics, Digital Systems, Power Electronics and Control Systems. Students also attend a module on Engineering Management and Labour Practices in preparation for the management role they will assume in Industry. Engineering Business and Entrepreneurship. Options that may be offered include High Voltage Engineering, Power Systems, Power Electronics, Electrical Machines, Control Systems, Automation, Digital Signal Processing, Embedded Systems, Illumination and Data Communications and Telematics.

He was also an Executive Committee Member for Engineers Without Borders UKZN which is an organization providing a platform for students & professionals to apply their skills to uplift their communities. Their duties are to implement the Board's fiduciary, strategic, and generative plans, policies, and decisions consistent with the organization's Vision, Mission, and Guiding Principles.

He was also awarded the Google Africa Developer Scholarship as an Associate Android Developer. He also completed an Azure Data Scientist Learnership. Microsoft Azure Fundamentals MCP Exam AZ-900, Designing and Implementing a Data Science Solution on Azure MCP Exam DP-100, Implementing an Azure Data Solution MCP Exam DP-200, Designing an Azure Data Solution MCP Exam DP-201, Designing and Implementing an Azure AI Solution MCP Exam AI-100. He was a Microsoft Learn Student Ambassador.

Isaac was also the Chief Technology Officer at Energy Efficiency where his duties were to develop technical aspects of the company's strategy to ensure alignment with its business goals, Design UX/UI/Planning, Conduct Design thinking & Sprints, Supervise students and trainees in projects, Discover and implement new technologies that yield competitive advantage, Help departments use technology profitably, Supervise system infrastructure to ensure functionality and efficiency, Build quality assurance and data protection processes, Monitor KPIs and IT budgets to assess technological performance, Use stakeholders' feedback to inform necessary improvements and adjustments to technology, Produce new products with Energy Efficiency, and Communicate technology strategy to partners and investor.

His businesses and current roles include the following:

Oringo Technologies (CEO & Co-Founder) - Our mission is to manufacture and enable manufacturing by reimagining, setting up a foundation, and developing an ecosystem for the manufacturing industry. Our services include Rapid Prototype Development, Internet of Things(IoT) Systems, Product Design, Consultancy, and Training. Our services are available to any business, person, or organization.

Q. What problem/s are you trying to address with your innovation?

A. Acquiring partners to assist and scale production.

Q. Where do you see yourself and your innovation in 5 years' time?

A. Our Mission in the next 5 year with this innovation, is to have increased human capital within STEM related fields across 10 countries in Africa. As this speaks to one of the main reasons as to why Africa is lagging behind in the world stage in terms of manufacturing and production.

Q. What has been the biggest lesson so far?

A. "Nothing can resist a human will that will stake its very existence on its stated purpose."
Benjamin Disraeli

Q. Advice to other innovators?

A. Have a clear plan. Get the right team. Monitor and evaluate all decisions. Be ruthless about what you want.



CHEMSTART INNOVATOR: BATHABILE MPOFU



NKAZIMULO
APPLIED SCIENCES

Bathabile Mpofo is the co-founder and CEO of Nkazimulo Applied Sciences. She graduated at UKZN with a Hons. Degree in Chemistry and I graduated from UCT with an MBA. Her innovation helps young people become confident scientists by providing science equipment young people need to learn and understand science concepts. In 2015 she developed **Chem-Start**, which is a portable science kit for use by learners at school or home to perform science experiments. This helps them better understand science concepts.

I grew up and went to rural school and the schools I went to had no science laboratories. My fascination with science started when I would watch science shows on TV. I was fascinated by seeing how science explained how the body works for example and I enjoyed watching science experiments. I would watch and look around for items so I could replicate what I saw on TV. One time, I went to school and conducted a reaction where if you mix two chemicals, the reaction spontaneously bursts into flames.

