CSIR SHAREHOLDER'S COMPACT

Cycle commencing 1 April 2019

science & technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

CSIR

our future through science

Acronyms

AISI	Aerospace Industry Support Initiative
ALC	African Laser Centre
ARC	Agricultural Research Council
ARDP	Accelerated Researcher Development Programme
B-BBEE	Broad-Based Black Economic Empowerment
BCC	Bio-composites Centre of Competence
BIDC	Biomanufacturing Industry Development Centre
BIDF	Biorefinery Industry Development Facility
CEO	Chief Executive Officer
CHPC	Centre for High Performance Computing
COGTA	Cooperative Governance and Traditional Affairs
CPDO	Campus Planning Development Office
CSIR	Council for Scientific and Industrial Development
DIFR	Disabling Injury Frequency Rate
DoD	Department of Defence
DST	Department of Science and Technology
dti	Department of Trade and Industry
DTPS	Department of Telecommunication and Postal Services
ECD	Enterprise Creation for Development
ERAs	Emerging Research Areas
ERM	Enterprise Risk Management
ESTs	Energy Storage Technologies
GDP	Gross Domestic Product
HCD	Human Capital Development
HEIs	Higher Education Institutions
HSRC	Human Sciences Research Council
IAS	Internal Audit Service
ICT	Information and Communication Technology
IDC	Industrial Development Corporation
IIPF	Industry Innovation Partnerships Programme
IP	Intellectual Property
IPAP	Industrial Policy Action Plan
IT	Information Technology
KPIs	Key Performance Indicators
L&V	Licensing and Ventures
MEME	Micro-Enterprise Media Engine
MICT	Media, Information and Communication Technologies
MTEF	Medium Term Expenditure Framework

NCNSM	National Centre for Nanostructured Materials
NDP	National Development Plan
NEPAD	New Partnership for Africa's Development
NFTN	National Foundry Technology Network
NIDF	Nanomaterials Industrial Development Facility
NLC	National Laser Centre
NSI	National System of Innovation
OEMs	Original Equipment Manufacturers
PFMA	Public Finance Management Act
PIC	Public Investment Corporation
PLM	Product Lifecyle Management
PoC	Point-of-Care
PPE	Plant, Property and Equipment
PPF	Photonics Prototyping Facility
PV	Photovoltaic
R&D	Research and Development
RD&I	Research, Development and Innovation
RIA	Research Impact Areas
RTOs	Research Technology Organisations
SAAF	South African Air Force
SAASTA	South African Agency for Science and Technology Advancement
SADC	Southern African Development Community
SALGA	South African Local Government Association
SANDF	South African National Defence Force
SANReN	South African National Research Network
SAPS	South African Police Service
SET	Science, Engineering and Technology
SETAs	Sector Education Training Authorities
SIPs	Strategic Infrastructure Programmes
SMMEs	Small, Medium and Micro Enterprises
STI	Science, Technology and Innovation
TIA	Technology Innovation Agency

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Overview of Shareholder's Compact

The Shareholder's Compact is the performance agreement between the Council for Scientific and Industrial Development (CSIR) and the Minister of Science and Technology. It consists of the text of the Compact itself (Chapter 2) and a series of supporting annexures covering the following aspects:

- Strategic planning documents:
  - Strategic Plan (Annexure A);
  - Annual Performance Plan: 2019/20 (Annexure B);
- Documents setting out the governance structures and risk management strategies of the CSIR:
  - Governance Structure (Annexure C);
  - Risk Management Strategy (Plan) (Annexure D);
  - Fraud Prevention Plan (Annexure E);
  - Materiality/Significance Framework (Annexure F).
- Documents setting out our Financial Plan and our compliance with the applicable financial legislation
  - Financial Plan (Annexure G)

Shareholder's Compact

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

SHAREHOLDER'S COMPACT AGREEMENT

FOR THE CYCLE COMMENCING 1 APRIL 2019

MADE AND ENTERED INTO BY AND BETWEEN:

THE MINISTER OF SCIENCE AND TECHNOLOGY

Mrs Mmamoloko Kubayi-Ngubane, in her capacity as Executive Authority being the responsible Cabinet member (hereinafter referred to as "the Executive Authority")

and

THE CSIR BOARD

herein represented by Prof Thokozani Majozi, the Chairperson of the Board (hereinafter referred to as "the Accounting Authority")

(The parties are hereinafter collectively referred to as "the Parties")

WHEREAS:

The Parties wish to conclude a Shareholder's Compact in order to underscore a constructive working relationship between them, clarify mutual expectations that are to be satisfied, articulate the CSIR's role in support of the effective functioning of the National System of Innovation and establish a framework of good corporate governance;

Treasury Regulation 29.2 issued under the Public Finance Management Act, 1999 (Act 1 of 1999) furthermore requires the Accounting Authority of a Schedule 3B public entity to conclude a Shareholder's Compact with its Executive Authority annually; and

The CSIR Board is the organisation's Accounting Authority and the Minister of Science and Technology is its Executive Authority as the Cabinet member responsible for the CSIR; the Parties have negotiated and reached an agreement on the contents of the Shareholder's Compact and wish to record the same in writing.

NOW THEREFORE THE PARTIES HEREBY AGREE AS FOLLOWS:

1. **GLOSSARY OF TERMS**

   In this Shareholder's Compact, the following words and/or phrases shall have the following meanings:

   1.1 **Accounting Authority** means the CSIR Board as established in terms of section 7 of the Scientific Research Council Act 1988 (Act No. 46 of 1988);

   1.2 The **Corporate Plan**, as embodied in Annexures A to G to this Shareholder's Compact, with

   - Annexure A being the CSIR Strategic Plan;
   - Annexure B being the CSIR Annual Plan for the 2019/20 financial year;
   - Annexure C being the CSIR Governance Structure;
   - Annexure D being the CSIR Risk Management Strategy (Plan);
   - Annexure E being the CSIR Fraud Prevention Plan;
   - Annexure F being the Materiality Framework; and
   - Annexure G being the Financial Plan (consisting in turn of the Budget and Cashflow for 2019/20; the Group's Three-year Financial Plan and the three-year borrowing plan).

   1.3 **Annual Budget** means the CSIR's annual budget as embodied in Annexures A, B and G;

1.4 **Balanced Scorecard Framework** means the Executive Authority's framework for evaluating the performance of science, engineering and technology institutes described in the Department of Science and Technology (DST) publication entitled "Reviewing the SETI scorecards" dated May 2003;

1.5 **Basic Conditions of Employment Act** means Act 75 of 1997;

1.6 **B-BBEE Codes** means the Broad-Based Black Economic Empowerment Codes as published in the Government Gazette from time to time;

1.7 **Employment Equity Act** means Act 55 of 1988;

1.8 **Effective Date** means the effective date of this Shareholder's Compact, which shall be 1 April 2019;

1.9 **Executive Authority** means the Minister of Science and Technology;

1.10 **Key Performance Indicators (KPIs)** means the performance measures described in the Corporate Plan, against which the performance of the CSIR shall be evaluated;

1.11 **Labour Relations Act** means Act 66 of 1995;

1.12 **Materiality Framework** means the materiality framework as envisaged by clauses 6.3 and 13.1.5. below and as recorded in Annexure F;

1.13 **Parties** means the Executive Authority and the Accounting Authority respectively;

1.14 **PFMA** means Act 1 of 1999;

1.15 **Shareholder's Compact** means this document and all annexures thereto;

1.16 **Scientific Research Council Act** means the CSIR's enabling legislation, namely Act No 46 of 1988;

1.17 **Skills Development Act** means Act 97 of 1998;

1.18 **Treasury Regulations** means any prescripts or legislative requirements or practice notes issued by the National Treasury for implementation by government departments, trading entities, constitutional institutions and public entities, issued in line with the PFMA.

