

INNOVATE
DURBAN



THE STATE **OF**
INNOVATION
IN KWAZULU-NATAL

2020

ABOUT INNOVATE DURBAN

Innovate Durban is a non-profit company (NPC) aimed at stimulating innovation within Durban. Its focus is to support and promote innovation by creating platforms that will build and develop the innovation ecosystem in Durban.

VISION:

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

MISSION:

Innovate Durban will nurture, co-ordinate 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.

ABOUT THE INNOVATION PUBLICATION

As part of Innovate Durban's objective to celebrate innovation, this Innovation Publication was developed. The objective of this publication, which will be published annually, is 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 also 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 second 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

This second edition of the Innovation Publication is published in the midst of the turmoil caused by the COVID-19 pandemic. South Africa has not escaped the negative economic impact of COVID-19 - gross domestic product (GDP) fell by just over 16% between the first and second quarters of 2020, giving an annualised growth rate of -51%.

The need for innovation has never been as urgent as businesses adapt to respond to these unusual times and requirements. The retrenchment of skilled personnel will likely lead to increased home innovation and startups, and the rapid move to virtual ways of conducting business will continue to provide opportunities for innovation. While we are aware of these changes and the impact COVID-19 is having, this report will not yet reflect this impact, as it predominantly covers the 2018 year due to data availability.

This edition contains 32 indicators, of which 10 have been introduced this year. This year sees the introduction of the Innovation Growth Index, which aims to provide a single reference for the health of innovation in KZN, and can be used as an indication of the impact Innovate Durban is having on innovation growth in KZN. The indicators reflect growth in innovation in KZN, with an Innovation Growth Index of 50%.

KZN remains a top performer in the number of enrolments and graduates across the maths, science and engineering fields at secondary schools, TVETs and Universities. UKZN is ranked first in South Africa for the number of PhD graduates and publication outputs. The value of investment increased across all indicators in the year of review. The 40 innovation events and 405 funding instruments relevant to innovators in KZN reflect a strong and growing innovation ecosystem.

Despite growth in these areas, it is concerning that R&D expenditure and venture capital investment still remains significantly lower than in Gauteng and the Western Cape. Furthermore, the number of KZN households that have internet access is below the national average of 64.7%, at 59.4%.

Through numerous programmes aimed at providing support and funding to startups, as well as penetrating low-income areas through innovation labs, Innovate Durban aims to make a positive impact on these indicators and hopes to see continued growth in coming years.



Innovate Durban is proud to showcase five new innovators in this edition and encourages innovators to take note of their advice and learn from their experiences. A theme across innovators is the importance of staying dedicated and being willing to devote time and resources to the innovation in order to achieve success.

¹ StatsSA (2020) 'Steep slump in GDP as COVID-19 takes its toll on the economy'

² New indicators include National Senior Certificate and TVET graduations, trademark applications, business expenditure on research and development, and further detail on the value of investment by venture capitalists and internet access.

³ A composite index made up of four key innovation indicators in KZN: PhD graduates, publications, total expenditure on R&D and investment by venture capitalists.



WHAT THE STUDY COVERS

Five categories have been included in the 2020 edition of the State of Innovation in KZN, namely, people, investment, infrastructure, ecosystem and impact. This year's edition has expanded the measure of innovation to include a number of new indicators.

2. INVESTMENT

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

3. INFRASTRUCTURE

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

4. ECOSYSTEM

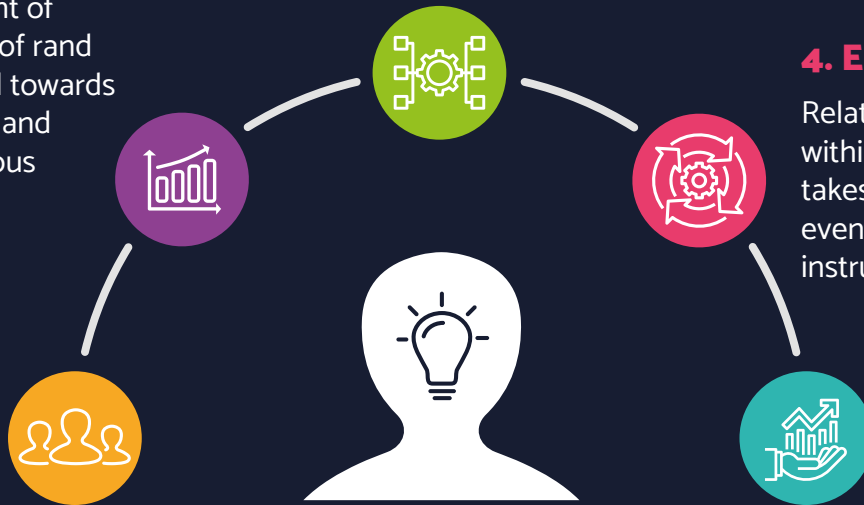
Relates to the environment within which innovation takes place and includes events and funding instruments.

1. PEOPLE

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

5. IMPACT

Lastly, the impact category 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 (2017-2019) |
| | | National Senior Certificate Performance in Physical Sciences (2017-2019) |
| | TVET Education | Students who completed N3 Engineering Studies (2018) |
| | | Students who Completed N6 Engineering Studies (2018) |
| | Public University Education | Higher Education Institutions Enrolment (2017-2018), SET |
| | | Higher Education Institutions Graduates (2017-2018), SET |
| | | Ranking of 26 universities in South Africa for SET enrolment and graduation |
| | | Doctoral Enrolment (2017-2018), All degrees |
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| | | Ranking of 26 universities in South Africa for doctoral enrolment and graduation |
| | | UNISA Enrolment (2017-2018), SET & Doctoral degrees |
| | | UNISA Graduates (2017-2018), SET & Doctoral degrees |
| | Knowledge Generation | Overall Publication Output Units (2016-2018) |
| | | Ranking of 25 universities in South Africa for research publications |
| | | Patents Lodged in South Africa (2016/17-2018/19) |
| | | Trademark Applications in South Africa (2016-2018) |

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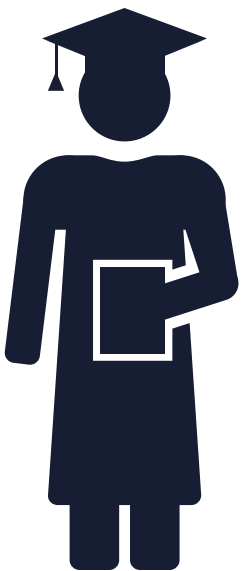
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| Category | Sub-category | Indicator |
|-----------------------------------|------------------------------------|--|
| Investment | Research & Development Expenditure | R&D Expenditure by Province (2008/9-2017/18) |
| | | KZN R&D Expenditure by Source (2008/9-2017/18) |
| | | GERD as a % of GDP by Province (2009/10-2017/18) |
| | | BERD as a % of GDP by Province (2009/10-2017/18) |
| | Venture Capital | Value Contribution by Type of Fund (2018) |
| | | Number of Investments (2008-2018) |
| | | Value of Investments (2009-2018) |
| | | Value Contribution by Stage of Deal, 2017 v 2018 |
| | | Value Contribution by Location of Investee Head Office 2017 v 2018 |
| | Infrastructure | Internet Access |
| Internet Access by Metro (2018) | | |
| Internet Access by Geotype (2018) | | |
| Ecosystem | | Number of innovation events held in KZN |
| | | Number of funds towards innovation in KZN |
| Impact | | Employment in the Telecommunications Sector (2015-2019) |
| | | KZN Innovation Growth Index |

HIGHLIGHTS

From a 'people' perspective, it has been a positive year for innovation in KZN. All indicators have increased and KZN is performing well in comparison to other provinces. Only national senior certificate maths performance suffered over the previous year, and this was experienced across most provinces.



KZN had the highest number of students passing maths (17,306) and science (20,225) with 40% or more in 2019, when compared to other provinces. Maths completions declined by 10%, while science completions grew by 2.5% in 2019.



In 2018, **KZN TVET colleges had the highest number of students complete N3 Engineering studies (7,627)**, and the second highest number of students complete N6 Engineering studies (2,617), when compared to other provinces.

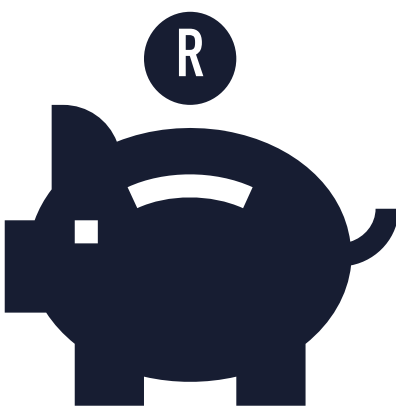


Across the 4 universities in KZN (DUT, MUT, UKZN, UniZulu) in 2018:

- **Enrolment and graduation for science, engineering and technology (SET) degrees increased** to 45,063 and 9,459 respectively.
- **Enrolment and graduation for all doctoral degrees increased** to 4,013 and 600 respectively.
- **Publication outputs increased by 6.6%** to 2,669.

Nationally, local patent applications have risen by 65% to 1,129 in 2018/19 and resident trademark applications have risen by 1% to 22,948 in 2018.

The value of investment increased across all indicators in the year of review but still remains significantly lower than Gauteng and the Western Cape.



KZN R&D expenditure was R4.17 billion in 2017/18, up by 14.7% from 2016/17. Most of this expenditure was in the business and higher education sectors.



KZN **GERD as a percentage of GDP increased by 0.05%** to 0.54% in 2017/18, compared to South Africa's GERD as a percentage of GDP which was 0.83% for the same period, and against a national target of 1.5%.



Investment by VCs into businesses with head offices in KZN **increased from 2.8% in 2017 to 6.8% in 2018**, when compared to other provinces.



In terms of a **national perspective on investment contribution** (value) by **fund type, angel investors contributed 4.2%** to all deals, captive other, captive corporate, captive government and independent funds contributed 11.3%, 15.7%, 33.7% and 35.1%, respectively.

The primary 'infrastructure' indicator is internet access. 59.4% of KZN households have internet access compared to the national average of 64.7%.



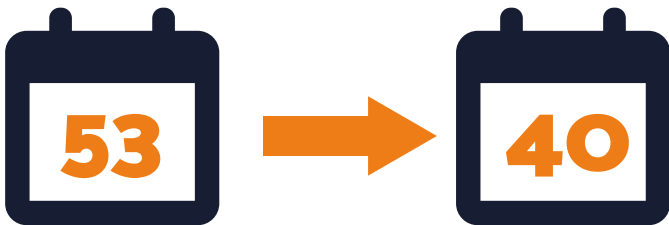
64.7%

SA

59.4%

KZN

Indicators of the innovation ecosystem include the number of innovation events and funding instruments.



There were **40** innovation events in KZN in 2020, down from **53** in 2019.

There are **405** innovation funding instruments with medium-high relevance to the Innovate Durban community.

There have been improvements across the people, investment, infrastructure and ecosystem indicators. The KZN Innovation Growth Index for 2018 is 50%, reflective of increasing innovation in KZN. However, the first and only impact indicator, 'employment in the telecommunications sector in South Africa' decreased from 37,063 in 2018 to 33,782 in 2019. Furthermore, only 31% of those employed are female.

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ACRONYMS

| | |
|-------------------|--|
| 4IR | Fourth industrial revolution |
| BERD | Business expenditure on research and development |
| CAD | Computer-aided design |
| CAM | Computer-aided manufacturing |
| CPT | City of Cape Town |
| DUT | Durban University of Technology |
| Ekurhuleni | Ekurhuleni Metropolitan Municipality |
| Ethekwini | City of eThekweni |
| GDP | Gross domestic product |
| GERD | Gross domestic expenditure on research and development |
| Geotype | Geographical type |
| KZN | KwaZulu-Natal |
| JHB | City of Johannesburg |
| Mangaung | Mangaung Municipality |
| Metro | Metropolitan |
| MUT | Mangosuthu University of Technology |
| NGO | Non-governmental organisation |
| NMMM | Nelson Mandela Metropolitan Municipality |
| R&D | Research and development |
| SET | Science, engineering and technology |
| STEM | Science, technology, engineering and mathematics |
| Tshwane | City of Tshwane |
| TVET | Technical and vocational educational training |
| UCT | University of Cape Town |
| UKZN | University of KwaZulu-Natal |
| UNISA | University of South Africa |
| UP | University of Pretoria |
| Wits | University of Witwatersrand |
| UniZulu | University of Zululand |

1. INTRODUCTION

The annual Innovation Publication is published by Innovate Durban in response to a demand from **government stakeholders** who are showcasing KwaZulu-Natal (KZN) as an investment destination and developing strategic interventions, **investors** who are scoping investment locations and looking for a healthy innovation ecosystem, and **innovators** who are trying to understand the environment they are operating in and looking to learn from fellow innovators. The Innovation Publication is one of several research outputs ⁴ published by Innovate Durban in order to achieve their desired impact to increase employment, create businesses and ignite investment, through growing the innovation ecosystem in KZN.

1.1 DEFINING INNOVATION

There are numerous definitions for innovation, however, the definition offered by Gault (2016) 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”. ⁵

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): social innovations (which meet a social need), commercial innovations (which lead to improved business success and profits) and grassroots innovations (which are community-led solutions). Innovation goes beyond science, technology, engineering and mathematics (STEM). Isaacson 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.” ⁶

⁴ Other outputs include the Funding Map, Ecosystem Map, and Events Calendar

<https://ecosystems.andeglobal.org/snapshot/durban-south-africa/2019/>

<https://www.innovate.durban/funding-map/>

<https://www.innovate.durban/events-calendar/>

⁵ Gault, F. (2016). Defining and Measuring Innovation in all Sectors of the Economy: Policy Relevance. From:

<https://www.oecd.org/sti/008%20-%20BS3%202016%20GAULT%20Extending%20the%20measurement%20of%20innovation%20.pdf>

⁶ Isaacson, W. (2014). Why Innovation Needs Both Art and Science. From:

<https://www.weforum.org/agenda/2014/10/walter-isacson-innovation-humanities-sciences/>

1.2 MEASURING INNOVATION

The varied nature of innovation makes it difficult to measure but it is essential that it is being measured. There are various publications and organisations that have been working on measuring innovation (see the acknowledgements) and we have drawn on these to identify the indicators used in this report: categorised as people, investment, infrastructure, ecosystem and impact. However, there are shortcomings, for example, how does one capture innovation taking place in communities and in homes, or the impact that design, art and shared spaces are having on innovation? These shortcomings are compounded by the lack of data available in South Africa, especially at a provincial level. Essential indicators, such as the number of startup businesses and the number of patents registered are not available for KZN. We are continuously working to improve indicators each year and welcome any feedback on how we can better measure innovation.

1.3 REPORT STRUCTURE

This report first provides innovation indicators under the categories of people, investment, infrastructure, ecosystem and impact. It then showcases five local innovations (Eloh App, Sturtium Informatics System, D Chem Group, Ocrum O&P and HyDrop).

