# SOUTH AFRICAN SCIENCE, TECHNOLOGY AND INNOVATION INDICATORS 2019

## EXECUTIVE SUMMARY

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

NACI
NATIONAL ADVISORY COUNCIL ON INNOVATION

# SOUTH AFRICAN SCIENCE, TECHNOLOGY AND INNOVATION INDICATORS

# 2019

## EXECUTIVE SUMMARY

innovation for a better future

# TABLE OF CONTENTS


1 BACKGROUND 1

2 FRAMEWORK FOR THE 2019 SOUTH AFRICAN STI INDICATORS REPORT 1

3 KEY HIGHLIGHTS OF THE 2019 SOUTH AFRICAN STI INDICATORS REPORT 2

3.1 R&D expenditure 2

3.2 STI human capital 3

3.3 STI funding and support 4

3.4 Scientific publications and patents 5

3.5 Innovation and entrepreneurship 6

3.6 Innovation for inclusiveness and social impact 7

# 1 BACKGROUND

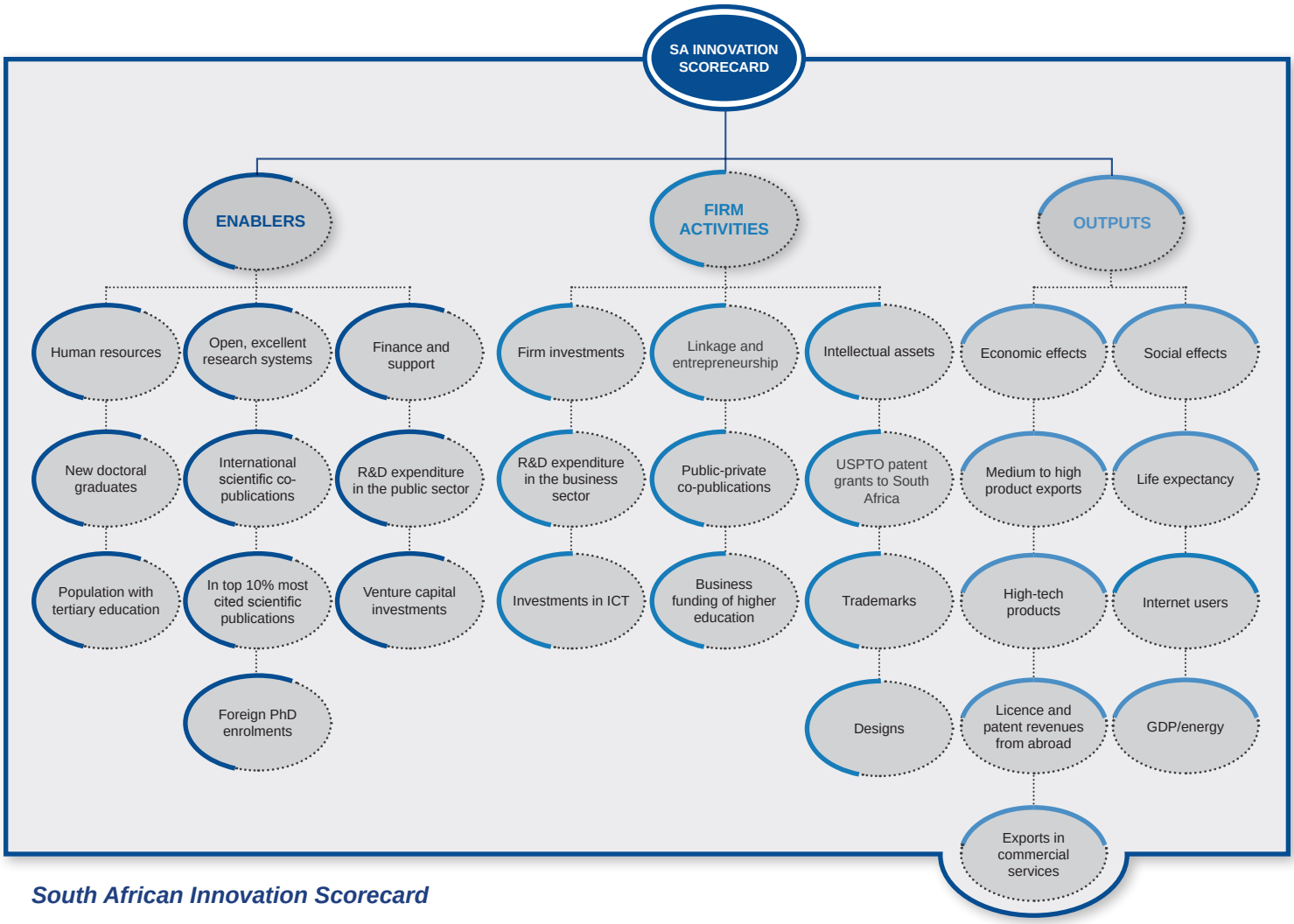
The National Advisory Council on Innovation (NACI) annually produces the South African Science, Technology and Innovation (STI) Indicators Report. The report provides an analysis of the state of STI in South Africa and includes indicators that are critical in the monitoring and evaluation of the South African National System of Innovation (NSI) and its impact and/or contribution towards achieving the country's set national objectives.