2. THE SHAREHOLDER'S COMPACT

2.1 This Shareholder's Compact represents the agreement between the Executive Authority of the CSIR, being the Minister of Science and Technology, and the Accounting Authority of the CSIR, being the CSIR Board, herein represented by the Chairperson of the Board. It is

a reflection of the expectations of each of the Parties, expressed in terms of outcomes and outputs that need to be achieved during the financial year starting on 1 April 2019.

2.2 This Shareholder's Compact shall operate as from the Effective Date and will be reviewed by the Parties at the end of the financial year ending on 31 March 2020.

3. LEGAL REQUIREMENT AND PRIMARY RELATIONSHIP BETWEEN THE SIGNATORIES

3.1 Chapter 29 of the Treasury Regulations impose the following legal requirements on the Accounting Authority of a Schedule 3B public entity, such as the CSIR, and its Executive Authority in terms of the conclusion of a Shareholder's Compact:

"*29.2 Shareholder's Compact*

29.2.1 The accounting authority for a public entity listed in Schedule 2, 3B or 3D must, in consultation with its executive authority, annually conclude a Shareholder's Compact.

29.2.2 The Shareholder's Compact must document the mandated key performance measures and indicators to be attained by the public entity as agreed between the Accounting Authority and the Executive Authority."

4. FRAMEWORK FOR SHAREHOLDER'S COMPACT

4.1 In terms of section 3 of its enabling legislation, namely the Scientific Research Council Act, the mandate of the CSIR is as follows: *"The objects of the CSIR are, through directed and particularly multidisciplinary research and technological innovation, to foster, in the national interest, and in fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors and thereby to contribute to the improvement of the quality of life of the people of the Republic; and to perform any other functions that may be assigned to the CSIR by or under this Act."*.

4.2 The Shareholder's Compact

The CSIR's strategic objectives are outlined in the Corporate Plan, which incorporates the CSIR Strategic Plan and the CSIR Annual Plan for the 2019/20 planning cycle; the CSIR's Risk Management Strategy; the CSIR's Fraud Prevention Plan; the Materiality Framework; the Budget and Cashflow for 2019/20; the Group's three-year financial plan and the organisation's three-year borrowing plan. The Accounting Authority undertakes to oversee the implementation of the said elements of the Corporate Plan.

5. INTERNAL TRANSFORMATION

The Corporate Plan of the CSIR deals with, in Annexure A, matters relating to, among others, transformation. In giving effect to the Corporate Plan, the Accounting Authority will ensure full compliance by the CSIR with all applicable legislation, such as, but not limited to, the Employment Equity Act, the Skills Development Act, the Labour Relations Act, the Basic Conditions of Employment Act, the Broad-Based Black Economic Empowerment (B-BBEE) Codes and the like.

6. THE ROLE AND POWERS OF THE ACCOUNTING AUTHORITY

6.1 The role and powers of the Accounting Authority are set out in sections 7(1), 11, 12 and 19 of the Scientific Research Council Act read with section 3 of the Science and Technology Laws Amendment Act, 2014 (Act 7 of 2014).

6.2 In terms of section 56 of the PFMA, the Accounting Authority has delegated in writing certain of the powers entrusted or delegated to it to officials in the CSIR. To this end, the Accounting Authority has also adopted an approval framework which governs the authorisation process in the CSIR. It deals with the development of strategic plans, development of operational plans and budgets, appointment of staff, approval of salaries and acquisition and disposal of assets, among others. It also defines authority levels in relation to organisational positions.

6.3 The Materiality Framework for reporting losses through criminal conduct and irregular, fruitless and wasteful expenditure, as well as for significant transactions as envisaged by sections 55 (2) and 54 (2) of the PFMA, is in place and is included as Annexure F attached hereto.

7. UNDERTAKINGS BY THE ACCOUNTING AUTHORITY OF THE PUBLIC ENTITY

7.1 The Accounting Authority undertakes to act in accordance with the approved Corporate Plan attached hereto.

7.2 In the event that it is envisaged that the Accounting Authority will not be able to fully execute the plans as embodied in Annexure A, it will promptly, and in writing, inform the Executive Authority accordingly to seek its advice prior to making decisions or taking action.

7.3 The Accounting Authority confirms that it will comply with the provisions of sections 50 and 51 of the PFMA, as more fully dealt with in Annexures D, E and F attached hereto, as well

as with the reporting requirements as embodied in the PFMA and the relevant Treasury Regulations.

7.4 The Accounting Authority undertakes to ensure that the CSIR complies with its statutory mandate as encapsulated in section 3 of the Scientific Research Council Act.

8. UNDERTAKINGS BY THE EXECUTIVE AUTHORITY AS THE SHAREHOLDER

8.1 The Executive Authority undertakes to allow the Accounting Authority to manage the business of the CSIR as has been approved in the Corporate Plan through ensuring the following:

8.1.1 Issuing of instructions and requests for information with sufficient prior notice and response times, with due cognisance that this will not be applicable in instances where the information is required by Parliament and must be provided urgently;

8.1.2 Not to renege on written guarantees and undertakings given;

8.1.3 To provide the organisation with strategic direction and control; and

8.1.4 To comply with the relevant provisions of the PFMA, as well as the Treasury Regulations insofar as the same relates to it in terms of the relationship between the Parties.

9. GOVERNANCE

9.1 The Accounting Authority recognises that systems of good corporate governance should be in place and be reviewed continuously to ensure that at all times they are sound and consistent with world-class standards, and that they are and remain relevant to the business of the CSIR. Apart from complying with the provisions of the Scientific Research Council Act, the Science and Technology Laws Amendment Act, the PFMA, as well as the Treasury Regulations issued thereunder, and all other applicable legislation, the Accounting Authority shall therefore ensure compliance with the relevant provisions of the King Code of Corporate Practices and Conduct and the Protocol on Good Corporate Governance in the Public Sector (1997) issued by the Department of Public Enterprises.

9.2 The Accounting Authority will strive to ensure that the CSIR upholds and sets in place review mechanisms and protocols to ensure that reports and publications, including public comments made by the employees of the CSIR, are based on sound scientific analysis, and do not bring the institution into disrepute.