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

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2. THE STATE OF INNOVATION IN KZN

2.1 PEOPLE

The people category includes the following indicators:

| Sub-category | Indicator |
|-----------------------------|--|
| High School Education | National Senior Certificate Performance in Mathematics (2017-2019) |
| | National Senior Certificate Performance in Physical Sciences (2017-2019) |
| TVET Education | Students who completed N3 Engineering Studies (2018) |
| | Students who Completed N6 Engineering Studies (2018) |
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| | Trademark Applications in South Africa (2016-2018) |

Section Highlights:

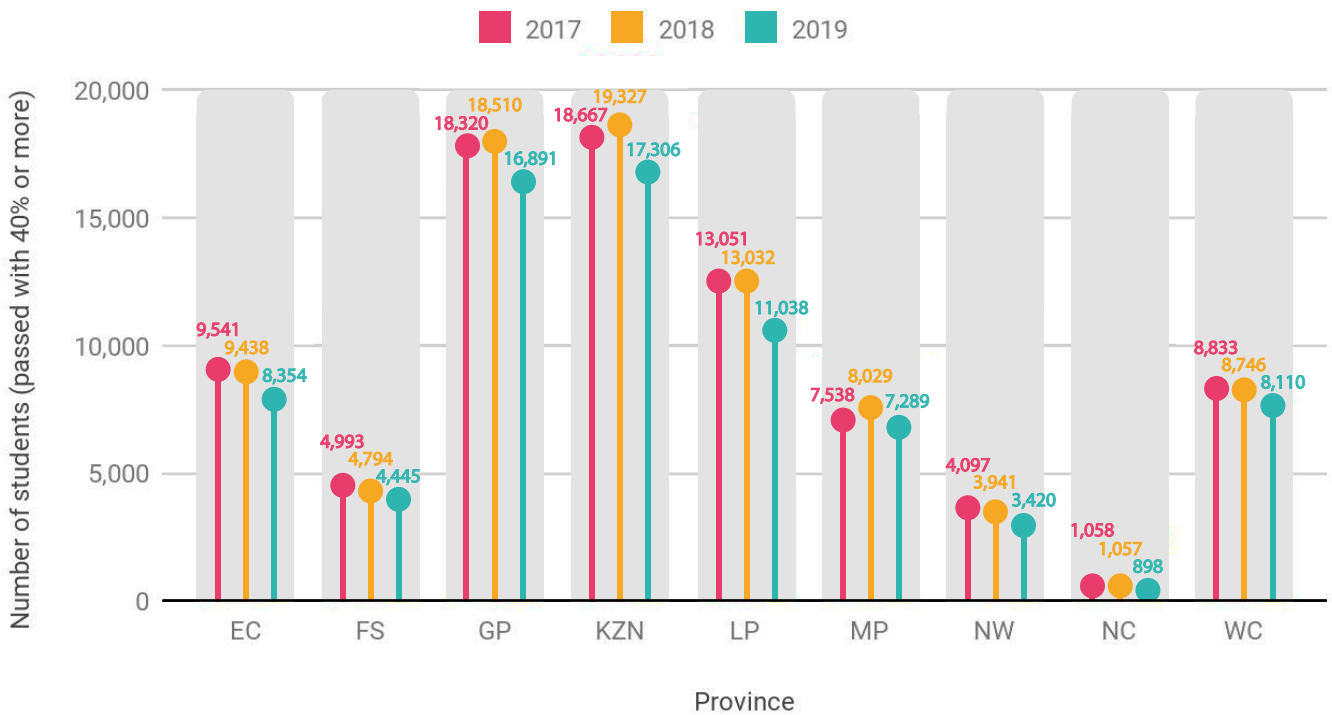
- National senior certificate performance (40% or above pass mark) for maths in KZN declined from 31.3% in 2018 to 29.9% in 2019. The number of maths graduates (40% or above pass mark) in 2019 was 17,306 - the most out of all provinces.
- National senior certificate performance (40% or above pass mark) for science in KZN increased from 48.5% in 2018 to 51.2% in 2019. The number of science graduates (40% or above pass mark) in 2019 was 20,225 - the most out of all provinces.
- In 2018, KZN TVET colleges had the highest number of students complete N3 Engineering studies (7,627), and the 2nd highest number of students complete N6 Engineering studies (2,617).
- Enrolment figures for science, engineering and technology (SET) degrees rose across the four universities in KZN (DUT, MUT, UKZN, UniZulu) from 44,001 in 2017 to 45,063 in 2018.
- Graduation figures for science, engineering and technology degrees also rose across the four universities in KZN (DUT, MUT, UKZN, UniZulu) from 9,044 in 2017 to 9,459 in 2018.
- UKZN achieved the highest enrolment (3,320) and graduation (497) in South Africa for doctoral degrees in 2018.
- UKZN obtained the highest overall publication output units in 2018 when compared to other universities in the country.
- Nationally, local patent applications have risen by 65% to 1,129 in 2018/19 and resident trademark applications have risen by 1% to 22,948 in 2018.

2.1.1 HIGH SCHOOL EDUCATION

The charts below show the performance of matriculants in mathematics (maths) and physical sciences (science) which are key subjects impacting the future health of the innovation ecosystem.

FIGURE 1:

National Senior Certificate Performance in Mathematics (2017-2019)



Source: Department of Basic Education (2018; 2019)

The chart above shows the number of matriculants who passed the maths subject with a pass mark of 40% and above between 2017 and 2019. The chart demonstrates that KZN has the highest number of maths graduates across all three years, however, 10% fewer students passed Maths in 2019 than in 2018. This trend aligns with a reduced pass rate - 1.4% fewer students passed in 2019 than in 2018. Western Cape has the highest pass rate for Maths at 52.6%, despite having fewer graduates.

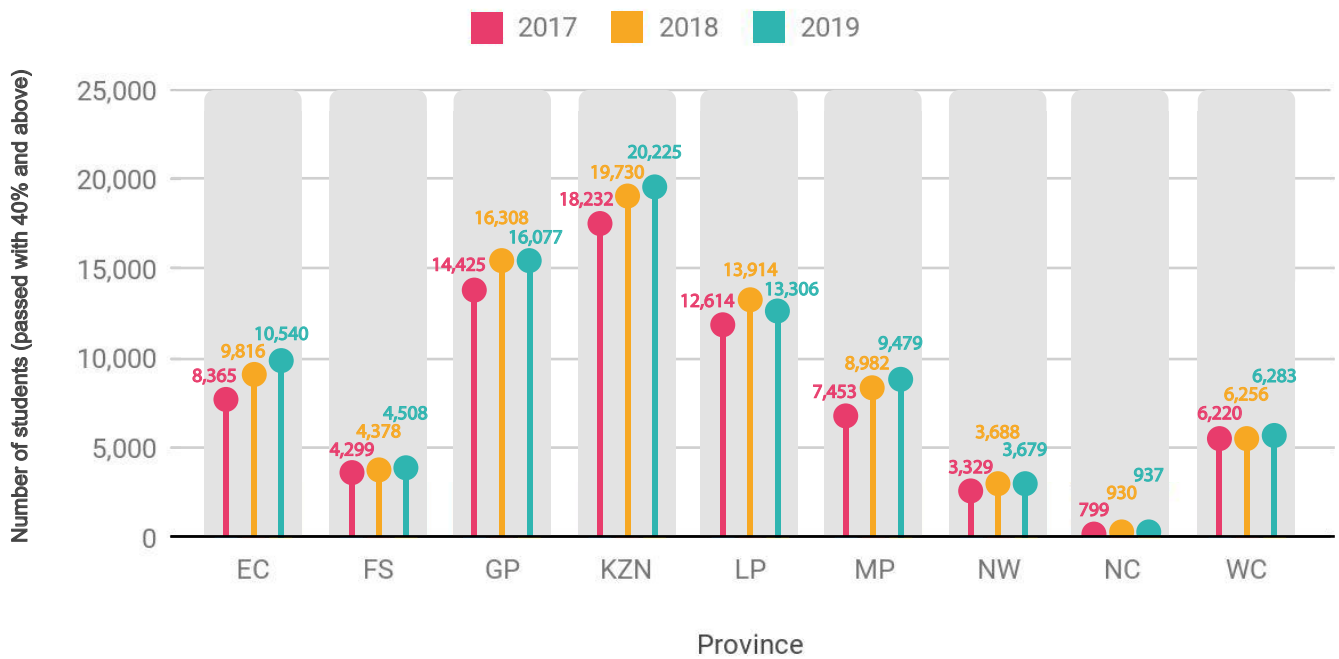
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FIGURE 2:

National Senior Certificate Performance in Physical Sciences (2017-2019)



Source: Department of Basic Education (2019)

The chart above shows the number of matriculants who passed science with a pass mark of 40% and above between 2017 and 2019. As with maths, KZN graduates the highest number of science students (20,225 in 2018). Unlike for maths, the number of students who have graduated has increased over the three years. The general trend in pass rates shows improvement across all provinces over the three year period. KZN performance in science has remained around the national average at 51.2%. Gauteng made a considerable improvement in 2018 to obtain the highest pass rate for science, from 49.4% in 2017 to 60.9% in 2018.

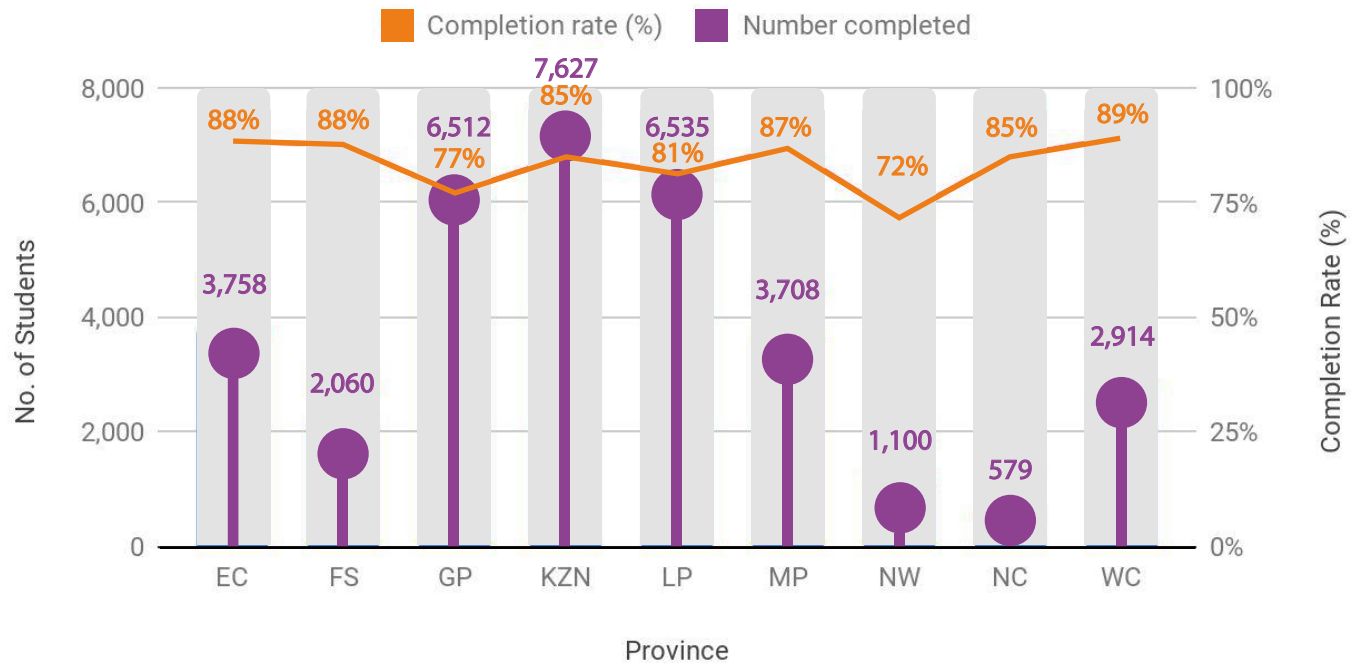
2.1.2 TVET EDUCATION

The charts below show performance in Engineering Studies for students in TVET colleges. The exit points which are reported below are N3 level, which is a Grade 12 equivalent, and N6, which is a post matriculation qualification.

FIGURE 3:

Students who Completed N3 Engineering Studies (2018)

Grade 12 Equivalent



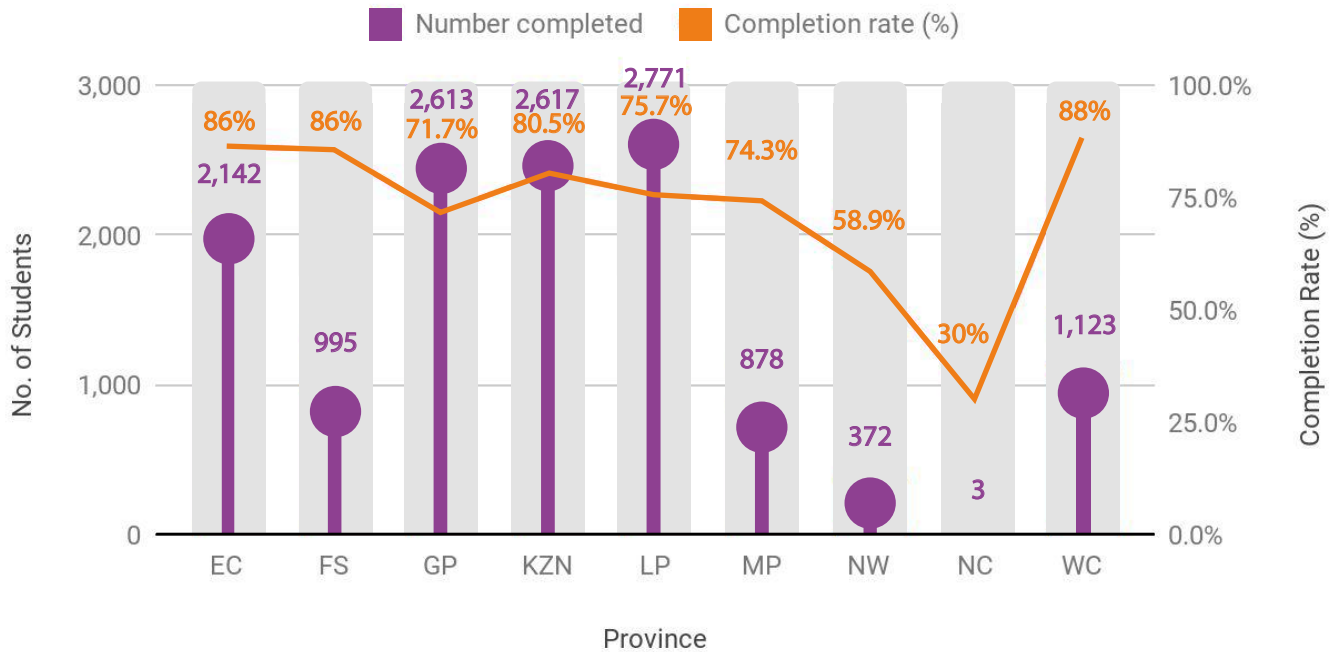
Source: Department of Higher Education and Training (2020)

The chart above shows that KZN TVET colleges had the highest number of students complete N3 Engineering studies (7,627), followed by Limpopo (6,535) and Gauteng (6,512). In terms of completion rate, students in the Western Cape experienced the highest completion rate (89.2%), followed by Eastern Cape (88.3%) and the Free State (87.5%).

FIGURE 4:

Students who Completed N6 Engineering Studies (2018)

Post Matric Equivalent



Source: Department of Higher Education and Training (2020)

The chart above illustrates that Limpopo, KZN and Gauteng had the highest number of students complete N6 level Engineering Studies with 2,771, 2,617 and 2,613, respectively. As in N3 level, completion rates for N6 level in Engineering Studies was highest amongst Western Cape students (88.4%), followed by Eastern Cape (86.4%) and Free State (85.8%).

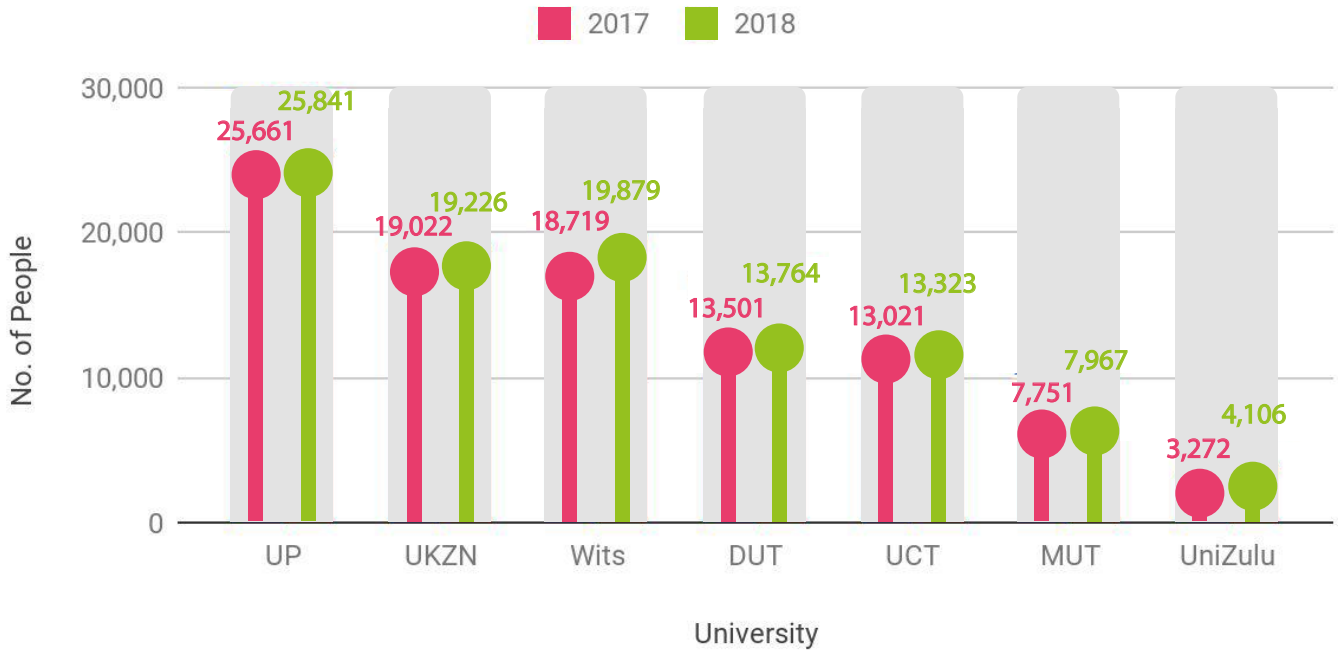
2.1.3 PUBLIC UNIVERSITY EDUCATION

The following charts explore enrolment and graduation from higher education institutions in KZN for science, engineering and technology (SET) courses, as well as all doctoral degrees, in comparison to some selected universities in South Africa.