I wanted to be a doctor but unfortunately my high school education did prepare me to pursue a science qualification. My experience in the lab was very overwhelming because I didn't have the confidence to perform science experiments which we had to do daily for the second half of the day. Because of this, I found myself disappearing in the background and struggling to catch up. I ended up not pursuing Medicine. Fortunately when I finished my BSc degree I got a job at UKZN as a Technician and I witnessed many students who had a background like mine struggle like I did. It's when I was studying my MBA that I realised that I'm the right person who can assist learners from disadvantaged schools and equip them so they can confidently pursue a career in science.

Q. What problem/s are you trying to address with your innovation?

A. Many learners find themselves at university without having performed a single science experiment at high school. They find themselves needing to catch up and this puts them at a disadvantage because instead of focusing on learning how science knowledge is applied, they are still absorbing basic information and skill they should have acquired in high school. This contributes to why we do not have enough students taking up STEM subjects. The ultimate result of this is few doctors, engineers and innovators in the country.

Q. What has been the toughest challenge/s to overcome in your innovation journey?

A. The biggest challenge for me was business operations. Managing stock so I do not run out of stock or keep too much stock thus restricting my cash flow. I also didn't have enough time to use a system that would help me manage stock. The reason why I didn't have enough time is because I was wearing many hats and fulfilling many roles. A person might ask why not hire the right people and this is hard to do because when the business is new, there are many uncertainties and paying that right person is not always affordable. At the beginning of 2020, I completely burnt out and so for me Lockdown could not have come at a better time.

Q. Where do you see yourself and your innovation in 5 years' time?

A. I see my innovation in all schools in the cities for starters. I know that performing experiments is not done regularly enough for different reasons. I see the portable kits used by learners at home and not at school. Then the experiments performed can be discussed in class the following day. We are continuously making videos and posting them on our YouTube channel so learners can watch the video and perform the experiment with more confidence.

Q. What has been the biggest lesson so far?

A. My biggest lesson is to always listen to your customers and take their advice on how one can improve on the product. We started with an all in one kit but now we have grade specific kits so the learner worry about doing experiments in their grade for that year.

Q. Advice to other innovators?

A. This will probably sound cliché but the sky is the limit in this country. There are so many opportunities for young people to start business. There is so much support awaiting the innovators. In fact there is not enough people taking advantage of them, and I can say this because I myself has been a recipient of them. I have received a lot of financial support, personal development, help with mental health because entrepreneurship is tough, and my opportunities to advertise on radio and TV. Even this feature is that very much needed support.



GLUCONATE INNOVATOR: LANDILE MABELE



Landile Mabele is a young innovator/Entrepreneur from KwaMashu, and he is an industrious person, who is passionate about helping people through technology and innovation.

From a young age I would say I have always been fascinated by technology and innovation. I would say it has been a calling for me to go into the Entrepreneurship, technology and the innovation space. I personally believe with technology and innovation we can change world for the better good. How my entrepreneurship journey started, in 2020 I innovated and developed a wrist bracelet to mitigate the spread of Covid-19. I designed the wearable bracelet to help with social distancing, contact tracing and it prevented people from touching their face as people could contract the Covid-19 virus of surfaces. With the help of my team, we developed an application that tracked the users' patterns and how often they touched their face, and it vibrated if the users were touching their face or not social distancing.

My innovation is called **Gluconate**, it's a glucose level monitoring wearable for people with diabetes. Gluconate monitors glucose levels in real time non-invasively it's here to offer a solution to the skin pricking as this method of testing shows only that current present reading at that specific time.

What sparked the interest to innovate a solution for diabetes and healthcare, my grandfather last year in 2021 succumbed to a heart attack. what worried me the most was that he did not have any cardiovascular diseases. He suffered from diabetes and he found it very hard to monitoring his glucose levels and manage his diabetes which lead to his heart attack. This opted me to innovate a device that could help people with diabetes to better manage, monitor and track their chronic illness. By offering them a continuous glucose monitoring device. I am the type of person who is passionate about giving back and innovating technology to help people with their daily challenges. My core belief is that with technology we can better people's lives for the better good and promote sustainability.