10. KPIs LINKED TO THE BALANCED SCORECARD FRAMEWORK

The KPIs have been summarised according to the categories of the Balanced Scorecard

Framework of the DST and to reflect the strategic objectives of the CSIR. The categories and their associated strategic objectives are:

SO1 Conduct research, development and innovation, localise transformative technologies and accelerate their diffusion.

This strategic objective will be achieved through accelerating the innovation, localisation and diffusion of transformative technologies in South Africa's high-impact industries.

SO2 Collaboratively improve the competitiveness of high impact industries to support South Africa's re-industrialisation.

This strategic objective seeks to improve the competitiveness of South Africa's high-impact industries through research, development and industrialisation in a collaborative manner with partners, thereby contributing to the re-industrialisation of the country.

SO3 Drive the socioeconomic transformation through RD&I which supports the development of a capable state.

This strategic objective emphasises the CSIR's role in supporting the development of a capable state and enabling government to drive the socioeconomic transformation of South Africa through research, development and industrialisation.

SO4 Build and transform human capital and infrastructure.

This strategic objective seeks to build and transform the required human capital and infrastructure to drive industrialisation and the advancement of society.

SO5 Diversify income, maintain financial sustainability and good governance

This strategic objective seeks to improve the CSIR's financial sustainability by diversifying revenue sources and optimising the business model to achieve competitiveness supported by good (efficient and sound) governance.

The strategic objectives are explained in greater detail in Annexures A and B.

Our KPIs provide an understanding of performance in terms of inputs, outputs, efficiencies, and to some extent provide lead indicators of the outcomes and impact that are required for the CSIR to fulfill its mandate. The KPIs provide a basket of measures that reflect various aspects of organisational performance.

SO1: Conduct research, development and innovation, localise transformative technologies and accelerate their diffusion

- **KPI 1 - Publication equivalents:** *Research publications are a measure of the CSIR's research quality, capabilities and outputs. The impact of the quantity and quality of peer-reviewed research publications is a contribution to the scientific knowledge base.*
- **KPI 2 - New priority patent applications filed:** *Priority patent filings serve as a pipeline indicator of patent families. It is the first patent application filed for a particular invention.*
- **KPI 3 - New patents granted:** *Patents provide a lead indicator of impact through commercialisation. The patents granted in multiple countries reflect the potential market size for and value of the technology.*
- **KPI 4 - New technology demonstrators:** *Measure an intermediate output of research and development activities with the potential to be developed further into technology packages that can be transferred to various markets for socioeconomic impacts.*
- **KPI 5 - Number of technology licence agreements signed:** *Technology licences are an indicator of the uptake of CSIR Intellectual Property in the market by private and/or public sectors.*
- **KPI 6 - Number of localised technologies:** *Accelerate re-industrialisation and prevent the need to 'reinvent the wheel'. Develop local products that can be used and perfected in the South African context and environment, which can then also be exported to other countries.*

SO2: Collaboratively improve the competitiveness of high-impact industries to support South Africa's re-industrialisation.

- **KPI 7 - Number of joint technology development agreements being implemented for industry:** *Accelerate re-industrialisation through joint R&D activities with partners from industry.*
- **KPI 8 - Number of SMMEs supported:** *Contribute to socioeconomic development and industrialisation.*

SO3: Drive the socioeconomic transformation through RD&I which supports the development of a capable state

- **KPI 9 - Number of reports contributing to national policy development:** *To assist government with evidence-based policy development and decision-making that can benefit from a significant SET input. An example of such policy work is the CSIR's input into the*

Integrated Resource Plan for South Africa. Detailed technical analysis was used to put forward the optimum energy mix for South Africa, and this work will ultimately find expression in the new Energy Policy. A second example is the CSIR-defined sediment quality guidelines that are used to regulate the disposal of sediment dredged in South African ports, in accordance with South African law (Act No 24 of 2008) and in accordance with requirements of the London Convention on the Prevention of Marine Pollution, to which South Africa is a signatory. A third example is a study conducted by the CSIR into spectrum requirements for Wireless Open Access Networks, which resulted in a proposed policy and policy direction gazetted by the Department of Telecommunications and Postal Services in 2018

- **KPI 10 - Number of standards delivered or contributed to in support of the state:** *Support for government policy and regulation; enable standardised practice across economic and social sectors (e.g. interoperability standards, accessibility standards, products or infrastructure standards). The CSIR collaborates with the SABS in developing product standards, but develops best practice standards for various government departments. An example is the pothole repairs work conducted for the Department of Transport. This standard on pothole repairs enables the Department of Transport to measure service providers conducting repairs aligned to best practise, leading to a capable state. A second example is where the CSIR has developed the National Domestic Waste Collection Standards for the Department of Environmental Affairs. The Standards have been published in Government Gazette 33935 in 2011.*
- **KPI 11 - Number of projects implemented to increase capability of the state:** *Improved efficiency and effectiveness within and between government department and entities, leading to improved service delivery (across public or private sector). An example is the work done by the CSIR on the National Health Patient Registration System that has been rolled out to more than 25 million people, and illustrates how a CSIR-developed solution has enabled the state to deliver services more efficiently. A second example is the work done by the CSIR to establish a cybersecurity capability for the City of Johannesburg (CoJ), which has resulted in the establishment of the CoJ Cybersecurity Centre in 2018.*

SO4: Build and transform human capital and infrastructure

- **KPI 12 - Total SET staff:** *SET staff is a measure of the CSIR's capacity to deliver on RD&I projects.*
- **KPI 13 - Percentage of SET staff who are black:** *These measures indicate the degree*

of demographic transformation within the RD&I capacity of the organisation.

- **KPI 14 - Percentage of SET staff who are female:** *These measures indicate the degree of demographic transformation within the RD&I capacity of the organisation.*
- **KPI 15 - Percentage of SET staff with a Doctoral qualification:** *The qualification profile is an indicator of the quality of SET capacity.*
- **KPI 16 - Total chief researchers:** *Chief researchers constitute the most senior research level within the CSIR, and are a critical component of the science leadership cohort within the SET base. Chief researchers include SET staff classified as chief researchers, chief engineers, chief project managers or chief knowledge applicators. The number of researchers at this level is an indicator of the quality of SET capacity.*
- **KPI 17 - Percentage of chief researchers who are black:** *These measures indicate the level of demographic transformation within the chief researcher level.*
- **KPI 18 - Percentage of chief researchers who are female:** *These measures indicate the level of demographic transformation within the chief researcher level.*
- **KPI 19 - Total principal researchers:** *Principal researchers constitute a senior research level within the CSIR, and are a critical component of the science leadership cohort within the SET base. Principal researchers include SET staff classified as principal researchers, principal engineers, principal knowledge applicators, principal project managers or research group leaders. The number of researchers at this level is an indicator of the quality of SET capacity.*
- **KPI 20 - Percentage of principal researchers who are black:** *These measures indicate the level of demographic transformation within the principal researcher level.*
- **KPI 21 - Percentage of principal researchers who are female:** *These measures measure the level of demographic transformation within the principal researcher level.*
- **KPI 22 - Number of exchange programmes with industry:** *The purpose is to share domain level knowledge or system and process information.*
- **KPI 23 - PPE investment (Rm) Investment in Property, Plant and Equipment:** *The CSIR needs to develop and maintain world-class facilities and equipment to provide the quality of RD&I that is expected of it. This indicator provides a measure of the CSIR's investment in research infrastructure.*