FIGURE 5:

Higher Education Institution Enrolment (2017-2018)

Science, Engineering & Technology



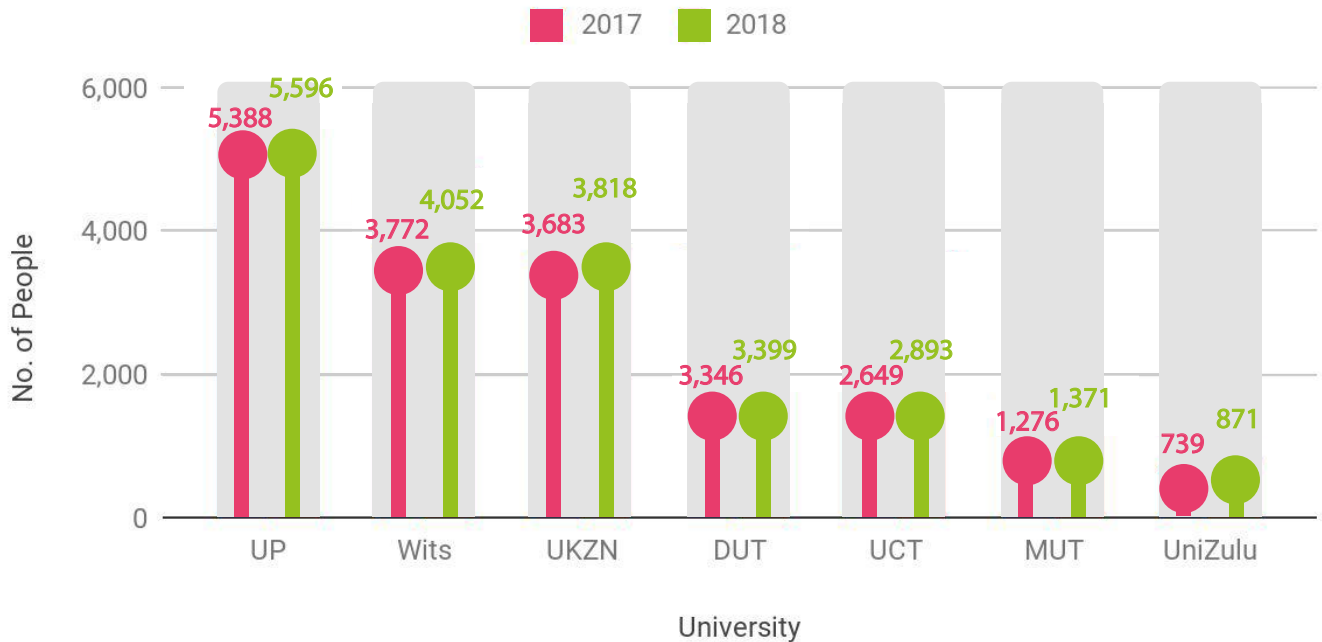
Source: Department of Higher Education and Training (2019; 2020)

The chart shows higher enrolment numbers in 2018 than 2017 for SET degrees at all universities shown. The University of Witwatersrand (Wits) had the highest number of new enrolments compared to the previous year, with 1,160 more students enrolled. Within KZN, the University of Zululand (UniZulu) had the highest number of new students enrolled for SET degrees in 2018 compared to 2017, with 379 new students. Overall, the University of Pretoria (UP) had the highest enrolment for SET degrees in both 2017 and 2018 with enrolment numbers of 25,661 and 25,841, respectively.

FIGURE 6:

Higher Education Institution Graduates (2017-2018)

Science, Engineering & Technology



Source: Department of Higher Education and Training (2019; 2020)

The chart above shows the number of students who graduated from SET degrees in 2017 and 2018 for selected universities. All universities have a higher number of SET graduates in 2018 than 2017. UP had the highest number of students graduate from SET degrees in 2018 (5,596), followed by Wits (4,052) and then UKZN (3,818).

The table below shows the ranking of 26 universities in South Africa for SET enrolment and graduation.

TABLE 1: Ranking of 26 universities in South Africa for SET enrolment and graduation

| University | 2017 Enrolment Ranking (SET) | 2018 Enrolment Ranking (SET) | 2017 Graduate Ranking (SET) | 2018 Graduate Ranking (SET) |
|------------|------------------------------|------------------------------|-----------------------------|-----------------------------|
| UKZN | 4 | 5 | 6 | 7 |
| DUT | 9 | 9 | 9 | 9 |
| MUT | 19 | 19 | 19 | 19 |
| UniZulu | 23 | 23 | 24 | 23 |

| | | | | |
|-------|----|----|----|----|
| UP | 2 | 2 | 1 | 1 |
| Wits | 5 | 4 | 4 | 5 |
| UCT | 10 | 10 | 11 | 10 |
| UNISA | 1 | 1 | 7 | 4 |

Source: Department of Higher Education and Training (2019; 2020)

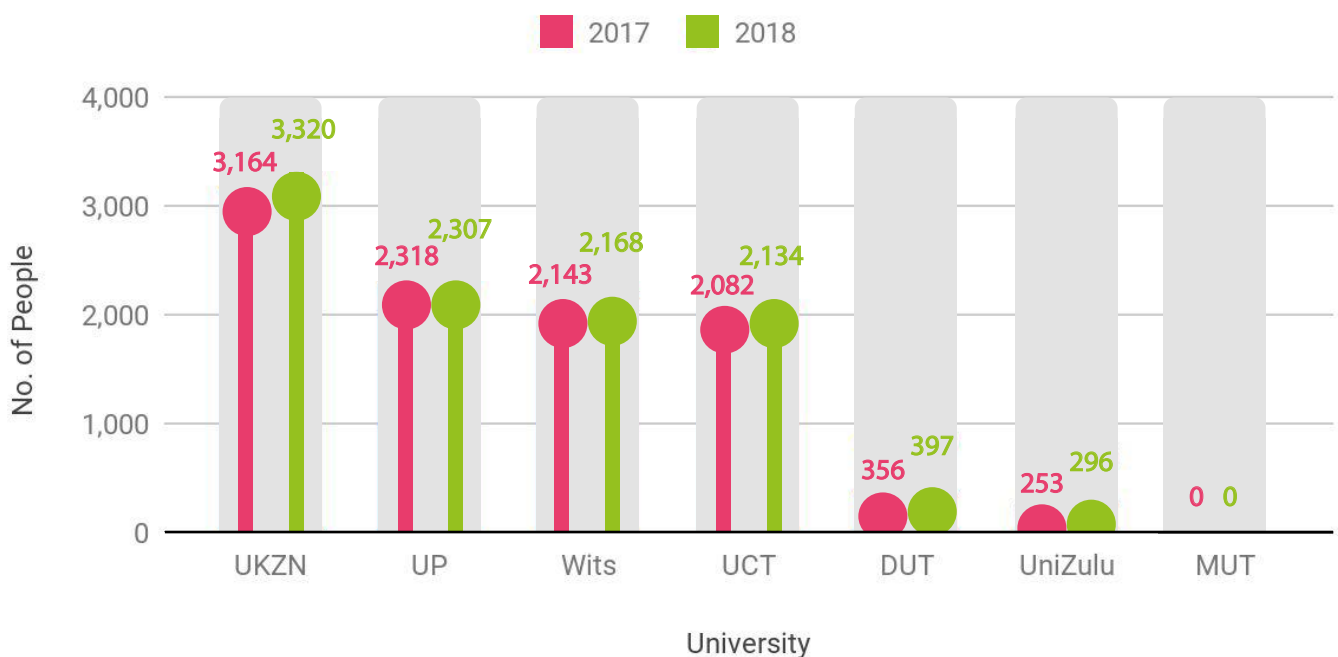
The University of South Africa (UNISA) maintained its number one position in terms of enrolment in 2018, followed by UP in second place. Wits improved in rankings to the fourth position, whereas, UKZN dropped one place to fifth position, and Durban University of Technology (DUT), Mangosuthu University of Technology (MUT) and UniZulu remained unchanged from 2017- 2018.

In terms of graduates, UP maintained first place in 2018. Improvement in overall rankings were experienced by UNISA which moved from seventh to fourth place, the University of Cape Town (UCT) which moved from eleventh to tenth place, and UniZulu which moved from twenty-fourth to twenty-third place. UKZN and Wits both dropped one place from 2017 rankings.

FIGURE 7:

Doctoral Enrolment (2017-2018)

All Doctoral Degrees



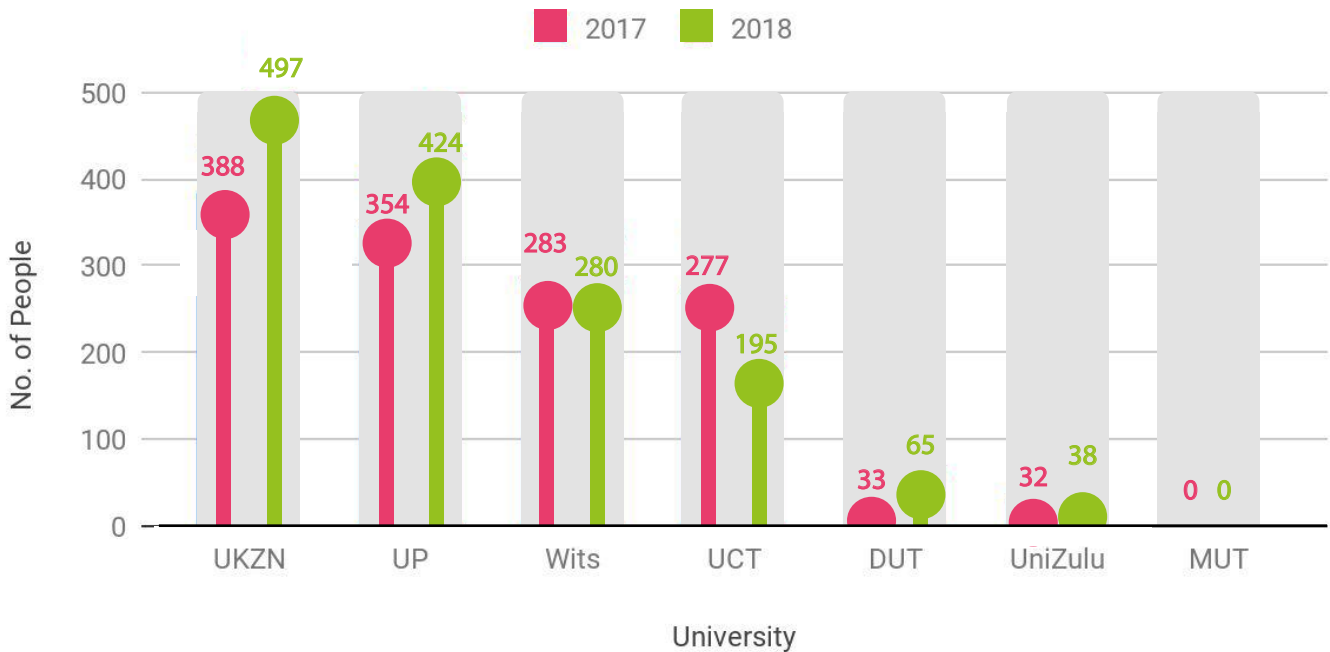
Source: Department of Higher Education and Training (2019; 2020)

The chart above shows enrolment into doctoral degree programmes in selected universities. Doctoral degree enrolment continues to rise at UKZN from 3,164 in 2017 to 3,320 in 2018. All other universities in the chart also show higher enrolment except UP and MUT. MUT had no Doctoral enrolments in both 2017 and 2018.

FIGURE 8:

Doctoral Graduates (2017-2018)

All Doctoral Degrees



Source: Department of Higher Education and Training (2019; 2020)

The chart above shows higher graduation numbers in 2018 for UKZN, DUT, UniZulu and UP compared to 2017 for doctoral degrees, whereas Wits and UCT show lower graduation numbers in 2018.

TABLE 2: Ranking of 26 universities in South Africa for doctoral enrolment and graduation

| University | Doctoral Enrolment Ranking (2017) | Doctoral Enrolment Ranking (2018) | Doctoral Graduate Ranking (2017) | Doctoral Graduate Ranking (2018) |
|------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------------------|
| UKZN | 1 | 1 | 1 | 1 |
| DUT | 15 | 16 | 13 | 14 |
| MUT | 24 | 24 | 24 | 24 |

| | | | | |
|---------|----|----|----|----|
| UniZulu | 19 | 18 | 17 | 17 |
| UP | 2 | 3 | 2 | 2 |
| Wits | 4 | 4 | 5 | 5 |
| UCT | 5 | 5 | 6 | 7 |
| UNISA | 3 | 2 | 4 | 3 |

Source: Department of Higher Education and Training (2019; 2020)

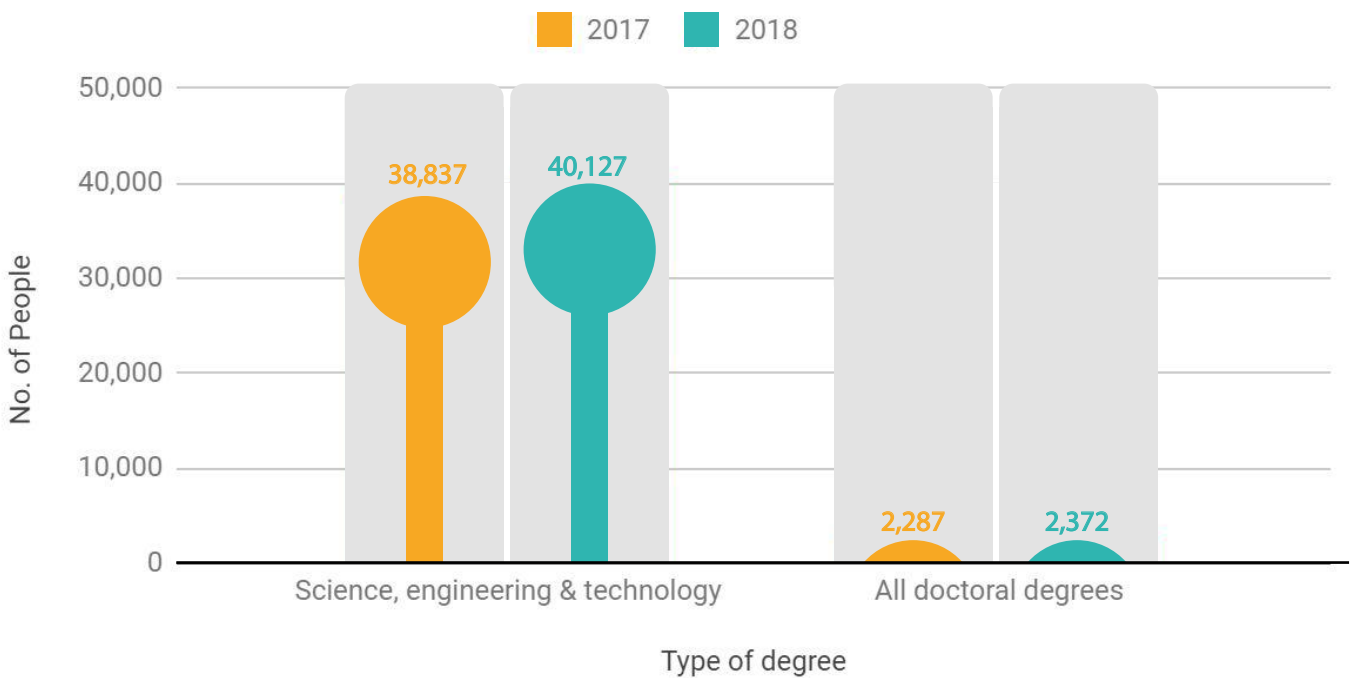
In terms of overall ranking across 26 universities, UKZN remains in first place for both doctoral degree enrolment and graduation in South Africa in 2018. UNISA and UniZulu improved in the national doctoral enrolment rankings by one place whereas DUT and UP both dropped one place. UNISA improved one place on the doctoral graduate rankings, while UCT and DUT dropped one place.