Achievements:

- Won first place in the innovators garage in the SA innovation Summit in Cape Town
- Won first place in the health category in the Moses Kotane Institute innovation and research summit awards this year in March

- Nominated as one of the Top 25 ICT most promising entrepreneurs in South Africa by the EBL Institute and MTN
- Made it to the Top 10 National finalist in south Africa in the Entrepreneurship World Cup
- Made it to the Top 50 in Africa in the starter up challenge held by Total Energies earlier this year

Q. What problem/s are you trying to address with your innovation?

A. Over 500 million people have diabetes worldwide and is highly common in the age group of 18 to 44 in South Africa, over 8 million people have diabetes in that age bracket, the problem I've identified is that in terms of measuring and testing glucose people still use their normal testing method which requires one to prick themselves in order to get that reading. The problem with this methodology is it only gives you that current reading at that current time. This is a huge problem because someone with your beat his needs real time monitoring of glucose level because they would think that they glucose level is still in a good average and make glucose level could drop and they could become hypoglycaemic.

Q. What has been the toughest challenge/s to overcome in your innovation journey?

A. My toughest challenge in my innovation journey is that I do not have a medical background and I didn't know where to start with developing a device for diabetic people but what I can say is I believed in my idea and that's what has brought me this far in my innovation.

Q. Where do you see yourself and your innovation in 5 years' time?

A. I see myself as the Elon Mask in the healthcare technology space and bring medical innovations to the South African economy. I see myself innovating technology that will help better the healthcare of people.

Q. What has been the biggest lesson so far?

A. Learning that I have to create a business out of the innovation. This always gets a innovation because we don't really know how to build a sustainable and scalable business out of our idea and innovation. This journey has taught me business skill and has developed me as a person.

Q. Advice to other innovators?

A. My advice to other innovators is believe in yourself and trust the process, I know it's not an easy road ahead. We all have a purpose and we all have to search within us to fulfil our purpose



MEARM ROBOTIC SORTING SYSTEM INNOVATOR: THULISILE MACHI



Thulisile Machi is the founder of **MeArm Robotic Sorting System**, a South African based waste management start-up that seeks to make use of 4IR robotic technology to advance waste management and recycling. She holds a Diploma in Microsoft End User, a Leadership skills development Certificate and Landscaping Irrigation NQF Level 2. Thulisile has worked in various positions at the Department of Health over a nine-year period. It was here where she developed the passion for the environment and has since established a waste management company that recycles waste material. Her participation in Yabasadi in 4IR programme is allowing her to contribute towards advancing the waste sector through the development of a robotic system that will assist in sorting waste in her recycling business which operates in waste collection, sorting, compacting and selling recyclable waste. Thulisile is currently in the Innovate Durban Start-Up Support Programme.

Q. What problem/s are you trying to address with your innovation?

A. Waste generators mix non recyclable waste with recyclable material. This contaminates valuable recyclable waste which then ends up in a landfill site. The contamination also becomes hazardous to waste sorters. The MeArm Robotic Sorting System aims to solve this problem by sorting waste and categorising it. The system uses advanced camera sensors to identify waste materials.

Q. What has been the toughest challenge/s to overcome in your innovation journey?

A. The toughest challenge has been accessing finance for the project and commercialising it.

Q. Where do you see yourself and your innovation in 5 years' time?

A. In 5 years time we plan to have a robotic system installed in 10 Municipal landfills. Our long term goal is to have the technology utilised at landfill sites across Africa and beyond. We want to contribute to building a circular economy and raising awareness of the value of waste.

Q. What has been the biggest lesson so far?

A. Having a good, reliable and dedicated team is a recipe for success.

Q. Advice to other innovators?

A. Innovators should participate in support offered by innovation hubs and incubation programmes to learn different approaches and engage with other innovators.