SO5: Diversify income, maintain financial sustainability and good governance

- **KPI 24 - Total income (Rm):** *Total income reflects the ability of the CSIR to ensure financial sustainability. Growth in total income indicates growth in the outcomes and impact achieved by the CSIR.*
- **KPI 25 - Net profit (Rm):** *Net profit is a key indicator of financial sustainability and the ability of the organisation to manage its expenses according to the affordability determined by income levels.*
- **KPI 26 - SA public sector income (% Total income):** *SA public sector income reflects the degree of public income in the CSIR. A reduction in SA public sector investment in conjunction with growth in total operating income is a key indicator of income diversification and impact in other sectors.*
- **KPI 27 - SA private sector income (% Total income):** *SA private sector income reflects the degree of private investment in the CSIR. Growth in SA private sector investment is a key indicator of income diversification as well as strategic alignment to; and growth in the outcomes and impact achieved by the CSIR within the South African private sector.*
- **KPI 28 - International contract income (% Total Income):** *International contract income reflects the global relevance of the CSIR. Growth in international investment is a key indicator of income diversification, as well as the relevance and impact of the CSIR within the global economy.*
- **KPI 29 - B-BBEE rating:** *The CSIR B-BBEE policy seeks to support socioeconomic transformation of society, within and outside the CSIR, by changing the demographic profile of meaningful and productive participation in the country's economic activity.*
- **KPI 30 – Recordable Incident Rate***: RIR indicates the effectiveness of health and safety management system within the organisation in a year.*
- **KPI 31 – Audit Opinion:** *The CSIR will aim to present all the affairs of its financial statements fairly in all material aspects. This opinion embodies the assumptions that the CSIR will observe compliance with generally accepted accounting principles and all statutory requirements. Such a view implies that any changes in the regulatory requirements and accounting policies, their application and effects, will be adequately determined and disclosed.*

The CSIR has developed a Campus Master Plan (CMP) that will guide the long-term development of our physical and research infrastructure.

The target values for the set of KPIs are given in Table 2.1.

11. REPORTING

11.1 The Accounting Authority will report on the achievement of its KPIs quarterly based on PFMA requirements.

11.2 A detailed KPI report approved by the Accounting Authority will be submitted to the Executive Authority annually on or before 31 July of each year in respect of the immediately preceding financial year. The format of such reporting will be based on the CSIR's KPIs linked to the categories of the Balanced Scorecard Framework.

Table 2.1: CSIR Key Performance Indicators: 2019/20

Indicator	Target/ Actual 2016/17	Target/ Actual 2017/18	Target 2018/19	Projected 2018/19	Target: 2019/20
SO 1: Conduct research, development and innovation, localise transformative technologies and accelerate their diffusion					
KPI 01: Publication equivalents	490/491	500/545.5	480	399	420
KPI 02: New priority patent applications filed	-	-	-	-	5
KPI 03: New patents granted	15/15	15/13	15	11	13
KPI 04: New technology demonstrators	30/56	40/60	50	56	66
KPI 05: Number of technology licence agreements signed	-	-	-	-	24
KPI 06: Number of localised technologies	-	-	-	-	12
SO2: Collaboratively improve the competitiveness of high impact industries to support South Africa's re-industrialisation.					
KPI 07: Number of joint technology development agreements being implemented for industry	-	-	-	-	39
KPI 08: Number of SMMEs supported	-	-	-	-	92
SO3: Drive the socioeconomic transformation through RD&I which supports the development of a capable state					
KPI 09: Number of reports contributing to national policy development	-	-	-	-	24
KPI 10: Number of standards delivered or contributed in support of the state	-	-	-	-	16
KPI 11: Number of projects implemented to increase the capability of the state	-	-	-	-	54
SO 4: Build and transform human capital and infrastructure					
KPI 12: Total SET staff	2100/1966	2100/1850	1860	1672	1619
KPI 13: Percentage of SET staff who are Black	60/61	61/61.57	62	61.90	62
KPI 14: Percentage of SET staff who are Female	37/36	37/36.43	37	36.30	36
KPI 15: Percentage of SET staff with a PhD	18/18	20/18.32	20	19.50	22
KPI 16: Total Chief Researchers	-	22/21	23	15	15
KPI 17: Percentage of Chief Researchers who are Black	-	9/9.52	13	6.70	13
KPI 18: Percentage of Chief Researchers who are Female	-	18/19.05	13	20.00	13
KPI 19: Total Principal Researchers	-	240/202	210	199	209
KPI 20: Percentage of Principal Researchers who are Black	-	22/26.24	27	27.60	28
KOI 21: Percentage of Principal Researchers who are Female	-	19/18.81	20	17.60	18
KPI 22: Number of exchange programmes with industry	-	-	-	-	8
KPI 23: PPE Investment (Rm)*	103/144	108/108	61	61	95
SO 5: Diversify income, maintain financial sustainability and good governance					
KPI 24: Total Income (Rm)	2611/2712	2863/2506	2740	2707	2859
KPI 25: Net Profit (Rm)	58/95.5	64/-14	0	-49	9
KPI 26: SA Public sector income (% Total Income)	-	-	55	55	55
KPI 27: SA Private sector income (% Total Income)	-	-	6	8	8
KPI 28: International contract income (% Total Income)	-	-	8	6	8
KPI 29: B-BBEE Rating*	2/3	2/3	2	3	3
KPI 30: Recordable incident rate*	-	-	-	-	2
KPI 31: Audit opinion	-	-	-	-	Unqualified audit opinion

11.3 The Accounting Authority will meet all the external audit requirements, the results of which will be made available to the Executive Authority, the external auditor of the CSIR being the Auditor-General, who is responsible for independently auditing and reporting on the financial statements of the CSIR.

12. EXTRA-ORDINARY REPORTING

The Accounting Authority will, at its discretion, report to the Executive Authority on matters of strategic importance and/or operational issues that fall outside the agreed framework of this Shareholder's Compact and the PFMA, as agreed from time to time during its Board meetings.

13. SUPPORTING DOCUMENTATION

13.1 Supporting documentation to this Shareholder's Compact is to be found in the following supporting documents attached hereto:

13.1.1 CSIR Strategic Plan as embodied in Annexure A attached hereto;

13.1.2 CSIR Annual Plan for the 2019/20 as embodied in Annexure B attached hereto;

13.1.3 Risk Management Strategy (Plan) as embodied in Annexure D attached hereto;

13.1.4 Fraud Prevention Plan, as embodied in Annexure E attached hereto;

13.1.5 Materiality Framework, as embodied in Annexure F attached hereto; and

13.1.6 Financial Plan as embodied in Annexure G attached hereto.

14. PENALTIES AND REWARDS

14.1 The Accounting Authority, in terms of the provisions of section 12 of the Scientific Research Council Act, shall determine the remuneration payable to employees of the CSIR, and, in addition, shall approve the payment of allowances, subsidies and benefits, including performance bonuses.