The following charts consider enrolment and graduation at UNISA separately since UNISA includes students from every province.

FIGURE 9:

UNISA Enrolment (2017-2018)

Science, Engineering & Technology; All Doctoral Degrees



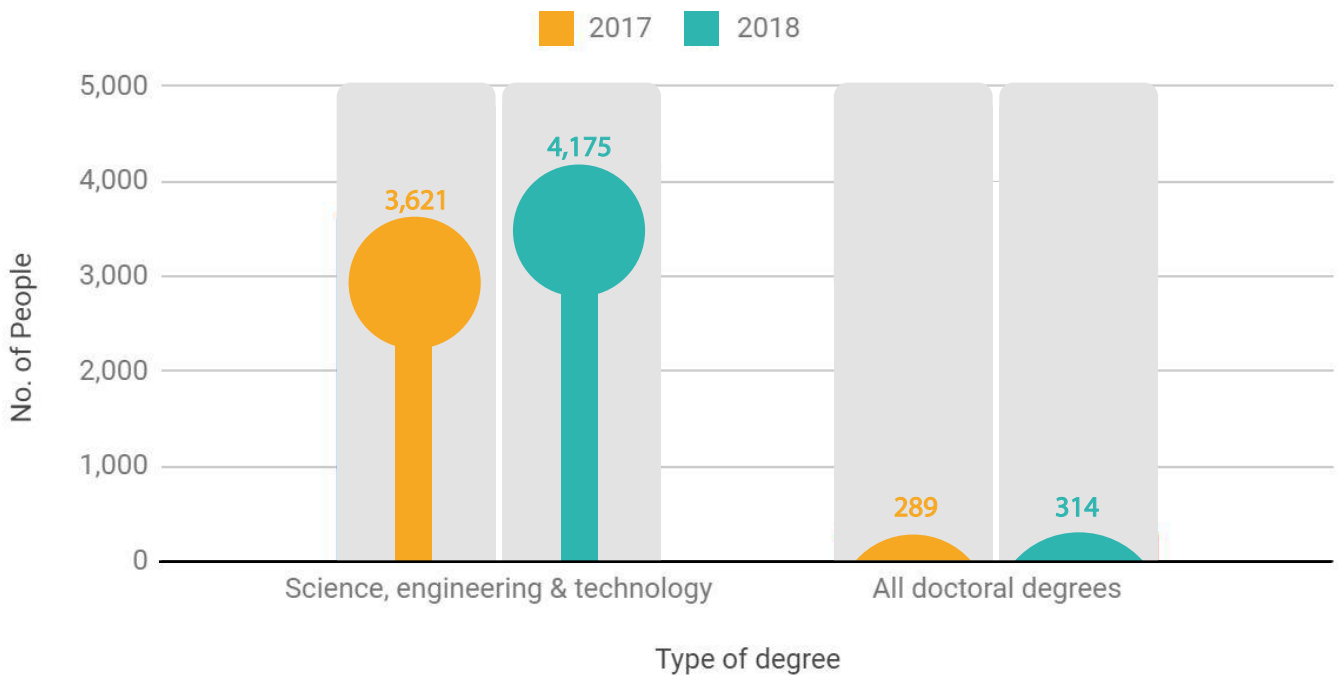
Source: Department of Higher Education and Training (2019; 2020)

The chart above shows that enrolment for SET degrees increased between 2017 and 2018, as did enrolment in doctoral degree programmes.

FIGURE 10:

UNISA Graduates (2017-2018)

Science, Engineering & Technology; All Doctoral Degrees



Source: Department of Higher Education and Training (2019; 2020)

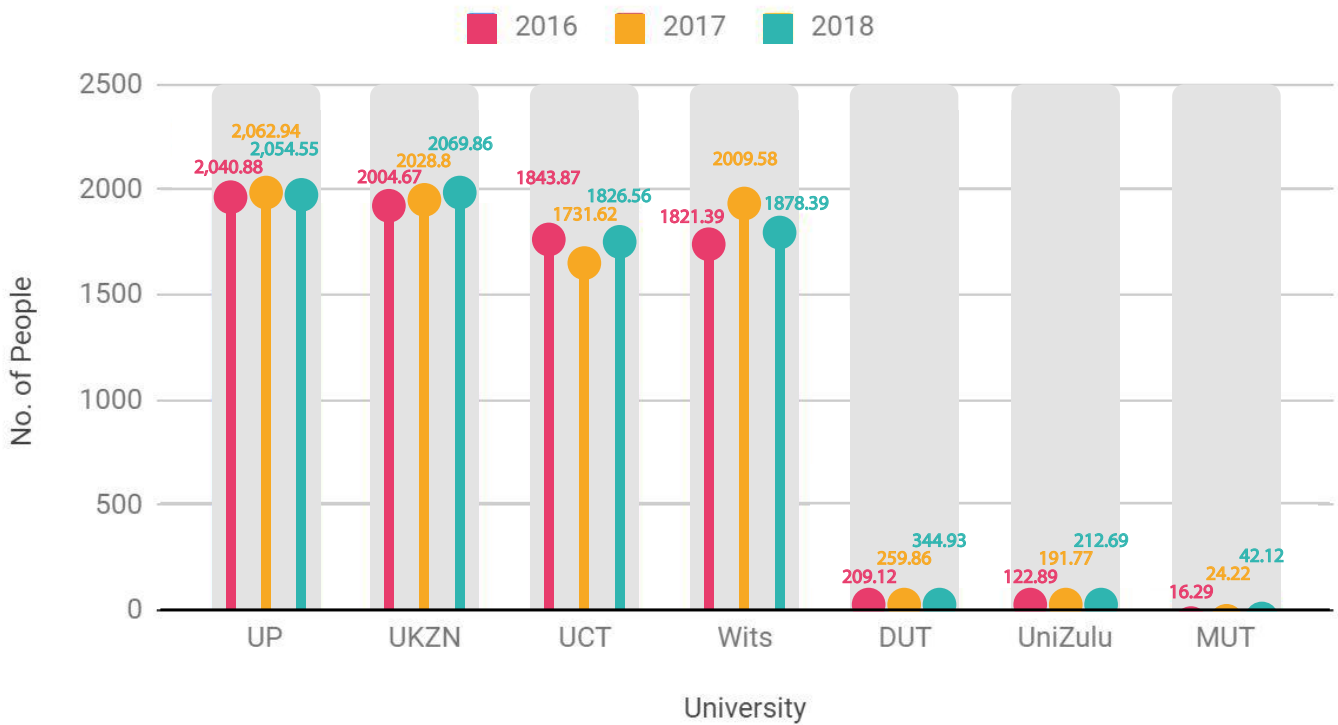
The chart above shows that SET graduates at UNISA increased from 3,621 in 2017 to 4,175 in 2018. Similarly, doctoral degree graduates increased to 314 in 2018, from 289 the previous year.

2.1.4 KNOWLEDGE GENERATION

Publication units measure the amount of new knowledge generated through research at academic institutions. The following charts compare overall publication units from selected universities as well as showing a national ranking of 26 universities. For specific publication units in terms of books and book chapters, conference proceedings and journals, see Appendix 1.

FIGURE 11:

Overall Publication Output Units (2016-2018)



Source: Department of Higher Education & Training (2018; 2019; 2020)

The chart above demonstrates that between 2016 and 2018, KZN universities show an upward trend in publication outputs. Furthermore, UKZN produced the highest overall publication outputs in 2018.

TABLE 3: Ranking of 25 universities in South Africa for research publications

| University | 2016 | 2017 | 2018 |
|------------|------|------|------|
| UP | 1 | 1 | 2 |
| UKZN | 2 | 2 | 1 |
| UCT | 3 | 6 | 5 |
| Wits | 4 | 3 | 4 |
| DUT | 17 | 16 | 13 |
| UniZulu | 19 | 18 | 18 |
| MUT | 25 | 24 | 25 |

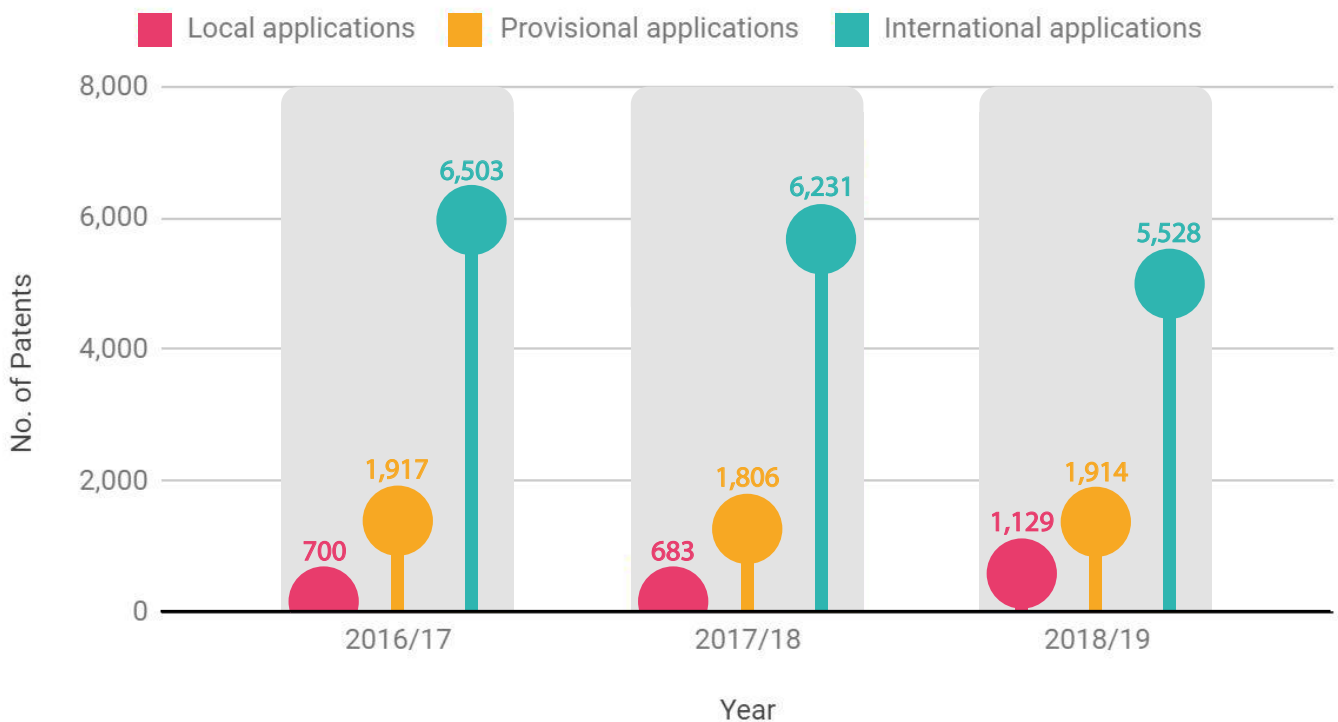
Source: Department of Higher Education & Training (2018; 2019; 2020)

The overall national rankings across 26 universities show that in 2018, UKZN climbed to first place, followed closely by UP. Wits, UCT and MUT all dropped one place from 2017 rankings to fourth, fifth and twenty-fifth, respectively in 2018. Whereas, DUT rose three places from 2017 to thirteenth in 2018.

The following charts focus on intellectual property in the form of patents and trademarks lodged annually between 2016/17 and 2018/19.

FIGURE 12:

Patents Lodged in South Africa (2016/17 - 2018/19)

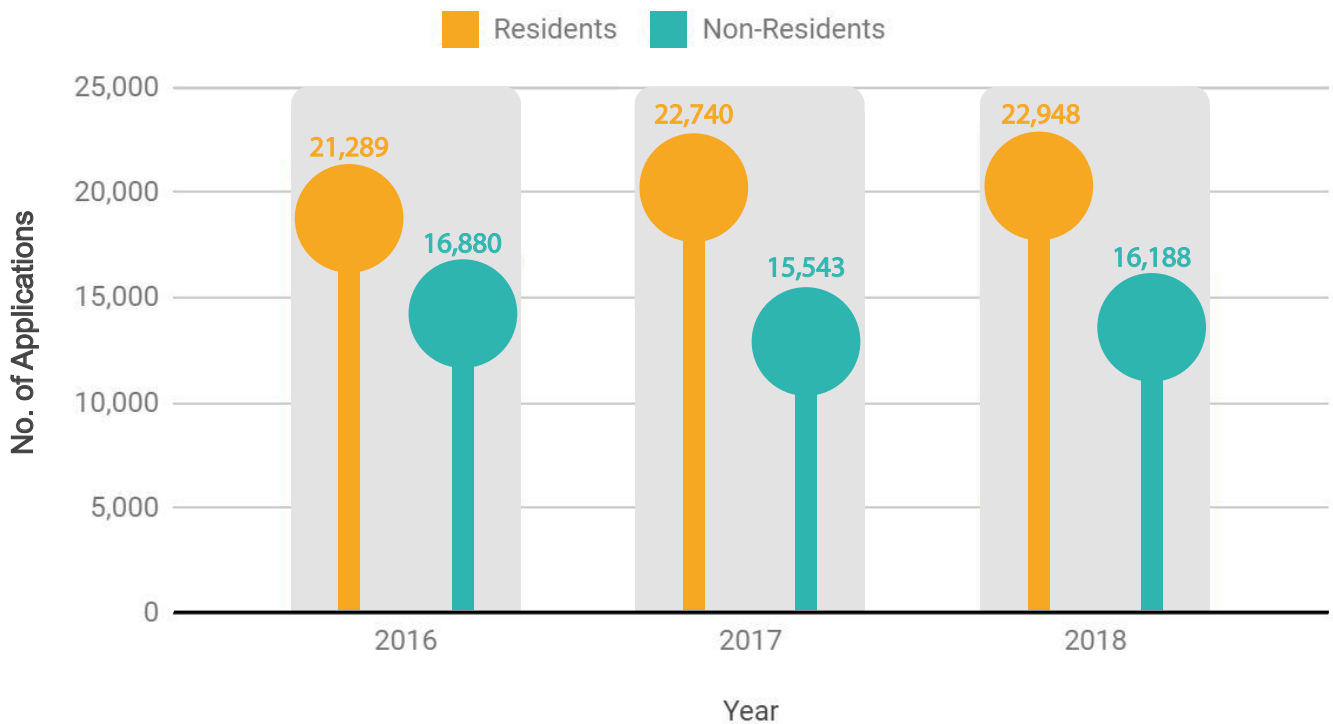


Source: CIPC (2017/18; 2018/19)

The chart above shows that local patent applicants in 2018/19 increased by 65% from 2017/18. Although international applications for patents have declined steadily since 2016/17, local applications still remain lower than international applications. In 2018/19, international patent applications totalled 5,528 whereas local patent applications were 1,129 and provisional applications were 1,914.

FIGURE 13:

Trademark Applications in South Africa (2016-2018)



Source: CIPC (2018/19)

The chart above illustrates trademark applications in South Africa between 2016 and 2018. The chart shows that trademark applications by South African residents increased year-on-year during this period. In 2018, trademark applications totalled 22,948 compared to 21,289 in 2016. Trademark applications by non-residents in 2018 (16,188) rose from the previous year (15,543), however, they were lower than in 2016 (16,880).

2.2 INVESTMENT

The investment category includes the following indicators:

| | |
|------------------------------------|--|
| Research & Development Expenditure | R&D Expenditure by Province (2008/9-2017/18) |
| | KZN R&D Expenditure by Source (2008/9-2017/18) |
| | GERD as a % of GDP by Province (2009/10-2017/18) |
| | BERD as a % of GDP by Province (2009/10-2017/18) |

| | |
|-----------------|--|
| Venture Capital | Value Contribution by Type of Fund (2018) |
| | Number of Investments (2008-2018) |
| | Value of Investments (2009-2018) |
| | Value Contribution by Stage of Deal, 2017 v 2018 |
| | Value Contribution by Location of Investee Head Office 2017 v 2018 |

Investment summary:

- KZN R&D expenditure was R4.17 billion in 2017/18, up by 14.7% from 2016/17. Most of this expenditure was in the business and higher education sectors, which combined make up 74.5% of R&D expenditure.
- KZN GERD as a percentage of GDP increased by 0.05% to 0.54% in 2017/18, compared to South Africa's GERD as a percentage of GDP which was 0.83% for the same period and against a national target of 1.5%. Western Cape GERD as a percentage of GDP surpassed other provinces at 1.41% in 2017/18.
- KZN has the 4th highest BERD as a percentage of GDP at 0.22% - this has decreased over the previous nine years from 0.27% in 2009/10. Gauteng's BERD as a percentage of GDP was the highest at 0.50%.
- The number of investments made by VCs ⁷ in South Africa increased to 181 in 2018. These 181 investments equated to a value of R1,5 billion rands.
- The largest share of VC investment was directed towards the startup stage (41.1%) and growth stage (29.4%), however, investment share into the seed, buyout and rescue stages are growing relatively.
- Value contributed to investees with head offices in KZN increased from 2.8% in 2017 to 6.8% in 2018, when compared to other provinces.