In order to adjust timelines and ensure that the publication date of the report is in line with the release date, the current report is titled the *2019 South African STI Indicators Report* (instead of the 2018 report). This change and many other ongoing changes take place as part of NACI's continuous efforts to improve the report so that it remains relevant to its stakeholders. This is also done in response to stakeholder engagement carried out as part of enhancing the report.

# 2 FRAMEWORK FOR THE 2019 SOUTH AFRICAN STI INDICATORS REPORT

The logic framework upon which the *2019 South African STI Indicators Report* is based derives from the South African Innovation Scorecard (SAIS), as adopted by NACI in 2017. This framework categorises STI activities into three broad categories: enablers, firm level activities and outputs.

The SAIS, together with its pillars and sub-pillars, is illustrated in Figure 1.1. This framework, together with other considerations, such as data availability and sources, formed the basis to inform the identification and selection of the various indicators collected in the report. However, stakeholders are cautioned that the framework is utilised only as a guideline, as the actual indicators included in this report may differ slightly from those proposed in the framework. More in-depth discussions, analysis and policy implications are included in the *2019 South African STI Indicators Synthesis Report*.




***South African Innovation Scorecard***

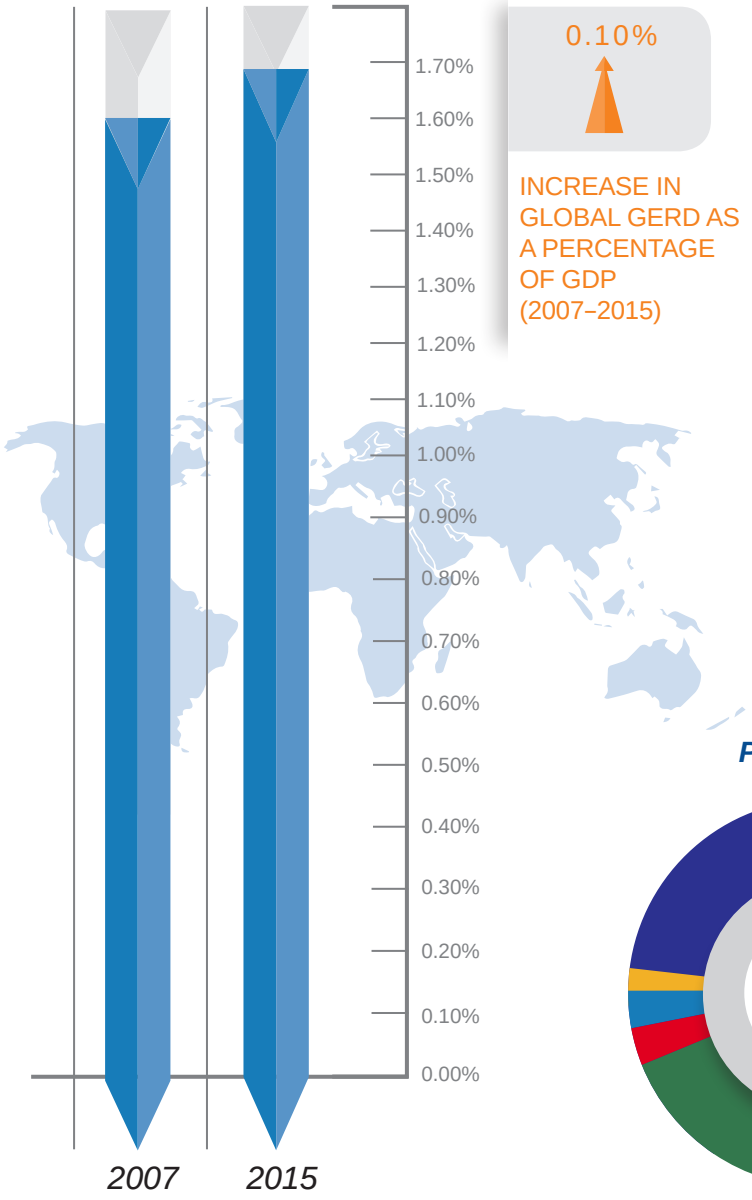