15. GOVERNING LAW AND DISPUTE RESOLUTION

15.1 This Shareholder's Compact shall be governed by and construed in accordance with the laws of the Republic of South Africa.

15.2 In the event of any dispute arising from this Shareholder's Compact, the Parties shall make every effort to settle such dispute amicably.

Should the dispute, despite such mediation, remain unresolved for a further period of 30 days after being so referred, either party may declare such dispute a formal intergovernmental dispute by notifying the other party of such declaration in writing, in which event the parties will follow the procedure as outlined in section 42 of the Intergovernmental Relations Framework Act, 2005 (Act 13 of 2005). Should the dispute remain unresolved for a period of 30 days, the said dispute or difference shall be adjudicated upon by a competent third party agreed upon by the Parties, unless otherwise agreed between the Parties by means of arbitration, mediation or other agreement.

15.3 Should the parties be unable to agree upon a competent third party as contemplated in clause 15.3, the dispute will be adjudicated by a competent court with jurisdiction to hear the matter.

16. NOTICES

16.1 The Parties choose as their domicilium addresses for purposes of this Shareholder's Compact the following physical addresses:

16.1.1 The Accounting Authority: Care of the Office of the Chief Executive Officer (CEO) CSIR, Building 3, CSIR Campus, Meiring Naudé Road, BRUMMERIA, Pretoria, 0184

16.1.2 The Executive Authority: DST, Building 53, CSIR Campus, Meiring Naudé Road, BRUMMERIA, Pretoria, 0184

16.2 Each Party shall be entitled from time to time, by written notice to the other, to vary its domicilium to any other address within the Republic of South Africa which is not a post office box or poste restante.

16.3 Any notice given by one party to the other ("the addressee") which:

16.3.1 is delivered by hand during the normal business hours of the addressee at the addressee's domicilium for the time being shall be presumed, until the contrary is proved, to have been received by the addressee at the time of delivery;

16.3.2 is posted by pre-paid registered post from an address within the Republic of South Africa to the addressee at the addressee's domicilium for the time being shall be presumed, until the contrary is proved, to have been received by the addressee on the 4th (fourth) day after the date of posting;

16.3.3 is transmitted by telefax or e-mail shall be deemed (in the absence of proof to the contrary) to have been received within one hour of transmission where it is transmitted during normal business hours of the receiving instrument, and within 2 (two) hours of the commencement of the following business day where it is

transmitted outside those business hours.

17. WHOLE AGREEMENT

17.1 This document together with the annexures thereto constitutes the whole of the agreement between the Parties. No instructions, agreements, representations or warranties between the Parties, other than those set out herein, are binding on the Parties.

17.2 All undertakings and annexures to this Shareholder's Compact are declared active on the effective date.

18. VARIATIONS

No variation or modification of any provision of this Shareholder's Compact or consent to deviate therefrom or waiver in terms thereof shall be valid, unless such variation or modification or waiver has been reduced to writing and has been signed by both Parties, and such variation, modification, consent or waiver shall be valid only for a specific case and only for the purpose for which and extent to which it was made or given.

19. AMENDMENTS TO THE SHAREHOLDER'S COMPACT

19.1 Should either party wish to make any amendment or alteration to the Shareholder's Compact, that party shall prepare a change order and present to the other party, which shall specify the following:

19.1.1 The date of the change order;

19.1.2 The description of the proposed amendment or alteration;

19.1.3 Previous unspecified ad-hoc work to be undertaken, if applicable,;

19.1.4 The reason for making the proposed amendment or alteration;

19.1.5 When the party requires the change to be implemented;

19.1.5.1 The resources available; and

19.1.5.2 The continued balance of the Parties' obligations under this Shareholder's Compact;

19.2 The other party shall be given an opportunity to consider such change order and make a decision on whether it is prepared to accept such change or not; and

19.3 No change order shall be of any force and effect until it is signed by duly authorised representatives of each of the Parties.

20. UNDERTAKING BY THE CHAIRPERSON

The Chairperson of the Board, undertakes to represent the Accounting Authority, in the carrying out of the terms of this Shareholder's Compact and in cascading the spirit of the agreement through the ranks of the CSIR.

21. UNDERTAKING BY THE MINISTER

The Minister of Science and Technology, Mrs Mmamoloko Kubayi-Ngubane approves of this approach and looks forward to the successful implementation of the undertakings embodied in this Shareholder's Compact and its annexures. The Minister accepts that, although the detail of this Shareholder's Compact may change due to variations and changes in the market and in society, the spirit thereof will remain unchanged.

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

CSIR
our future through science

THE CSIR SHAREHOLDER'S COMPACT

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

CSIR
our future through science

Agreed to and signed in Pretoria on 26 Feb. 2019

Prof Thokozani Majozi

T. Majozi

On behalf of the Accounting Authority

Agreed to and signed in Rustenburg on 28 Feb 2019

Mrs Mmamoloko Kubayi-Ngubane

The Executive Authority

A

Strategic Plan

Contents

A.1 Strategic Context

The CSIR mandate calls for the CSIR to foster industrial and scientific development through directed multidisciplinary research and technological innovation to improve the quality of life of South Africans. The interpretation of this mandate should thus seek to balance the focus of the organisation's efforts between directed research through scientific excellence, and effective and meaningful translation of that research and development into solutions that address the triple challenge of poverty, inequality and unemployment.

The past decade or so has seen a significant investment of CSIR resources towards strengthening the science, engineering and technology base of the CSIR. Evidence of this includes the establishment of emerging research areas; science-focused investment programmes, such as the thematic programme; and creation of structures to support scientific excellence, such as the Strategic Research Panel – all in pursuit of 'our future through science'. While this strategic positioning was necessary, given the position of the CSIR at the time, it led to a situation where the effective and meaningful translation of the CSIR's scientific endeavour into solutions that create new enterprises and make our existing industries more competitive, was curtailed.

Therefore, the CSIR has embarked on a process of amplifying the 'I' in 'CSIR'. The organisation seeks to leverage its strong SET capability base and build on current industrial development opportunities, while creating the right balance between scientific development and industrial development in its innovation portfolio.

The strategic direction of the CSIR is influenced by a number of external and internal environmental factors. Our research programmes address national priorities and as such our research, development and innovation activities are developed in response to national strategies such as the NDP, the National 9-Point Plan and the derivatives of these through various government departments (not least the DST). Equally, we develop capabilities to respond to national and international private sector requirements. Nonetheless, we are cognisant of changing environmental factors, both internally and externally, that may influence that strategic direction.