7. EXTERNAL FACTORS IMPACTING ON INNOVATION

7.1 COVID-19

The COVID-19 pandemic has had a disastrous impact on innovation, R&D, public health systems and economic progress across the globe. Millions of people have died, and economies have declined sharply. Unemployment has increased significantly. Poverty is on the rise. Inequality is deepening. The gains related to the Sustainable Development Goals (SDGs) are at risk, and vulnerabilities and inequalities within and between nations have been exposed.

Despite the challenge posed by COVID-19, some businesses in South Africa continued to invest in R&D. Also, businesses with innovation activity—including R&D but also other types of activity—quickly adapted to the challenging context of the global COVID-19 pandemic with new coping and survival strategies. A Statistics South Africa business impact survey in 2020 highlighted key trends which remain significant as the country confronts the challenges of COVID-19's second wave in 2020. The World Health Organisation permitted South Africa to establish a world-class consortium to create the first technology transfer hub for COVID-19 vaccines in Africa.

7.2 JULY CIVIL UNREST

In August 2021, National Treasury presented briefly on the impact the social unrest that took place in KZN in July 2021, had on the economy. The civil unrests left 144 “learning centres” damaged and led to the province’s annual winter school programme being cancelled. The vandalising and targeting of schools to steal food and equipment had been on the rise with the advent of COVID-19 in 2020, and the civil unrest only worsened the situation. Fortunately, there was an increase in the matriculant pass rate for mathematics and physical science across all provinces.

7.3 FLOODS

Approximately 826 companies were affected by the floods that ravaged KZN in April 2022, according to a survey by the Department of Trade, Industry and Competition. This equates to an estimated cost of R7 billion in damages. An estimated 31 220 jobs had been affected in the province, with eThekweni Municipality, the main economic hub of the province, accounting for 68% of this number.

More than 600 schools have been affected, with 124 being seriously damaged and 101 completely inaccessible and more than 320,000 pupils affected. The effects of these, in terms of the people-centric indicators in this publication, will be seen in next year’s statistical reports, across various sectors.

8. CONCLUSION

8.1 CONCLUDING REMARKS

This report offers indicators to measure the state of innovation in KZN. The data has been provided for the years 2017 to 2021 (where data is available), which allows for trend analysis and innovation ecosystem growth tracking. The indicators provide a unique way for a KZN-focused measure of innovation and growth of the innovation ecosystem. The data provided allows for a comparison of the performance of the same indicators with other provinces. This provides an updated, evidence driven base with which to plan interventions targeted at innovation growth in KZN. Current data aids understanding with regard to which areas are considered enablers for innovation growth, and which areas require attention and resources. Policy makers, business leaders, industry associations, funders and academia can use this report's analysis of trends and patterns of innovation to consider how existing policy instruments and funding mechanisms can better promote, support and facilitate innovation in South Africa.

8.2 RECOMMENDATIONS

The following recommendations have been identified through putting this report together and other Innovate Durban research initiatives. These recommendations are seen as:

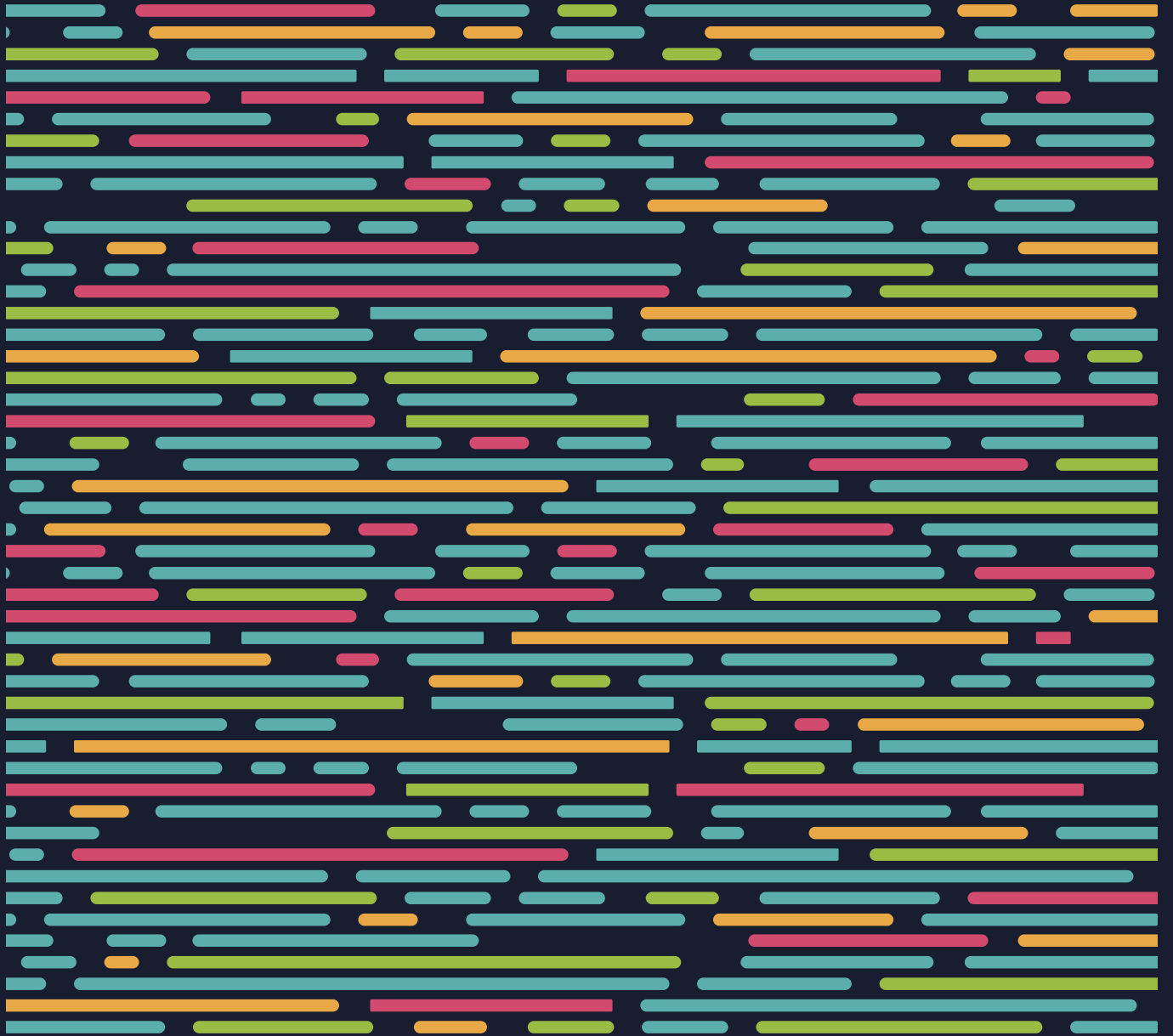
- The regional innovation ecosystem need to interrogate the extent to which support interventions offered seek to redress social and economic inequalities prevalent in the region.
- More effort is required from the key innovation stakeholders to addressing the skills gaps experienced
- An end-to-end digital support agency should be established to support the growing demand in digital innovation
- Increase and promote innovation education and awareness at grassroots and school level
- A platform to synergies the support offered by the key regional innovation support institutions is required. There is an opportunity to leverage on the existing Innovate Durban Innovation Stakeholder Forum as a provincial centralised platform for stakeholder collaboration. The innovation stakeholder forum has more than 35 private and public institutions represented. This has resulted in an established and well-functioning innovation ecosystem in eThekweni.
- The province requires increased financial support into both innovation support and funding for innovators/start-ups

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