# 3 KEY HIGHLIGHTS OF THE 2019 SOUTH AFRICAN STI INDICATORS REPORT

**The main findings of the *2019 South African STI Indicators Report* can be clustered into the following six broad categories: research and development (R&D) expenditure, STI human capital, STI funding and support, scientific publications and patents, innovation and entrepreneurship, and inovation for inclusiveness and social impact.**

## 3.1 R&D expenditure

### South Africa compared to global figures

#### GLOBAL GERD AS A PERCENTAGE OF GDP




0.10%

INCREASE IN GLOBAL GERD AS A PERCENTAGE OF GDP (2007–2015)

#### SOUTH AFRICAN GERD AS A PERCENTAGE OF GDP TARGET IN RELATION TO OTHER UPPER MIDDLE-INCOME COUNTRIES (UMIC)

TARGET: 1.5%

ON PAR GLOBALLY

2016/17 — 0.82% (SA)

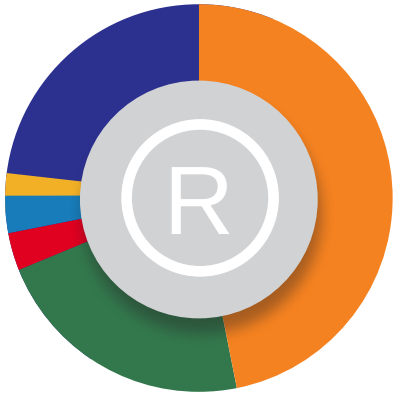
2015 — 1.4% (UMIC)

GERD AS A PERCENTAGE OF GDP

#### *GROSS FIXED CAPITAL FORMATION*

The rate of increase in BERD is lagging behind that of GFCF

#### *PROVINCIAL R&D EXPENDITURE 2016/17*



Gauteng: **46.0%**

Western Cape: **23.3%**

Limpopo: **2.0%**

Mpumalanga: **2.0%**

Northen Cape: **1.5%**

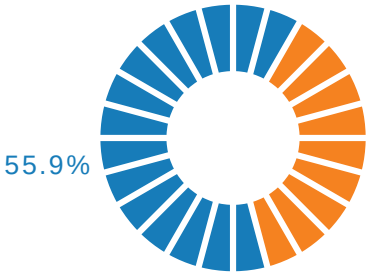
Other provinces: **25.5%**

## 3.2 STI human capital

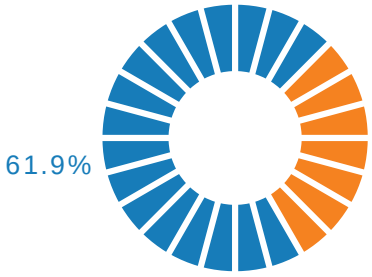
## South Africa compared to global figures

The country matches other upper middle-income countries in terms of the **production** of human capital capacity (formal qualifications), but lags behind in terms of the **deployment, development and know-how** of its human capital.