A.1.1 External Context

- **Global megatrends**

Several global drivers that impact the competitiveness of South Africa's economy contribute to the CSIR's decision to reposition its industrial development offering. These vary from political, economic and social drivers to technological, legal and environmental drivers. The volatile mix of geopolitical uncertainties (Brexit, political instability in some parts of the world, populist movements in the West) is likely to cause turbulence in the global trade regime; an increase in protectionist measures; and continuing aggressive market penetration of domestic markets (IPAP 2018; Global Risks Report 2018, World Economic Forum). Threats to global stability include natural disasters, security and economic shocks that have implications for supply networks. Globalisation in economic terms has seen the rise of global value chains, changing patterns of offshoring and outsourcing of production activities as well as the associated research, development and innovation activities.

On the social front, megatrends include urbanisation; aging populations in the West and youthful populations in places such as Africa; and ongoing populist movements in the West. Urbanisation is

on the rise, with the urban population expected to grow from 50% to 70% of the total population by 2050 (UNIDO Industrial Development Report, 2016). This change will come along with mobility and housing requirements, among other infrastructure and social amenities needs, which will require strategic responses from governments and industry. In Africa, the burgeoning youthful populations could be a double-edged sword: If healthy, well-educated and skilled, it could be the workforce of tomorrow and Africa's demographic dividend can be realised, if not, it will pose a significant threat to stability on the continent.

Economically, the lingering effects of the 2008/09 global recession resulted in weak growth and demand; commodity oversupply, as well as oversupply and overcapacity in key global sectors; and an ongoing commodity slump, especially due to slowing growth in China (IPAP, 2018). South Africa has not been able to recover its manufacturing capabilities and outputs to the pre-2008 levels. However, there are also significant changes in consumer habits, with the rise of a new global middle class and rapid technological adoption, with implications for product life cycles and speed to market; presenting huge opportunities for innovation, also for the CSIR.

The fourth industrial revolution is significantly impacting competitiveness. The digitisation of manufacturing is characterised by technology convergence, impacting the way data is organised, analysed and shared. It includes the integration of cloud computing, big data analysis, the Internet of Things, apps, mobile computing and so on into manufacturing. Also included are manufacturing trends where technology is impacting the way we sense and interact with the physical world, for example through advances in robotics, cyber physical systems, integrative production technologies, model-based production, embedded software and sensors, 3D printing and additive manufacturing, and the industrial internet. Opportunities abound for organisations like the CSIR, who can contribute to South Africa's ability to harnessing this wave to address service delivery, customer demands and new industry pressures.

The requirements of global agreements, especially agreements regarding climate change and trade, will influence industrial endeavours. Climate change and related gradual and extreme events, as well as water scarcity, loss of arable land, and so on, are setting the limits on the expansion of certain industries and trade-offs will have to be made. Climate change will impact local production locations, affecting resource availability, including energy and raw materials. Sustainability issues with regard to waste and recycling will also have new implications for industry.

All these issues have serious implications for innovation organisations like the CSIR and their multidisciplinary capabilities. New innovation trends that the CSIR must examine include challenge-led innovation, new emerging technologies and frontier sciences, increased speed of translation and scale-up, requirements for new capabilities, and new local and global connectivity. In particular, the CSIR needs to examine the breadth, depth and quality of its connections with industry locally and globally.

- **The African regional perspective**

Sub-Saharan Africa (SSA) is forecasted to record increasingly higher growth rates, buoyed by gradually improving demand for commodities and their respective prices. The IMF estimates the GDP growth for SSA at 3.4% for 2018, up from 2.2% in 2017. However, political challenges and subdued capital inflows could undermine the region's prospects.

Regional integration is vital to South Africa's economic development plans and its economy benefits greatly from regional trade, but could do even better. South Africa's commitment to promoting growth and development on the continent is also recognition that it would be creating opportunities for itself, while supporting the region's developmental initiatives. The African Union (AU) recognises the importance of science, technology and innovation, and has put out the Science, Technology and Innovation Strategy for Africa (STISA-2024), which was adopted by African heads of state in 2014, as an integral part of the AU Agenda 2063. STISA responds to the demand for science, technology and innovation to play a role in critical sectors such as agriculture, energy, environment, health, infrastructure, mining, security and water. Closer to home, but still aligned to STISA-2024, the SADC Industrialisation Strategy and Roadmap, launched in 2015, is even more relevant in this regional context, with its rooting in three key anchors of 'industrialisation as champion of economic and technological transformation; competitiveness as an active process to move from comparative advantage to competitive advantage; and regional integration and geography as the context for industrial development and economic prosperity' (SADC Industrialisation Strategy and Roadmap 2015 – 2063). It is against this background that the CSIR is also reviewing its role on the continent, and putting forward a responsive Africa strategy.

- **The South African Perspective**

South Africa has aspirations to transform its economy into an overall vibrant knowledge economy. This is no trivial feat, as the economy is on the one hand rooted in the minerals energy complex with many deeply entrenched historical challenges, and on the other has a highly sophisticated services sector with a gap in development in between. We want to integrate innovation and technology, and at the same time, stimulate job-rich growth. The Industrial Policy Action Plan (IPAP 2018) cites a number of critical challenges facing the South African economy. These include continued resource dependence, which at its height spurred growth but has engendered overvaluation and volatility of the currency. There are high levels of concentration in some sectors, resulting in sub-optimal levels of competition, with high barriers to entry for new entrants. There is a range of cost drivers for domestic manufacturing, including electricity pricing, logistical inefficiencies (road, rail and port); slow roll out of ICT infrastructure and high input costs where the abuse of market power in concentrated sector raises prices (IPAP, 2018). Deep-seated skills shortages and mismatches have also acted as a barrier to growth.

South Africa's economy is intricately rooted in the minerals energy complex, but the country aspires to become a green, sustainable knowledge economy. Technology plays a significant role in moving towards structural transformation to a greener, more inclusive economy. Technological change for environmental sustainability impacts production processes and the production structure – involving environmental, economic and social trade-offs.

The nature of the South African industry has changed significantly over time. It has expanded at an average rate of 3.3% between 1994 and 2012, but the rate of growth in more recent years has dropped significantly. The manufacturing sector played a dominant role in the economy in 1994, contributing 21% of GDP at 2013 prices. However, by 2012, at 12.4%, it was only the fourth largest contributor after the financial and services sector, wholesale and retail, and the government sector, and remained fourth in 2016, contributing 13.4%.

As at the end of the first quarter of 2017, the South African economy was in a technical recession (IDC, 2017). With the exception of agriculture and mining, all broad sectors reported lower output levels for the first quarter of 2017 (TIPS, Real Economy Economic Bulletin, 1st Quarter 2017). Despite

the 144 000 jobs created in the first quarter of 2017, the employment rate rose to the highest level in 14 years, standing at 27.7%, up from 26.5% in the last quarter of 2016. Since 2016, the private sector has accounted for a rising portion of new jobs, with the contribution of the public sector declining (IDC, 2017). The economy's labour absorption capacity has deteriorated and the pace of job creation is insufficient to accommodate an expanding labour force. In its change strategy, the CSIR must thus consider how it can better contribute to job creation.