2.2.1 RESEARCH AND DEVELOPMENT EXPENDITURE

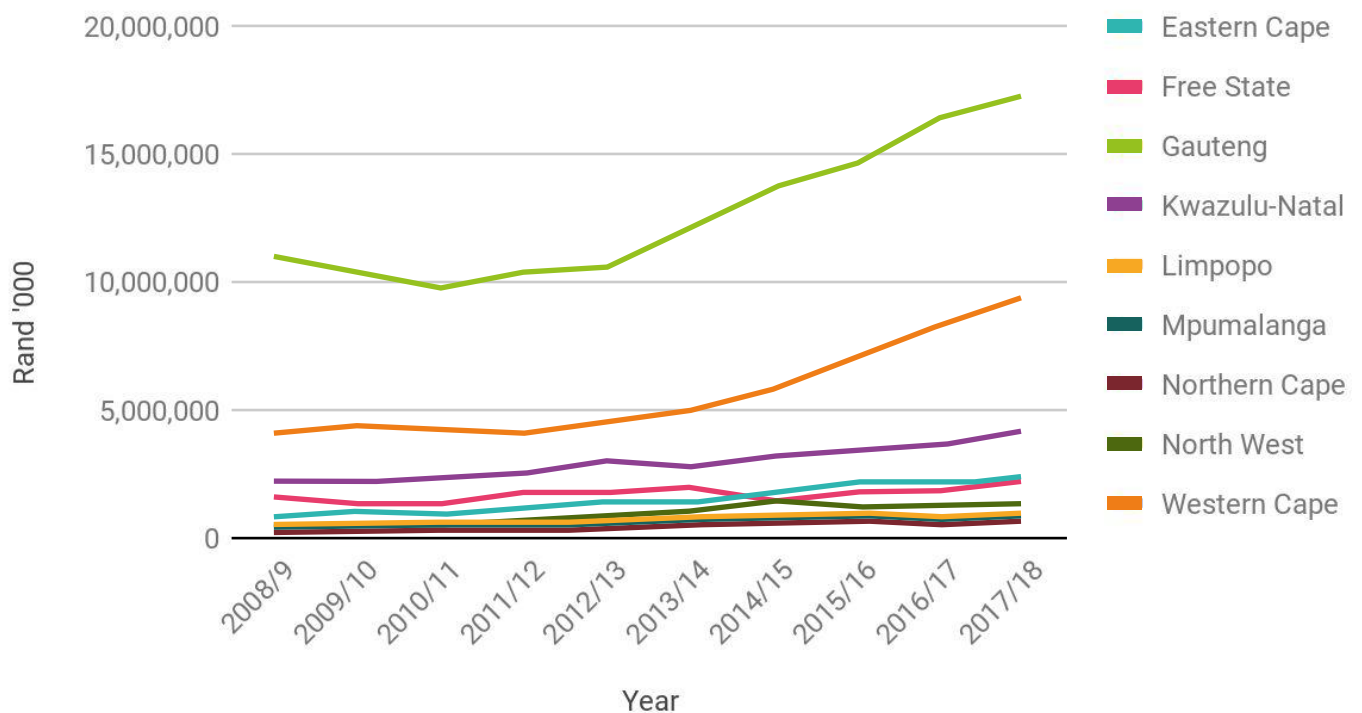
The following charts reflect the investments into research and development as well as investment made to support innovations. Provincial R&D is made up of business expenditure, government expenditure, expenditure by the higher education sector, science councils and the not-for-profit sector.

⁷ SAVCA VC Industry Survey 2019

The main indicators that will be discussed in this section are GERD and BERD as a percentage of GDP, as well as the value and number of investments made by venture capitalists.⁸

FIGURE 14:

R&D Expenditure by Province (2008/9 - 2017/18)



Source: Department of Science & Technology (2017/18)

The chart above shows R&D expenditure in value (Rands)⁹ for each province from 2008/9 to 2017/18. Gauteng R&D expenditure shows an overall upward trend and is the highest in comparison to other provinces. Gauteng R&D expenditure was R17.32 billion in 2017/18, up by 5.5% from 2016/17. R&D expenditure in the Western Cape is the second highest in comparison to other provinces and shows a significant increase between 2014/15 and 2017/18. Western Cape R&D expenditure was R9.33 billion in 2017/18. All provinces increased their rand value expenditure on R&D in 2017/18. KZN R&D expenditure was R4.17 billion in 2017/18, up by 14.7% from 2016/17.

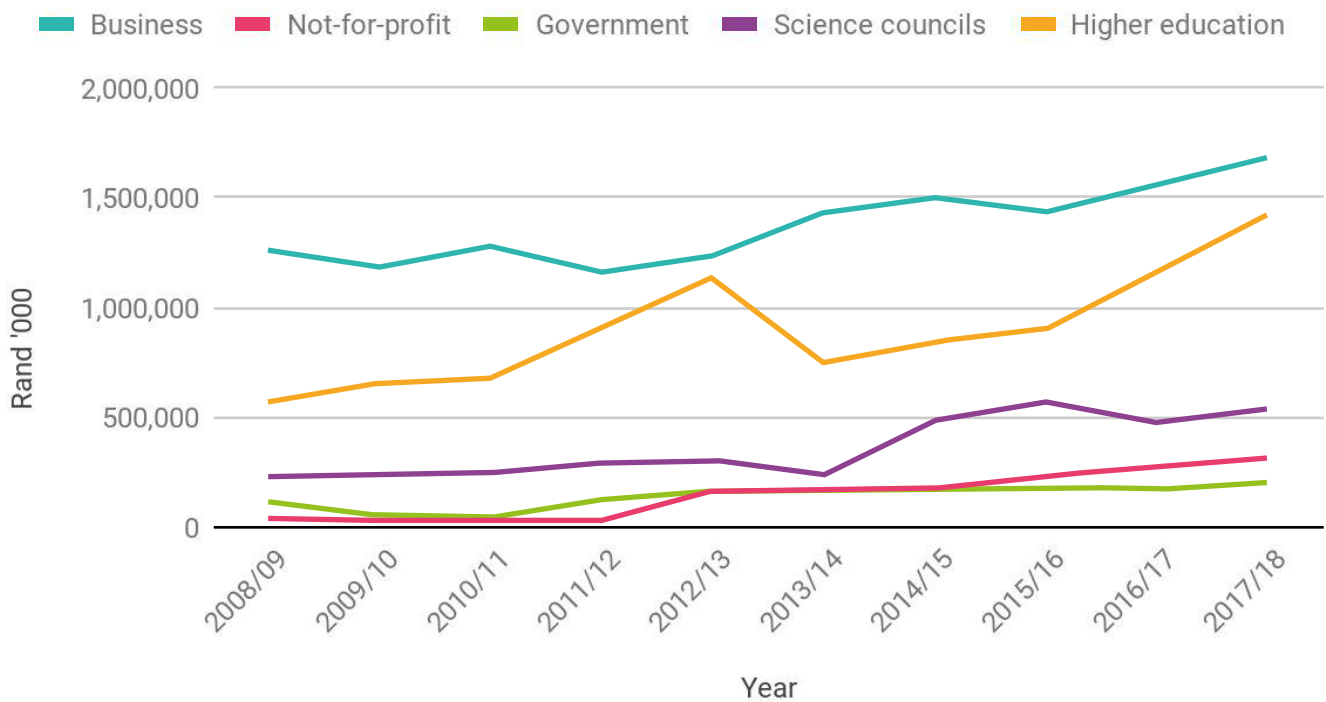
⁸ Calculations for GERD as a % of GDP are based on R&D expenditure for financial years whereas GDP is based on calendar years.

⁹ Note: The source document does not indicate whether these are real (adjusted for inflation) or nominal figures. It is assumed they are nominal.

Closer examination of R&D expenditure in KZN in 2017/18 reveals the sources of funds, which has been shown in the chart below.

FIGURE 15:

KZN R&D Expenditure by Source (2008/9 - 2017/18)



Source: Department of Science & Technology (2017/18)

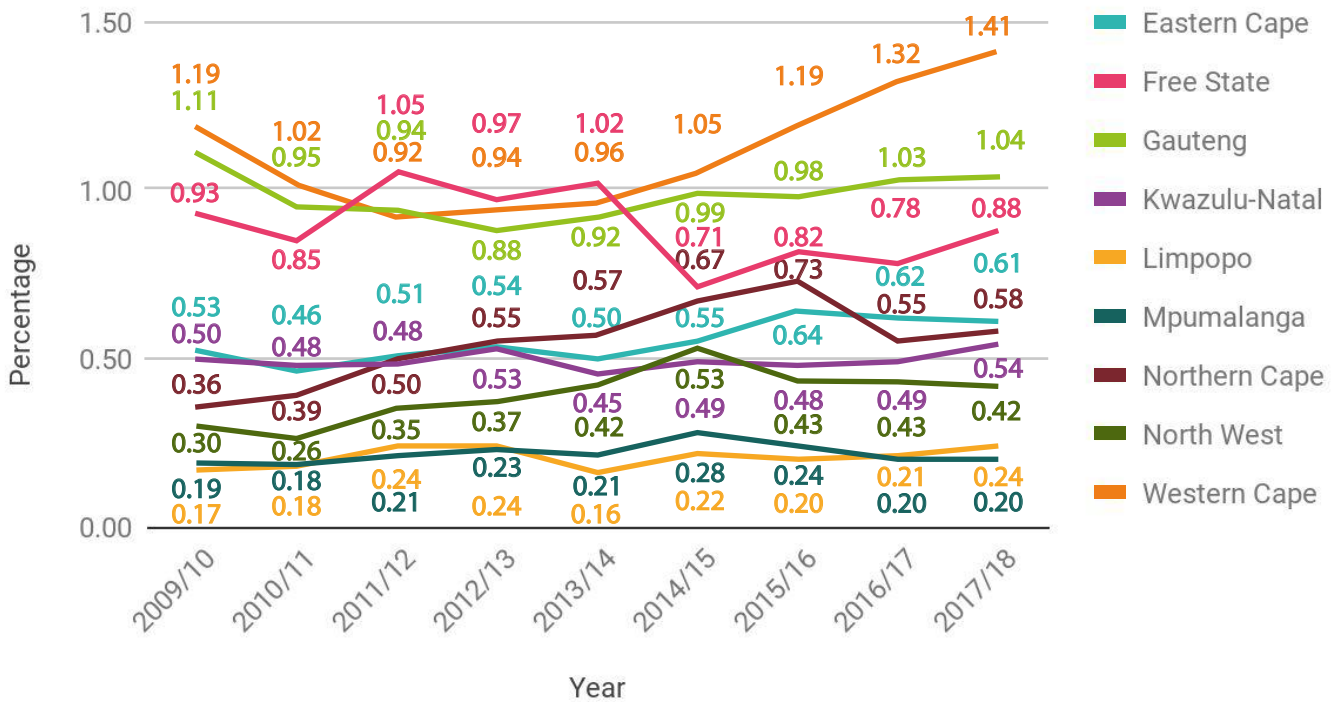
Business sector contributions make up the largest share of R&D expenditure (40%), followed by the higher education sector (34%), the science councils sector (13%), the not-for-profit sector (8%) and lastly the government sector (5%). All sectors increased the amount invested in R&D in 2017/18.

The chart below shows gross expenditure on R&D (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.¹⁰ However, in 2016/17 South Africa's GERD as a percentage of GDP was under the target at 0.83% and in 2017/18 it remained unchanged at 0.83%.

¹⁰ National Advisory Council on Innovation. (2019). South African Science and Technology and Innovation Indicators.

FIGURE 16:

GERD as a % of GDP by Province (2009/10 - 2017/18)

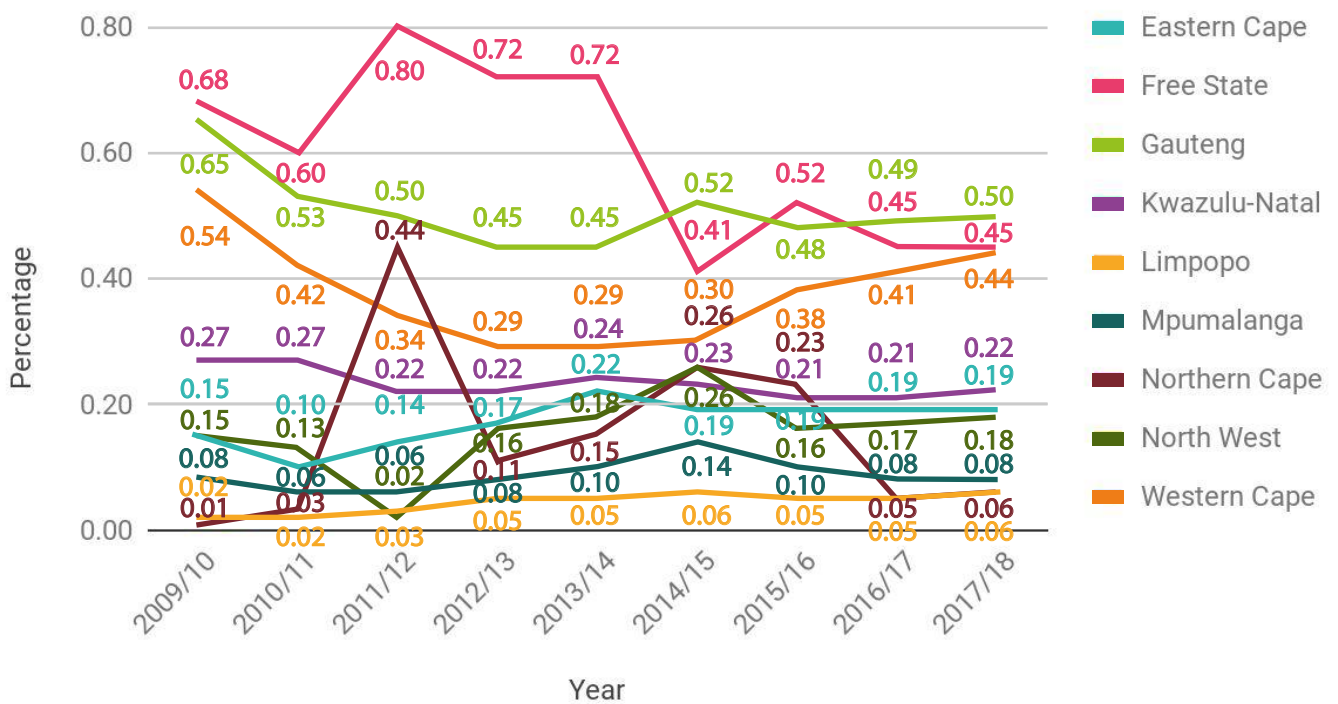


Source: Department of Science & Technology (2017/18); Stats SA (2019)

The chart above shows that in 2017/18, GERD as a percentage of GDP was highest in the Western Cape with 1.41%, which is an increase of 0.09% from the previous year. Gauteng follows with 1.04% in 2017/18, which is an increase of 0.01% from 2016/17. In third place is the Free State, which in 2017/18 had GERD as a percentage of GDP at 0.88%, a 0.10% increase from the previous year. KZN GERD as a percentage of GDP was 0.54% in 2017/18, an increase of 0.05% from 2016/17.

FIGURE 17:

BERD as a % of GDP by Province (2009/10 - 2017/18)



Source: Department of Science & Technology (2017/18); Stats SA (2019)

In terms of business expenditure on R&D, the chart above shows that in 2017/18 Gauteng’s BERD as a percentage of GDP was the highest at 0.50% (up from 0.49% in 2016/17), followed by the Free State at 0.45% (unchanged from 2016/17) and Western Cape at 0.44% (up from 0.41% in 2016/17). The graph shows that BERD as a percentage of GDP in 2009/10 was higher than in 2017/18 for a number of provinces such as the Free State, Gauteng, Western Cape and KZN. BERD as a percentage of GDP was 0.27% for KZN in 2009/10 and has decreased to 0.22% in 2017/18.