### SOUTH AFRICAN FEMALE RESEARCHERS (2015/16)




RATIO OF MALE TO FEMALE RESEARCHERS
SOUTH AFRICA

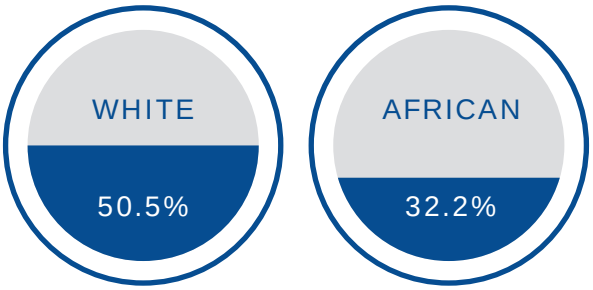



RATIO OF MALE TO FEMALE RESEARCHERS
GLOBAL FIGURES

**SOUTH AFRICA'S PORTION OF FEMALE RESEARCHERS WAS HIGHER THAN THE GLOBAL AVERAGE DURING THE IDENTIFIED PERIOD**


## Local challenges

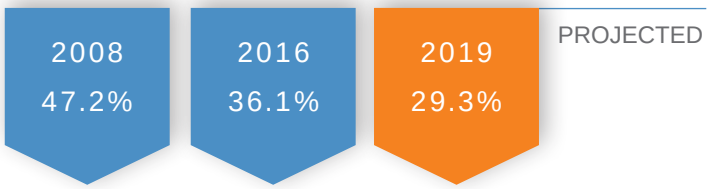
### SOUTH AFRICAN RESEARCHERS BY RACE 2016/17




**DURING THE IDENTIFIED PERIOD, THE PORTION OF WHITE RESEARCHERS REMAINED THE LARGEST, WITH AFRICAN RESEARCHERS SECOND**

### SOUTH AFRICAN RESEARCHERS IN THE BUSINESS SECTOR (DECLINE)

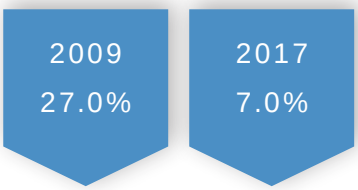
PERCENTAGE OF SOUTH AFRICAN RESEARCHERS EMPLOYED IN THE BUSINESS SECTOR



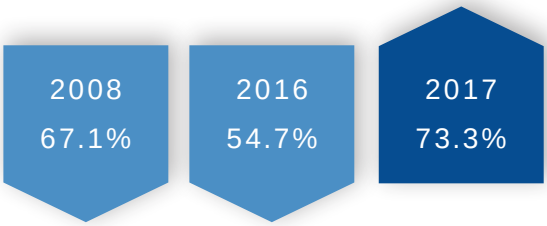

### POSTGRADUATE EDUCATION AND RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY (SET)

There has been a phasing out of SET-related postgraduate diploma and/or certificate programmes, mainly due to non-alignment to the 2013 Higher Education Qualifications Sub-framework.