More severely, South Africa has experienced a premature de-industrialisation over the past decade. This position is further exacerbated by the fact that South Africa struggles in the key factors required to reinvigorate the industrial sector from a global perspective (83rd in labour market efficiency; 112th in higher education and training; 124th in technological readiness; 135th in innovation). Therefore it is clear that addressing these key enablers is essential to reversing the deindustrialisation that SA is experiencing and in this, particularly with respect to innovation and technology readiness and partially in training, the CSIR intends to play a significant role.

Addressing de-industrialisation is not limited to the manufacturing sector alone, but instead should focus on the primary (mining and agriculture), secondary (manufacturing), and tertiary (business services, tourism, etc.) sectors of the economy as well as the enabling environment surrounding these sectors. This enabling environment includes elements of infrastructure (logistics, services, ICT), natural resources (including the balance between industrial activity and sustainable resource use), labour (both the supply of scare, skilled labour and the retention of existing labour) and a conducive policy environment (trade, regulatory, etc.). The CSIR considers all these aspects as crucial in stimulating the country's re-industrialisation.

A.1.2 Internal Context

Historically, the CSIR has contributed significantly to South Africa's research, development and innovation, supporting university, medical and industrial research. It contributed significantly to industrial development, through setting up other specialised councils, rendering support to enterprises, setting up successful start-up companies, and enhancing significant parts of major players such as Denel Aerostructures. To date, the CSIR has created 105 companies, 54 of which are still thriving.

A.1.2.1 CSIR Mandate

The CSIR was established on 5 October 1945 by an Act of Parliament. The Act under which the CSIR now operates, the Scientific Research Council Act, 1988 (Act 46 of 1988), stipulates the following mandate:

> The objects of the CSIR are, through directed and particularly multidisciplinary research and technological innovation, to foster, in the national interest and in fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act.
> *Extract from the Scientific Research Council, 1988 (Act 46 of 1988)*

Specifically, section 4 of the mandate dictates that the CSIR supports better utilisation of the resources of the Republic, improvement of the productive capacity of its population, improvement of technical processes and methods to improve industrial production, the promotion and expansion of existing, as well as the establishment of new industries, standardisation in industry and commerce and training of manpower.

The CSIR utilises a framework to manage its business and fulfill this mandate (Figure A.1). This framework also forms the basis of our key performance indicators (KPIs).

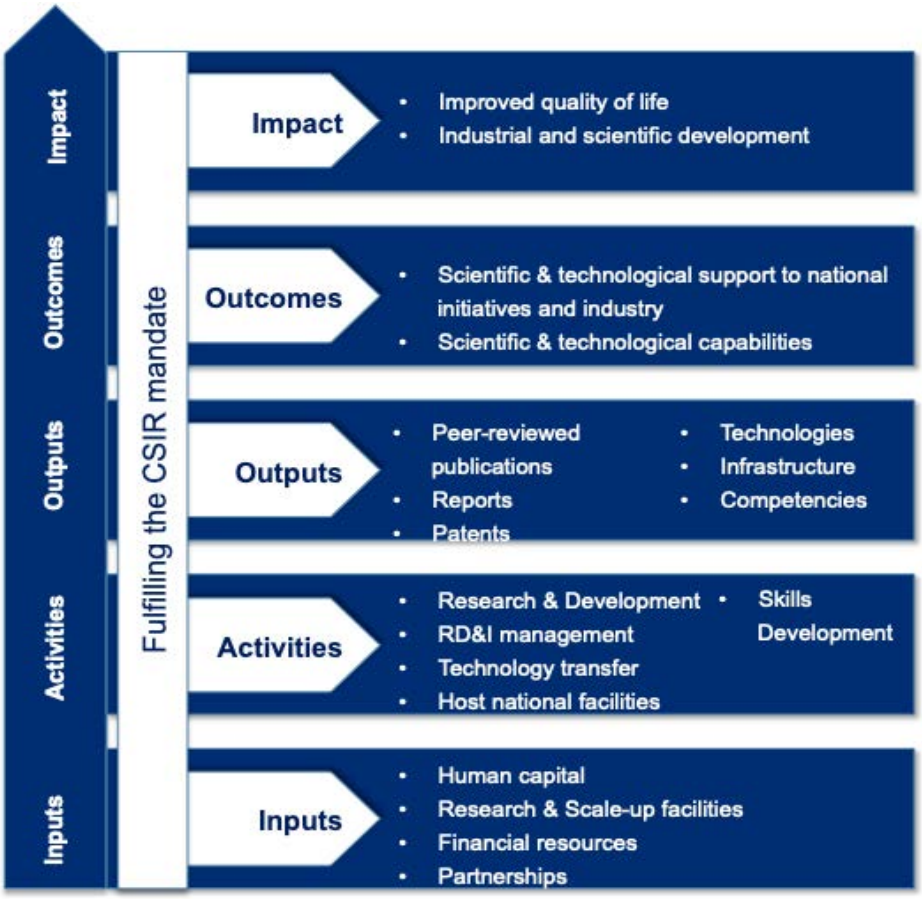

Figure A.1: CSIR Framework for fulfilling its mandate.

- **Inputs**

The inputs that the CSIR invests in fulfilling its mandate include human capital, research facilities, financial resources and good governance. The CSIR has a total of 2 392 employees, of which about 1 646 are in the SET base. In accordance with the CSIR's intention to partner more closely with

industry, the CSIR would need to broaden the profile of its skills for the organisation to meaningfully contribute to industrial development. It should seek to complement skills and competencies that are already in existing industry.

For a research and technology organisation (RTO) to fulfill its mandate, it also needs infrastructure that can be used for industrial development type activities, notably research testing, prototyping, piloting, upscaling and on-site demonstration. While the CSIR has some of the requisite infrastructure, it certainly does not have adequate facilities in these critical areas required to support industrial development.

The CSIR receives less than a third of its funding from the government as an unrestricted grant. The bulk of its funding, more than 70%, is earned as contract income from the public sector. The income earned from the private sector is often used as a proxy for relevance to the private sector, and this is a very small contribution to the total CSIR income base. The CSIR thus seeks to intensify its engagement with the private sector in order to diversify its income stream towards better financial sustainability.

- **Activities**

CSIR activities prescribed in its mandate include research, development and innovation (RD&I), RD&I management, technology transfer and commercialisation as well as hosting national programmes and national strategic research and testing infrastructure. The RD&I portfolio is currently skewed towards research and development, but there are a handful of research translation programmes that can be leveraged, including the Industry Innovation Programme (IIP), Enterprise Development and Support Programmes and flagship programmes. There will be a need to design new programmes to address priorities in key sectors.

The CSIR has put together a commercialisation framework that supports the development of start-ups and spin-offs, and the licensing of technology to different parties, including established industrial players.

The CSIR hosts a number of programmes to support industry on behalf of the state. These include, the National Cleaner Production Centre in collaboration with the dti and UNIDO, the Technology Localisation Unit, the Aerospace Industry Support Initiative, the National Foundry Technology Network, the Collaborative Programme in Additive Manufacturing, and Agrémént South Africa, among others. Initial consultations with stakeholders point to the need for the CSIR to address a major gap in the system – hosting research and testing infrastructure to create standards for new products and new markets, a role that others in the system are not addressing.