2.2.2 VENTURE CAPITAL

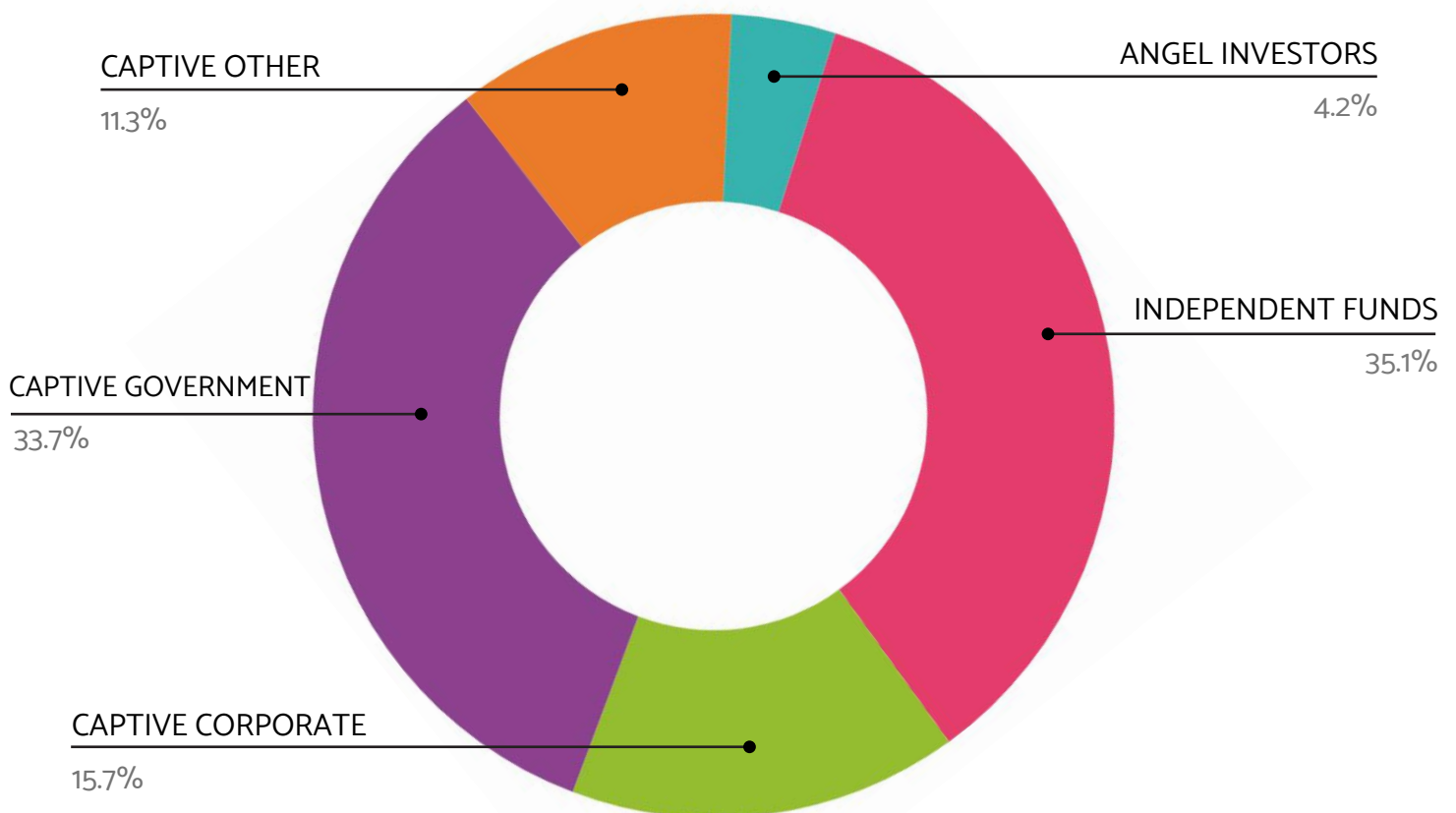
The following series of charts focus on investments made by venture capitalists, according to the Southern Africa Venture Capital and Private Equity Association.

The chart below shows the value of investments by type of fund. The type of funds included are angel investors, captive funds (including captive government, captive corporate and captive other) and independent funds. Angel investors are individuals who invest in start-up businesses in return for equity or convertible debt. Captive funds describe funds which cannot be traded publicly. In other words, the fund shares can only be sold back to the fund.¹¹ Captive government funds are mainly sourced from government agencies or public bodies. Captive corporate funds are mainly sourced from corporations. Captive other funds are obtained from family offices. Independent funds are funds “in which third parties are the main source of capital and in which no one investor holds a majority stake”.¹²

FIGURE 18:

Value Contribution by Type of Fund (2018)

South Africa



Source: SAVCA (2019)

¹¹ Investopedia. (2020). Captive Fund.

¹² SAVCA. (2019). Venture Capital Industry Survey.

The chart above shows that in 2018, the profile of funds that were managed by venture capitalists were made up mostly of independent funds (35.1%), followed closely by captive government funds (33.7%). Angel investors, who are critical for early stage investment made up 4.2% of funds.

FIGURE 19:

Number of Investments (2008-2018)

Southern Africa



Source: SAVCA (2019)

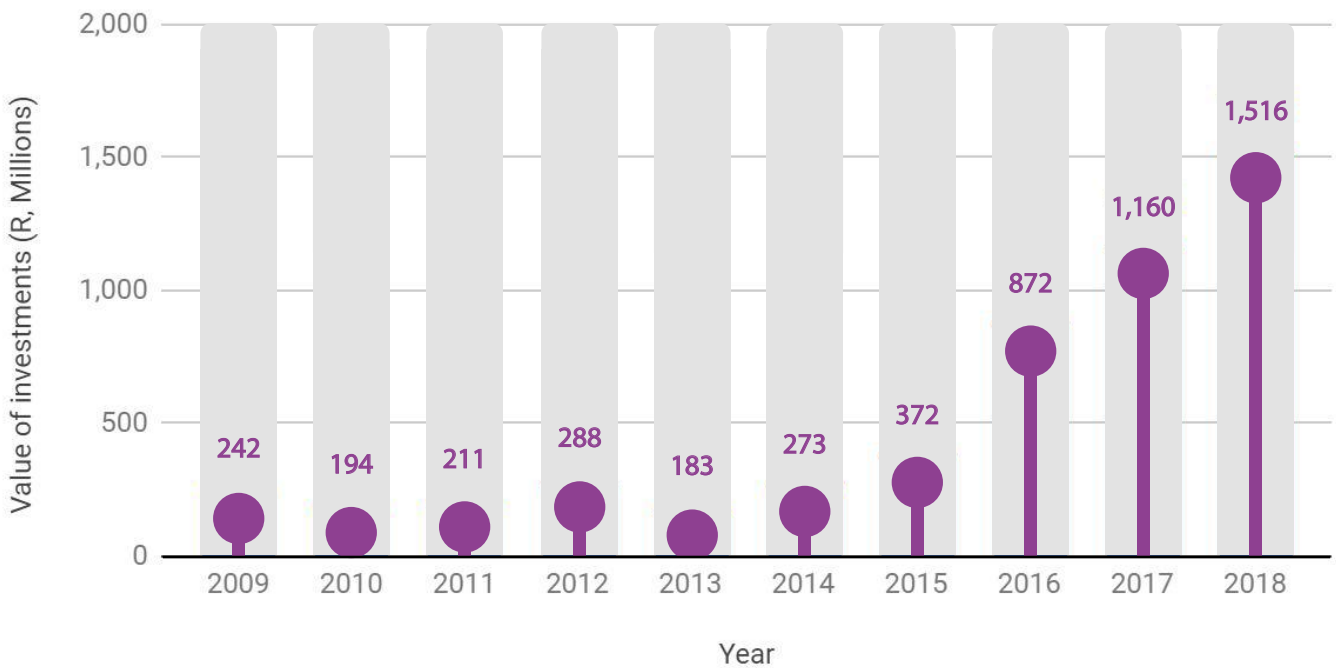
The chart shows that there has been a steady increase in the number of investments since 2015. At the end of 2018 there were 181 investment deals which suggests increased confidence and interest in South African industries.

The chart above shows that in 2018, the profile of funds that were managed by venture capitalists were made up mostly of independent funds (35.1%), followed closely by captive government funds (33.7%). Angel investors, who are critical for early stage investment made up 4.2% of funds.

FIGURE 20:

Value of Investments (2009-2018)

South Africa



Source: SAVCA (2019)

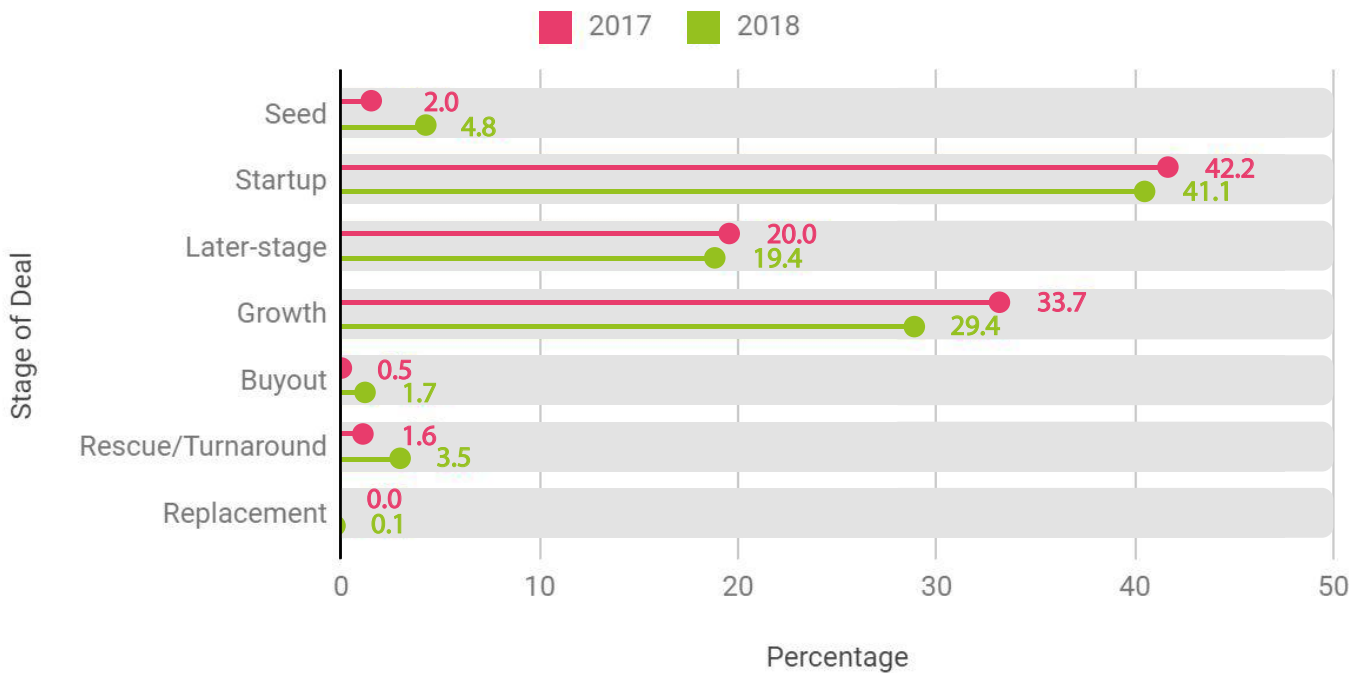
The chart above shows an upward trend in the value of investments since 2013. In 2018 the total value of investments was R1,516 million which is an increase of 30.69% from 2017.¹³ Over 40% of investment value went toward the manufacturing, food and beverage, medical devices and equipment, and energy sectors.

¹³ Non-SA investments included however, make up 0.3% of total contributions

FIGURE 21:

Value Contribution by Stage of Deal (2017 v 2018)

South Africa

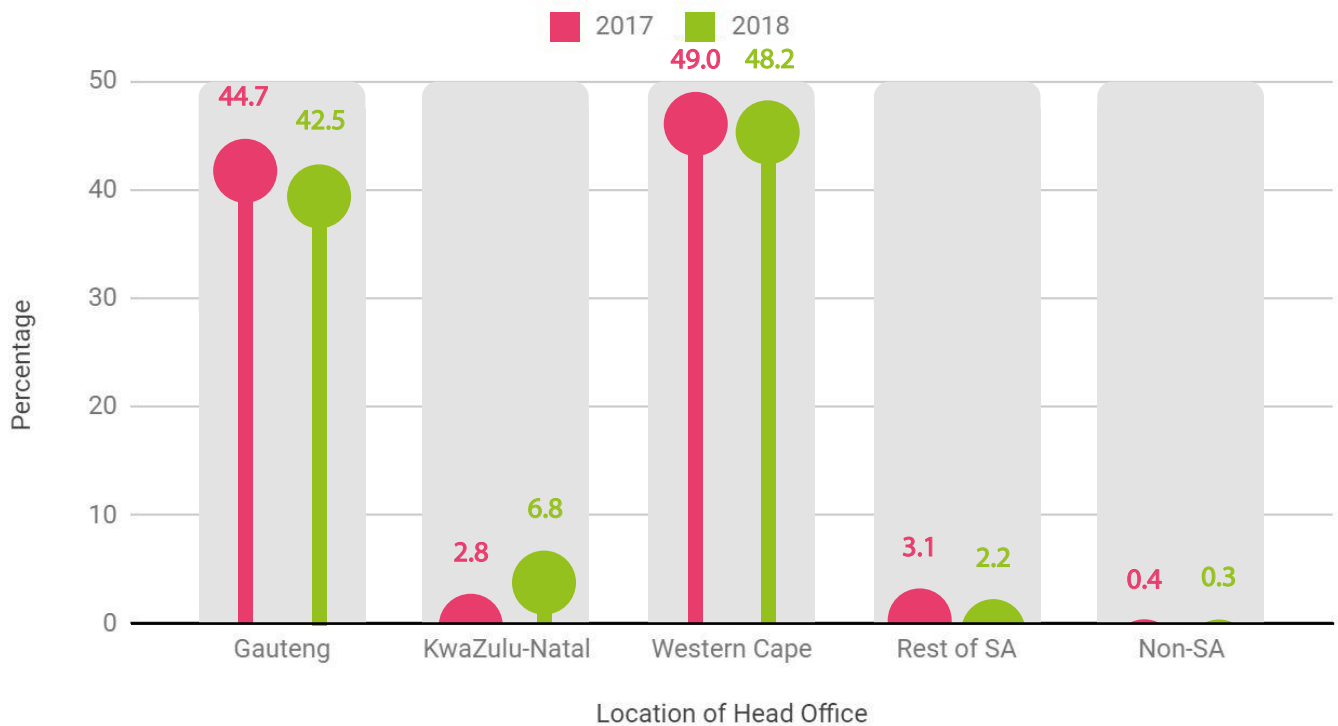


Source: SAVCA (2018; 2019)

The chart above is a national view of the spread of investment value according to the stage of the deal. The chart shows that in 2018, the majority of investment deals in terms of value (42.2%), went towards the start-up phase. This was followed by 29.4% share invested in the growth stage and 19.4% share in later-stage deals. The contributions for these three stages of deals declined since 2017, whereas the share of investments towards seed, buyout, rescue/turnaround and replacement increased in 2018.

FIGURE 22:

Value Contribution by Location of Investee Head Office (2017 v 2018)



The chart above shows that in 2018, the majority share of investment (value) went to investees with head offices in the Western Cape (48.2%). Investees with head offices in Gauteng received 42.5% of the share of investment. Although investees with head offices in KZN received a significantly lower share of investment at 6.8%, this is more than double the share received in 2017 (2.8%).