SET POSTGRADUATE DIPLOMA AND/OR CERTIFICATE GRADUATES




SET DOCTORALGRADUATES



## 3.3 STI funding and support

## Government contribution

*2016/17*

**R16 428 billion** — GOVERNMENT FUNDING OF R&D

**R14 851 billion** — GOVERNMENT R&D BUDGET

FOR THE FIRST TIME, GOVERNMENT FUNDING OF R&D WAS MORE THAN ITS R&D BUDGET

*2010/11* **45.0%** *2016/17* **56.1%**

GOVERNMENT FUNDING OF R&D FOR THE HIGHER EDUCATION SECTOR

GOVERNMENT FUNDING OF R&D FOR THE HIGHER EDUCATION SECTOR IS ON THE INCREASE, RISING FROM A SHARE OF 45.0% IN 2010/11 TO 56.1% IN 2016/17

*2008/09* **9.6%** *2016/17* **2.8%**

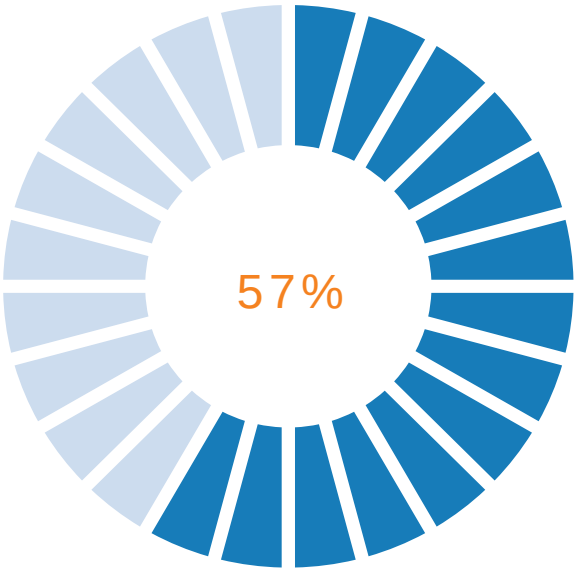
GOVERNMENT FUNDING OF R&D FOR THE BUSINESS SECTOR

GOVERNMENT FUNDING OF R&D FOR THE BUSINESS SECTOR CONTINUED TO DECREASE, DROPPING FROM A SHARE OF 9.6% IN 2008/09 TO 2.8% IN 2016/17

### BUSINESS INCUBATION

105

TOTAL ESTIMATED NUMBER OF BUSINESS INCUBATORS IN SOUTH AFRICA




57% of the estimated 105 incubators in South Africa are supported by the public sector.

### PROVINCE PARTICIPATION

*GP* **33%** *KZN* **15%** *WC* **14%**

INCUBATOR HOSTS

THE DOMINANT PROVINCES IN RESPECT OF THE NUMBER OF INCUBATORS ARE GAUTENG (GP) (33%), KWAZULU-NATAL (KZN) (15%) AND WESTERN CAPE (WC) (14%)

## 3.4 Scientific publications and patents

South Africa compared to global figures

### SOUTH AFRICAN SCIENTIFIC PUBLICATIONS

| 2008 | 2017 |
|---|---|
| 192 | 350 |

NUMBER OF SCIENTIFIC PUBLICATIONS PER MILLION INHABITANTS

SOUTH AFRICA EXPERIENCED AN INCREASE IN THE NUMBER OF SCIENTIFIC PUBLICATIONS PER MILLION INHABITANTS DURING THE IDENTIFIED PERIOD

During the identified period, South Africa produced more scientific publications per million inhabitants than the global average.

**307**

GLOBAL AVERAGE

***SOUTH AFRICAN SCIENTIFIC PUBLICATIONS EXPERIENCED AN ANNUAL GROWTH RATE OF 7% FOR THE PERIOD BETWEEN 2008 AND 2017***

### FOURTH INDUSTRIAL REVOLUTION (4IR)

For research areas related to 4IR, South Africa has the highest world share of scientific publications in Artificial Intelligence (AI) and Internet of Things (IoT)

| AI | IoT |
|---|---|
| 1.01% GLOBAL SHARE | 0.68% GLOBAL SHARE |

### PATENTS

PATENT APPLICATIONS PER MILLION INHABITANTS

| 2008 | 2017 |
|---|---|
| 42 | 38 |

DECLINE

THE LINEAR FORECASTING OF THESE IS CONCERNING AS THE COUNTRY IS EXPECTED TO REMAIN AT 37 PATENT APPLICATIONS PER MILLION INHABITANTS FOR A THREE-YEAR PERIOD (2018 TO 2020)

South Africa is lagging behind the average patent applications per million inhabitants for upper middle-income countries.