2.3 INFRASTRUCTURE

The infrastructure category includes the following indicators:

1. Internet Access by Province (2018)
2. Internet Access by Metro (2018)
3. Internet Access by Geotype (2018)

Infrastructure highlights:

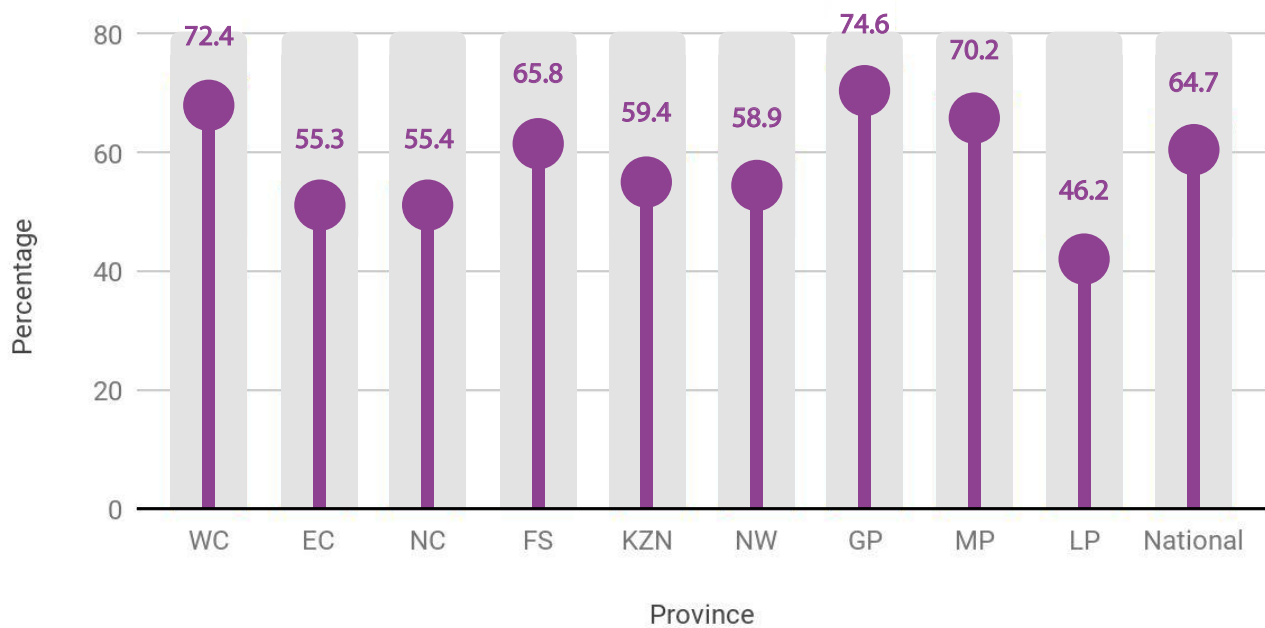
- 59.4% of KZN households have internet access compared to the national average of 64.7%.
- 66.6% of households in eThekweni Municipality have internet access compared to the metro average of 74.5%.

2.3.1 INTERNET ACCESS

Internet access is the indicator used to measure infrastructure. The charts below show internet access by province and by geographical type, i.e. metro, rural, traditional areas, and farms. Internet access includes access at home, at work, through a mobile phone and via an internet café or educational facility.

FIGURE 23:

Internet Access by Province (2018)

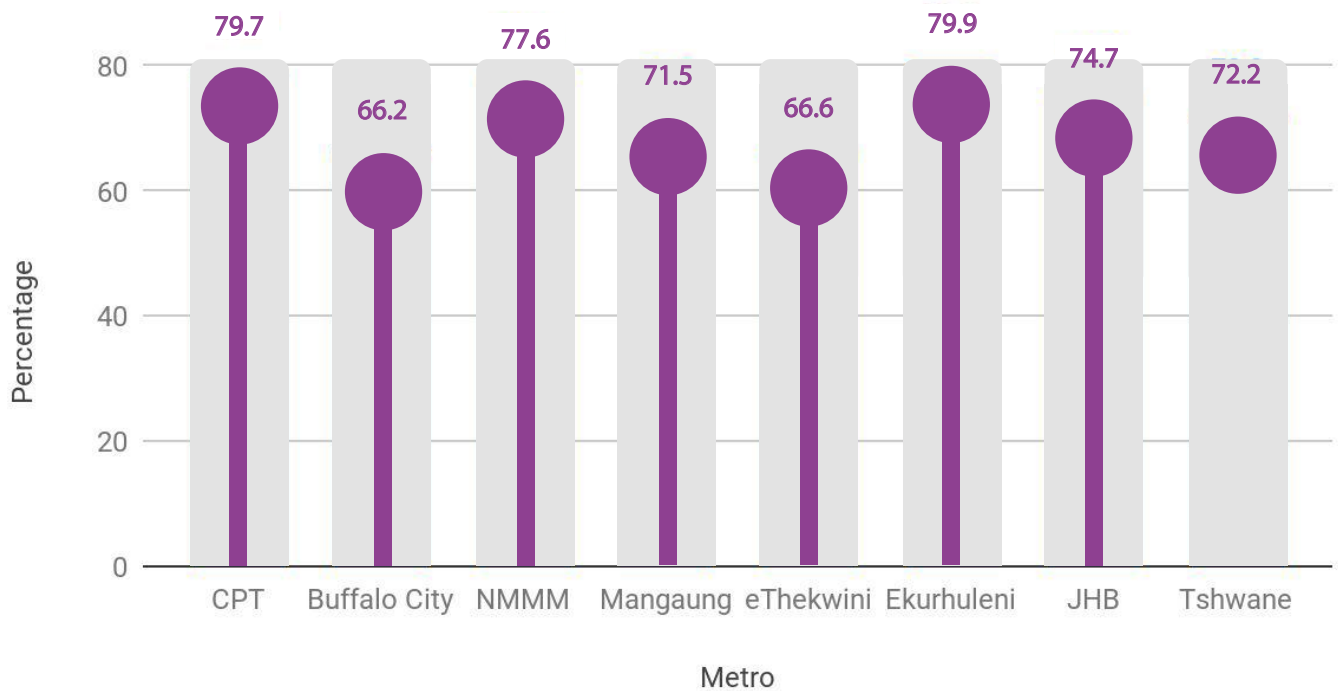


Source: General Household Survey (2018) Upon Request

The chart shows that Gauteng households have the most access to internet connectivity (74.6%), followed by the Western Cape (72.4%) and Mpumalanga (70.2%). Internet access for KZN households (59.6%) was below the national average (64.7%) in 2018.

FIGURE 24:

Internet Access by Metro (2018)

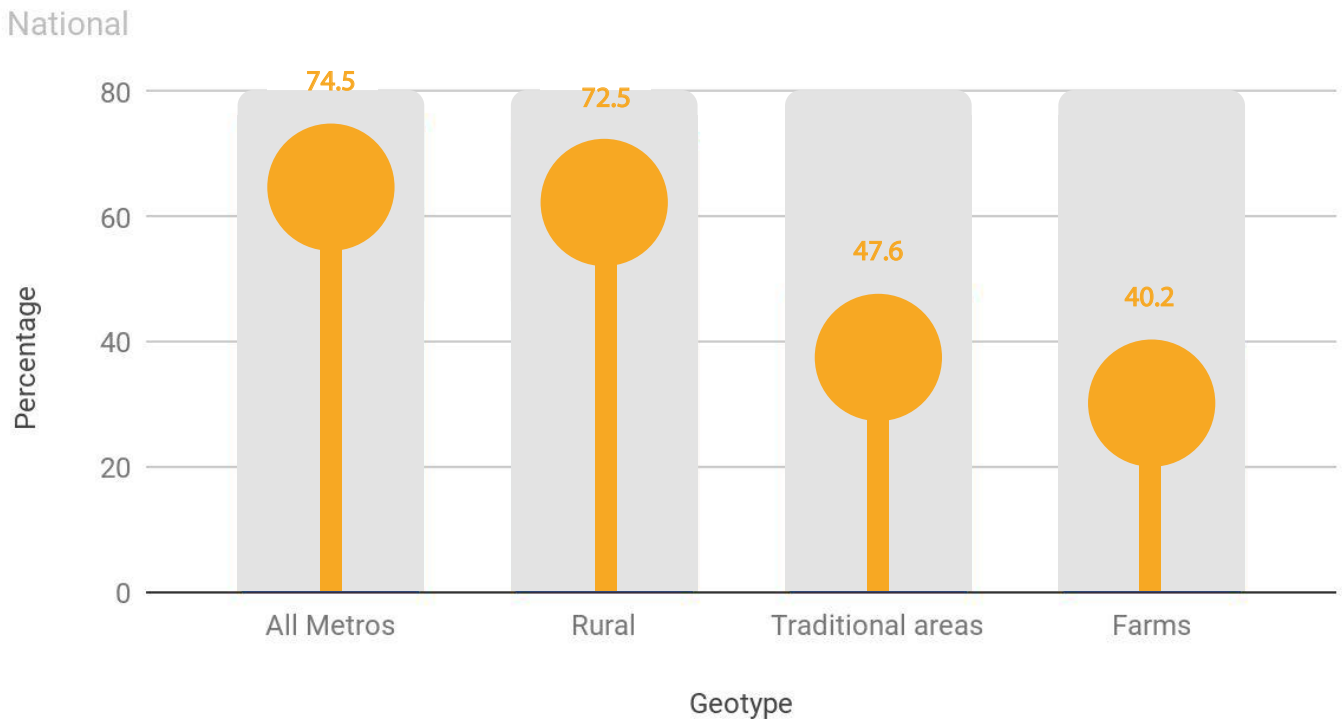


Source: General Household Survey (2018) Upon Request

Approximately 72-80% of households located in metro areas have access to the internet. However, in eThekweni and Buffalo City, 66.6% and 66.2% of households had access to the internet in 2018, respectively.

FIGURE 25:

Internet Access by Geotype (2018)



Source: General Household Survey (2018) Upon Request

The chart above shows that from a national perspective, there is no significant difference in household internet access across metros (74.5%) and rural areas (72.4%). However, households in traditional areas and farms experience more exclusion from connectivity with 47.6% and 40.2% of households having internet access, respectively.

2.4 ECOSYSTEM

The ecosystem category includes the following indicators:

1. Number of innovation events held in KZN
2. Number of funds towards innovation in KZN

FIGURE 26:

Number of Innovation Events Held in KZN (2020)



The number of innovation events in 2020 within the KZN province were affected by the COVID-19 pandemic, and many events transitioned into the virtual space. A total of 40 events took place in 2020 compared to 53 in 2019.

The table below shows the number of funding instruments that are relevant to innovators within the Innovate Durban community. The information below has been extracted from Innovate Durban's Funding Map, which was developed in 2019. The Funding Map includes a variety of fund types such as debt funding, equity investment, grants and incubators.

TABLE 4: Number of funds towards innovation in KZN

| | |
|--|-----|
| Number of High Relevance Funding Instruments | 136 |
| Number of Medium Relevance Funding Instruments | 269 |

2.5 IMPACT

The impact category includes the following indicators:

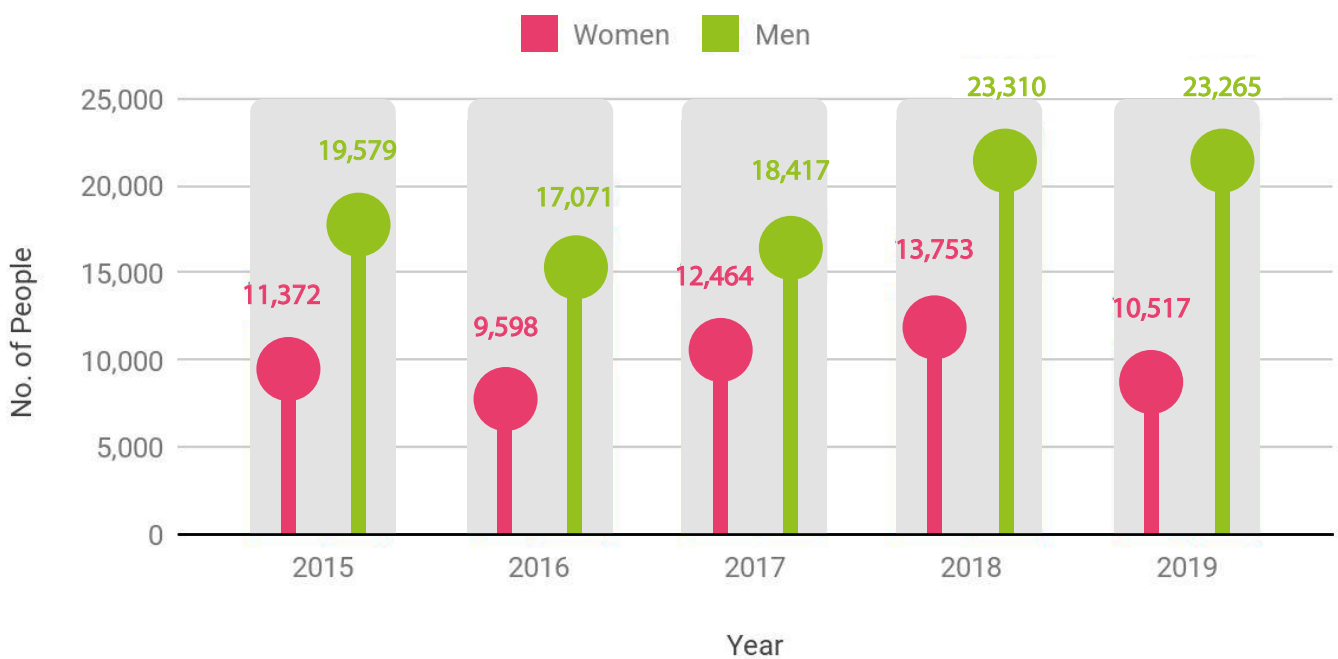
1. **Employment in the telecommunications sector (2015-2019)**
2. **Overall (growth) innovation index**

2.5.1 EMPLOYMENT

FIGURE 27:

Employment in the Telecommunications Sector (2015-2019)

National



Source: ICASA (2020)

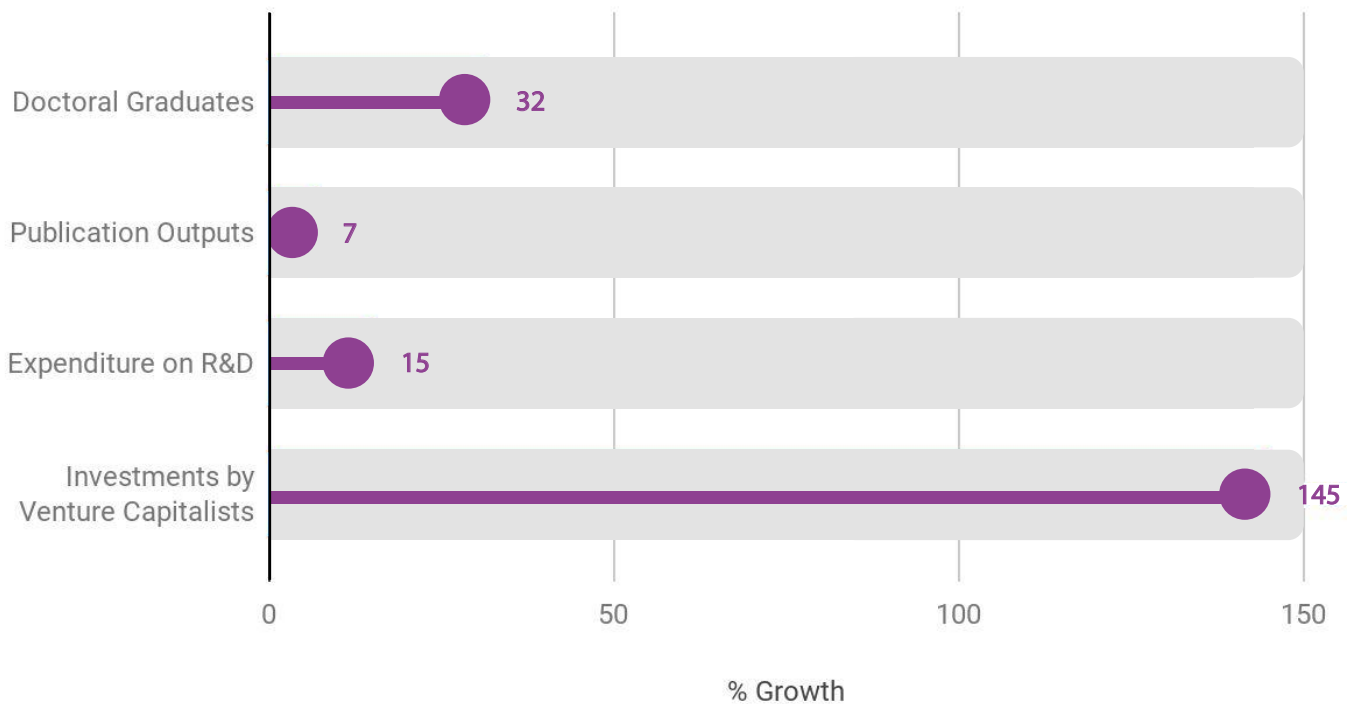
The chart above shows employment in the telecommunications sector between 2015 and 2019. The sector is dominated by men and the employment gap between men and women widened in 2018 and 2019 compared to previous years. The sector grew in 2019 compared to 2015, by 2,831 jobs. The peak of employment in the sector was in 2018 which had a total employment of 37,063.

2.5.2 INNOVATION GROWTH INDEX

The Innovation Growth Index measures the growth of key innovation indicators for the most recent year for which data is available (in this case, 2017-2018). This methodology was recommended by the National Advisory Council for Innovation on how to measure innovation in South Africa (2016).¹⁴ The index requires KZN-specific data, data availability for the 2017 and 2018 years, and data that represents a raw number (as opposed to a ratio or percentage). Only indicators within the 'people' and 'investment' categories met these requirements. The two highest impact indicators from each category were selected. The few indicators used in the index are a limitation, however, the index will grow and improve as data quality and availability improves each year. The **Growth Index for 2018 is 50** (average growth of the four selected indicators).

FIGURE 28:

KZN Innovation Growth Index (2018) = 50



¹⁴ Pouris, A (2016) South African Innovation Scorecard Framework. National Advisory Council on Innovation.

3. KZN INNOVATIONS

3.1 ELOH APP

Sanele was born and raised in Durban. A matriculant of Rossburgh High School, Sanele went on to study electrical engineering at Mangosuthu University of Technology. He is the owner and founder of Eloh App which was started with the sole intention of increasing employment opportunities and improving business services.

“YOU HAVE TO GO BEYOND YOUR PASSION AND LIMITATIONS AND BE OBSESSED WITH SOLVING A PROBLEM BECAUSE ALL SOLUTIONS THAT CURRENTLY EXIST WERE ONCE SEEN AS A PROBLEM THAT COULD NOT BE SOLVED.”

INNOVATOR

SANELE MHLONGO

Eloh App is a digital application that allows customers to connect to a professional service provider easily using their handheld device. Customers are able to view, book and request a variety of services (such as barbers, car wash services and home cleaning, amongst others) at their own convenience. The Eloh App saves the customer time because they do not have to search extensively for service providers in their local area and because the service comes to the customer. Lastly, Eloh provides greater convenience since the customer can book a time that best suits their schedule. The App screens service providers to ensure that the customer will receive quality services and provides a mechanism for customers to rate and provide feedback to the service providers.

When asked what advice Sanele would give to budding innovators, he stressed that you have to go beyond your passion and limitations and be obsessed with solving a problem because all solutions that currently exist were once seen as a problem that could not be solved. Sanele decided to sell his car, house appliances, furniture and other valuables in order to generate capital to support and start the business. He did this because other funding approaches including, entering competitions, exhibitions and approaching individuals who may have the means to contribute to capital generation were unsuccessful.

3.2 STURTIUM INFORMATICS SYSTEM

Ryshan is a master's student at the University of KwaZulu-Natal (UKZN) and a water resources and environmental consultant. He has a Bachelor of Science Honours degree specialising in environmental science, earth science and hydrology. He has a keen interest in the applications of new and emerging technologies which aim to improve the relationship between humans and nature, and promote sustainable development. Udhav is currently pursuing a Master of Science degree in engineering at UKZN. He has a Bachelor of Science degree in agricultural engineering. His interests are in applications of engineering to solving environmental and agricultural challenges.

“DON'T TAKE ON TOO MANY IDEAS AND TASKS AT A TIME BECAUSE THIS CAN DIMINISH PRODUCTIVITY.”

The Sturtium Informatics System allows users to submit short reports and information on water resources, waste, environmental and infrastructure management problems which they encounter in their cities or municipalities. The data from the reports can be used by service providers, public institutions, research groups and non-governmental organisations (NGOs) for problem solving, planning and management as well as being used as a mechanism to hold respective entities accountable for service delivery.

Sturtium Informatics System aims to address service delivery issues and data availability by harnessing the technological capability of the South African population that carries around smartphones to improve awareness of infrastructure, water, waste, environmental and service delivery issues that affect the wellbeing of natural ecosystems and society.

Additionally, the innovation aims to increase public participation in natural resource management and social upliftment, and to provide useful data for problem solving, research and development. The innovation is targeted at the general public, research groups, NGOs and private companies who are involved with water, environmental management, infrastructure management and service delivery issues.

The biggest lesson Ryshan and Udhav have drawn thus far in their innovation journey is the importance of not taking on too many ideas and tasks at a time because this can diminish productivity.



INNOVATORS

**RYSHAN RAMLALL
& UDHAV MAHARAJ**

3.3 D CHEM GROUP: TRADITIONAL MEDICINE

Nomandla was named one of the Mail & Guardian's Top 200 Young South Africans in 2016. She is driven by her love of independence and fear of mediocrity. She is a 27 year old PhD candidate in medicinal chemistry at the University of KwaZulu-Natal. Nomandla is the founder of D Chem Group which is a cosmetic and detergent manufacturing company which will now be branching into traditional medicine.

“TRY BY ALL MEANS TO MAINTAIN THE SAME LEVEL OF ENTHUSIASM YOU HAD WHEN YOU WERE JUST THINKING ABOUT THE INNOVATION.”



INNOVATOR

NOMANDLA NGCOYA

The goal is to ensure the safe administration of traditional medicine by putting it into a capsule with proper dosages as proposed by a pharmacist. The benefits of housing the medicine in a capsule include eliminating the bitter taste that is usually associated with traditional medicines and ensuring appropriate dosages because traditional healers generally instruct people to drink half a cup for example, however, cup sizes vary amongst households which increases risk of overdose.

The innovation is targeted at people who are living with diabetes and prefer traditional medicine as treatment. The business model is to sell to pharmacies, and in five years' time. Nomandla hopes to have traditional medicine available in pharmacies across the country as prescription medicine.

Her advice to other innovators is to try by all means to maintain the same level of enthusiasm you had when you were just thinking about the innovation. She warns that if your innovation does not excite you it will be difficult to see your journey to completion. She also highlights that everyone's journey is unique and that it may take time to find support from people because they do not understand your vision in the same way. Therefore, it is important to be passionate about your innovation.

3.4 OCRAM O&P

Marco is a 21 year old prosthetics and orthotics student with a vision of making the world a better place by responding to basic human rights and needs through the development of more effective and individualised solutions for people to have improved quality of life. Marco knew from a young age that he would become an orthotist/prosthetist. Therefore, from early on he started to get as much experience as possible. Marco recalls that in his first year of university, coming from church one evening, he had a revelation.

“ I KNEW WITH CERTAINTY THAT I WOULD TRAVEL ACROSS THE AFRICAN CONTINENT PROVIDING HEALTHCARE TO THOSE WHO OTHERWISE WILL NOT BE ABLE TO RECEIVE IT.”

INNOVATOR

MARCO PRETORIUS

As opposed to focusing on one product/innovation, the core of Ocram O&P is to develop a system and products to assist with various healthcare problems. The first innovation they developed is providing a 3-D printed prosthetic arm and leg to a 5-month-old patient that was matched to his not-amputated limb. This innovation led to Marco being nominated for JCI South Africa's Ten Outstanding Young Persons Award for 2020.

Another innovation was making a 3-D printed prosthetic cover which acts as a protection for the components within, as well as an aesthetic finish to match the patient's other limb. Currently, Ocram O&P is working on developing other alternative solutions using the advancements of the fourth industrial revolution (4IR), such as CAD/CAM and industrial 3-D printing.

The goal is to provide affordable care throughout the African continent using a mobile clinic equipped to see patients and educate practitioners whilst increasing access to their medical devices. Target groups include: i) people living with disabilities or medical conditions needing assistance and support, ii) practitioners in rural excluded areas, iii) people needing rehabilitation devices, iv) orthotists and prosthetists to make their work easier with sustainable workflow methods and skills, v) individuals/organisations involved in 3-D printing and prototyping, and lastly, vi) animals living with mobility impairments.

Marco recognises that the innovation journey is a long one, particularly when you are trying to improve systems. Therefore, he has learnt that you must have patience and learn to manage your time appropriately, balancing time spent on your innovation and other aspects of your life.

3.5 HYDROP

Ntando was born and raised in KZN. He is an innovator at heart, with a passion for environmental sustainability and green living. Ntando is currently pursuing a postgraduate diploma in international shipping at the Durban University of Technology (DUT). He has travelled a meandering path to get to this point; growing up, Ntando's dream was to become a commercial pilot. Unfortunately, due to financial constraints, he was unable to attend flight school. This led him to study Mechanical Engineering at the University of KwaZulu-Natal. A year later however, he decided to pursue Nautical Studies at DUT. It was during his first year at DUT that Ntando registered his business and started developing this innovation.



INNOVATOR

NTANDO NDI MANDE

“ASSESS AND PRIORITISE EXPENDITURE TOWARDS ACTIVITIES THAT WILL YIELD RESULTS.”

HyDrop is a foot operated tap, which has been designed to save up to 74% of water and optimise hygiene. It works by a person using their foot to press a foot pedal which dispenses water, and lifting their foot to close the tap. It is non-electronic and works on simple principles of mechanics. The innovation is aimed at shopping centres or malls, hotels as well as medical centres and hospitals. The biggest lesson so far for Ntando has been around managing finances. He encourages other innovators to really assess and prioritise expenditure towards activities that will yield results.

In terms of funding approaches, SkyHigh Innovations (the holding company for HyDrop) entered various competitions and innovation challenges, and joined and became a member of various incubators. From these competitions and incubators they have raised over R120,000. In addition to funds raised, these competitions and incubators were an opportunity to access business coaching and mentorship from industry experts.

4. CONCLUSION

4.1 CONCLUDING REMARKS

This report offers a measurement of innovation in KZN for the 2018-2019 period. It applies a unique, KZN-focussed measure of innovation, indicating progress with trend data (where available) and comparisons with other South African provinces (where available). This provides an updated evidence base with which to plan interventions targeted at innovation growth in KZN. It aids understanding with regard to which areas are considered enablers for innovation growth in the literature, and which areas require attention and resources according to current data. 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.

The South African, provincial and municipal government, industry leaders, funders, civil society and academia have all made great strides towards growing innovation in the year under review. Core indicators including doctoral graduates, publication outputs, expenditure on R&D and investments by venture capitalists all show growth over the period. Support for basics such as education, employment and ICT services (e.g. internet connectivity) remain essential for continued growth. Innovate Durban will continue to work with stakeholders to build the KZN innovation ecosystem, facilitate effective innovator support programmes and produce research content, in order to achieve impact.

4.2 RECOMMENDATIONS FOR FUTURE RESEARCH

Measuring innovation is a growing field of study and new studies on this topic are being released more frequently. It is clear when referencing international documents that there are gaps in data availability in South Africa.

In addition, there is a gap in bespoke indicators suited to a country with the economic characteristics of South Africa. The following areas of research are recommended to grow and improve the measurement of innovation in South Africa and KZN.

- How can we quantify grassroots/kitchen innovation? Grassroots potential indicators include:
 - Number of organisations supporting grassroots innovation
 - Number of innovators categorised as grassroots
 - Value of funding supporting grassroots innovation
- What is the number of businesses incorporating PhD findings and graduates into their businesses? What are the main mechanisms being used to commercialise PhD findings?
- We know that the arts and creative sectors in general are critical for Industry 4.0 and for innovation but how can we include the arts in our measure of innovation?
- How can we better measure impact, as opposed to output indicators?
- Working with CIPC to release disaggregated data on business license and trademark applications, including provincial and sectoral data.
- Working with the Department of Small Business Development, SARS and CIPC to understand startup culture in KZN, including how many businesses are registering, after how long are they generating income, how many are making it to 3 years etc.
- Working with StatsSA to gather credible disaggregated data on employment per sector at a provincial level.
- The impact of Covid-19 on innovation in KZN.
- Understanding the relationship between innovation and smart city measurement.

Collaboration is essential for finding unique ways to gather data and conduct future research. A critical stakeholder for future research is the Department of Science and Innovation and the HSRC who authored the Business Innovation Survey, 2014-2016 15 and are active in this space.

5. ACKNOWLEDGEMENTS

The indicators used in this report were identified through an extensive literature review of local and global bodies that are measuring innovation. Several reports compiled by the International Organisation for Standardisation, and the European Innovation Commission's European Innovation Scorecard 2020: Methodology Report were used to compare global standards for measuring innovation. The innovation growth score was developed for KZN using the methodology identified in the South African Innovation Scorecard Framework (2016) by Professor Anastassios Pouri.

The indicators would not have been possible if not for the following organisations collecting and releasing data:

- The Department of Basic Education: National Senior Certificate Examination Report
- The Department of Higher Education and Training: Statistics on Post School Education and Training and Report on the Evaluation of the 2018 Universities' Research Output
- Companies and Intellectual Property Commission: Annual Report
- Department of Science and Technology: Statistical Report
- Southern African Venture Capital and Private Equity Association: Venture Capital Industry Survey
- Statistics South Africa, who conducted analysis on their General Household Survey data specifically for this report
- Independent Communications Authority of South Africa: State of the ICT Sector Report

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¹⁵ Centre for Science, Technology and Innovation Indicators (CeSTII). 2020. Innovation performance in South African businesses, 2014 – 2016: activities, outcomes, enablers, constraints. Human Sciences Research Council: Cape Town. Available: <http://www.hsrc.ac.za/en/departments/cestii/latest-results>

This report was reviewed by a working group made up of prominent thought leaders in the KZN local innovation ecosystem - we appreciate their time and expertise:

- **Aneesa Nassar:** Transnet Port Terminals DBN
- **Bongiwe Julayi:** Moses Kotane Institute
- **Nicholas Steffens:** Royal Haskoning DHV
- **Nkululeko Mthembu:** Pista
- **Richard Gevers:** Open Cities Lab

Further recommended reading includes:

- WIPO's Global Innovation Index 2020: South Africa Country Profile
- Centre for Science, Technology and Innovation Indicators (CeSTII)'s Innovation performance in South African businesses
- The National Advisory Council on Innovation's South African Science, Technology and Innovation Indicators



APPENDICES

APPENDIX 1: PUBLICATION OUTPUT IN 2018

| University | Books and Book Chapters | | Conferences | | Journals | |
|------------|-------------------------|--------------------------------|-------------|--------------------------------|----------|--------------------------------|
| | Units | % of Total Institutional Units | Units | % of Total Institutional Units | Units | % of Total Institutional Units |
| UKZN | 176.05 | 8.50% | 46.57 | 3.70% | 1847.25 | 11.70% |
| UP | 266.81 | 12.90% | 85.2 | 6.70% | 1702.54 | 10.80% |
| SU | 280.51 | 13.60% | 97.63 | 7.70% | 1527.83 | 9.70% |
| WITS | 196.46 | 9.50% | 83.4 | 6.60% | 1598.53 | 10.10% |
| UCT | 169.63 | 8.20% | 101.17 | 7.90% | 1555.76 | 9.90% |
| UJ | 220.42 | 10.60% | 301.14 | 23.70% | 1169.4 | 7.40% |
| NWU | 131.85 | 6.40% | 133.38 | 10.50% | 1173.05 | 7.40% |
| UNISA | 146.56 | 7.10% | 75.06 | 5.90% | 1077.64 | 6.80% |
| UFS | 182.55 | 8.80% | 26.95 | 2.10% | 783.23 | 5.00% |
| RU | 94.87 | 4.60% | 12.81 | 1.00% | 441.7 | 2.80% |
| UWC | 45.43 | 2.20% | 11.26 | 0.90% | 424.61 | 2.70% |
| NMU | 35.48 | 1.70% | 41.93 | 3.30% | 349.93 | 2.20% |
| DUT | 49.66 | 2.40% | 18.46 | 1.50% | 276.81 | 1.80% |
| UL | 2.71 | 0.10% | 31.42 | 2.50% | 310.16 | 2.00% |
| UFH | 12.05 | 0.60% | 2.83 | 0.20% | 315.01 | 2.00% |
| TUT | 3.86 | 0.20% | 41.34 | 3.20% | 250.33 | 1.60% |
| CPUT | 13.9 | 0.70% | 41.9 | 3.30% | 161.87 | 1.00% |
| UNIZULU | 17.38 | 0.80% | 8.21 | 0.60% | 187.1 | 1.20% |
| UNIVEN | 10.76 | 0.50% | 5.42 | 0.40% | 163.53 | 1.00% |
| CUT | 6.19 | 0.30% | 58.89 | 4.60% | 105.13 | 0.70% |
| VUT | 2.74 | 0.10% | 40.62 | 3.20% | 106.39 | 0.70% |
| SMU | 0 | 0.00% | 0.57 | 0.00% | 88.02 | 0.60% |
| WSU | 0.73 | 0.00% | 3.92 | 0.30% | 54.79 | 0.30% |
| UMP | 3.33 | 0.20% | 0.79 | 0.10% | 45.21 | 0.30% |
| MUT | 0 | 0.00% | 1.88 | 0.10% | 40.24 | 0.30% |

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