**592**

GLOBAL AVARAGE

***HIGHEST NUMBER OF PATENTS GRANTED TO UNIVERSITIES AND SCIENCE COUNCILS OVER THE PAST EIGHT YEARS:***

38 CSIR 31 UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

## OPERATION PHAKISA

### MAJOR NSI CONTRIBUTIONS

- Ocean economy
- Mining
- Chemical and waste
- Bio-diversity economy

**SEVERAL KEY INSTITUTIONS OF THE NSI ARE CONTRIBUTING SIGNIFICANTLY TO THE SUCCESS OF OPERATION PHAKISA**

## INNOVATION INTEGRATION

**±51.35%** ***OF TECHNOLOGY TOP 100 ORGANISATIONS INTEGRATE INNOVATION, PEOPLE AND TECHNOLOGY ACTIVITIES AND PRACTICE***

## TECHNOLOGY EXPORTS

**CAUSE FOR CONCERN**

South Africa has lost its competitive advantage in terms of medium-technology exports when compared to the average of other upper middle-income countries. This trend is likely to continue beyond 2020. By the year 2020, South Africa is likely to rank below the lower middle-income countries in terms of the export of low-technology products.

## CONTRIBUTION FROM BUSINESS

**BUSINESS-LED REGIONAL INNOVATION ECOSYSTEMS ARE MOST PROMINENT IN THE FOLLOWING PROVINCES: FREE STATE, GAUTENG, KWAZULU-NATAL, MPUMALANGA AND NORTH WEST**

## 3.6 Innovation for inclusiveness and social impact

## South Africa's contribution

OPERATION PHAKISA
planning | implementation | growth

THE CSIR CONTRIBUTED TO OPERATION PHAKISA'S "IDEAL CLINIC" CONCEPT BY DEVELOPING A PROTOTYPE FOR THE DESIGN OF MAXIMUM USABLE SPACE FOR CLINICS.

## Human Development Index

113th

Human Development Index

This is relative to the average for upper middle-income countries (90th)

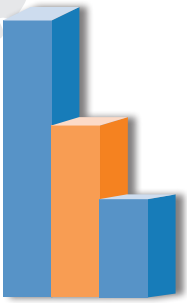
CAUSE: LOW RANKING IN LIFE EXPECTANCY AT BIRTH COMPONENT

161st

OUT OF 189 COUNTRIES

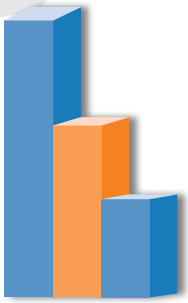
## Social Progress Index

Factors that prove challenging for South Africa's ranking:



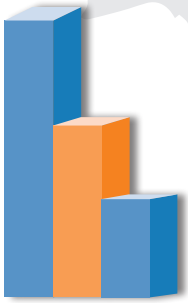
135th

PERSONAL SAFETY



102th

HEALTH AND WELLNESS



100th

NUTRITION AND BASIC MEDICAL CARE

OUT OF 146 COUNTRIES

### RENEWABLE ENERGY

*The country lags behind many world economies (including most low-income countries) in adopting renewable energy technologies for electricity production. This indicates the presence of carbon lock-in caused by an abundance of relatively cheap coal deposits in the country.*

The 2019 South African Science, Technology and Innovation Indicators Report was compiled with the latest available data from various organisations and institutions that were mandated to collect the data. In many instances, the data is not necessarily an update of the previous versions of the report as this is not a statistical report.

We welcome comments and suggestions that would enhance the value of the report to our stakeholders by contributing to our continuous efforts to improve the publication. Please email such comments and suggestions to naci@dst.gov.za.

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