- **Outputs**

The CSIR produces a number of research and human capital outputs. Products of fundamental and applied research include peer-reviewed publications, book chapters, software and policy support reports, amongst others. Outputs related to implementation include technology demonstrators, technology packages, patents and licence agreements. In term of capacity development, the CSIR supports the completion of post-graduate degrees (both internally and externally) as well as internal (human capital development) and external (internships) development of industry-relevant skills. Finally, the CSIR also coordinates and develops national research infrastructures.

- **Outcomes**

The outcomes that the CSIR strives to influence include an increase in the innovation capacity of the country (both in the public and private sector through infrastructure and human capital development); an enhanced profile of the NSI (through number and impact of international publications); availability and uptake of technologies that enhance industry competitiveness; implemented technologies that enhance the capability of the state; and accessible technology for marginalised or previously disadvantaged groups.

- **Impact**

Through the outputs and the associated outcomes of the CSIR, we aim to ultimately improve the lives of the people of South Africa through the implementation of technologies that improve service delivery, lead to import replacement or export creation, lead to increased GDP, job creation or lead to the provision of basic services such as sustainable water and energy supply to all of society. Further, the CSIR aims to mitigate the effects of climate change for the country and ensure that both industrial and societal development occur in an environmentally sustainable manner. The CSIR also contributes to evidence based policy development.

A.1.2.2 Vision, Mission and Values

Following an organisational review, an as-is analysis and employee and stakeholder survey as part of the Synapse Project, a case for change was developed leading to a new vision, mission and values for the CSIR.

OUR VISION

We are accelerators of social-economic prosperity in South Africa through leading innovation.

OUR MISSION

Collaboratively innovating and localising technologies while providing knowledge solutions for the inclusive and sustainable advancement of industry and society.

OUR VALUES

We **EXCEL** in R&D and industrial innovation solutions that address South Africa's challenges. Quality and efficient thinking, systems and processes enable the necessary agility to change course should our stakeholders or environment require it. We are unashamedly passionate about the impact we make and pursue excellence in every facet of CSIR life.

We care about **PEOPLE** – our impact through innovation aims to improve lives. We respect each other's diversity, and uphold the dignity of every person, regardless of culture or belief system. Our systems and processes enable continuous personal development and we encourage one another to seize opportunities. We treat our stakeholders the way we like to be treated.

We value **INTEGRITY** – in ourselves and in others. We are honest and fair in how we work and how we engage the world us. We respect the trust that our colleagues and our stakeholders place in us and commit to ethical decision-making, delivery and governance.

We are keen to learn from one another and **COLLABORATE** across the organisation and with external partners to ensure that our work has the best chance to innovate a better future for South Africans. We actively share our knowledge and expertise by design, formally and informally, so that we can realise large-scale impact.

A.1.2.3 CSIR Review

In terms of section 3 of the 1997 White Paper on Science and Technology, periodic institutional reviews are to be carried out on science, engineering and technology institutions. This review was conducted from 9 July 2018 to 13 July 2018. Some important outcomes and observations of this review include:

- A concern was noted by the Panel that some recommendations or issues from the 2009 review were still not addressed. The length of time to resolve issues or complete work was also highlighted as a concern by other stakeholders; and as the CSIR pursues its journey towards a more balanced R&D and industrial development offering, this should receive attention.
- A number of issues of concern can be addressed through normal efficiency improvement measures including the necessity for reviewing KPIs to align more closely with a commercialisation focus; a review of shared services costs; and the immediate review and institution of service level agreements.
- It was encouraging to see the leadership and staff's dedication to ensuring that the organisation takes its rightful place in South Africa as a national asset, offering innovative and relevant solutions to address the country's triple challenges by stimulating the economy through new industry development, contributing to equal opportunities for socioeconomic development, and creating jobs.

The Panel congratulated the CSIR on its work in the R&D arena, in particular the excellent human capital development (HCD) programmes that are now bearing fruit and where projects are well received by especially the public sector.

The organisation has many challenges to meet, some of which require a response from the NSI with the leadership of the DST, and government as a whole noting the strategic role of the CSIR.

The CSIR will actively address the general and more specific recommendations of the review in the coming year.

A.1.3 National Priorities

The design and implementation of the CSIR's strategic plan is guided by a range of policy documents, chief among which is the NDP which sets out the long-term developmental framework for the nation. This long-term vision is then supported by more immediate policies, which include policies to stimulate development and the DST Strategic Plan: 2015-2020.

Investments into science, technology and innovation have the potential to grow the economy through new firms and increased competitiveness of existing firms; increased exports and reduced imports; as well as new opportunities for emerging black and female entrepreneurs. An updated science,

technology and innovation policy will see these recognised as drivers of competitiveness and economic growth, integrated across government departments and appropriately funded. A new white paper on science and technology is at an advanced level of development.

A.1.3.1 The National Development Plan – Vision 2030

The NDP offers a long-term perspective on South Africa's development by clearly articulating a desired destination and identifying the role different sectors of society need to play in reaching that goal. As a long-term strategic plan, it serves four broad objectives:

- Provides a set of overarching goals that we need to achieve by 2030;
- Builds consensus on the key obstacles to achieving these goals, and what needs to be done to overcome those obstacles;
- Provides a shared long-term strategic framework within which more detailed planning can take place;
- Creates a basis for making choices about how best to use limited resources.

The CSIR's R&D programme speaks to seven of the focus areas identified in the NDP:

i) Economy and employment. The CSIR initiates programmes directly aligned to support key national economic sectors. New strategic clusters for the chemicals, mining and manufacturing sectors will focus specifically on this goal.

ii) Building a capable state. Our interventions in this area focus on service delivery and its associated issues. We have defined strategic clusters, those of Smart Logistics, Smart Places and Smart Institutions to support government in this area.

iii) Economic and social infrastructure. The CSIR is coordinating two of the national Strategic Infrastructure Projects (SIPs), namely the Higher Education Infrastructure and Access to Communication Technology. In addition, we conduct research to inform policy-making and technology development for water, transport, coastal and ICT infrastructure, as well as improved building design and improved building materials.

iv) Transition to a low-carbon economy. The CSIR is working on improving the measurement and management of our natural resources, improving our ability to understand the long-term effects of climate change and thus assist government with the formulation of mitigation and adaptation strategies.

v) Transforming human settlements. The CSIR is supporting metropolitan areas and municipalities in a number of areas, including spatial planning, the management of infrastructure and the transition to greener and smarter economies. Our Smart Places strategic cluster in particular, will address elements of long-term planning and technology integration for smarter, more efficient communities.

vi) Improving health. Under a new dedicated strategic cluster, NextGen Health, the CSIR's work in support of health ranges from technical support to the National Health Insurance initiative, the development of interconnected and inter-operable point-of-care devices and the development of new methods to understand, manage and diagnose disease at the cellular and molecular level.

vii) Building safer communities. CSIR interventions in this area focus on supporting the acquisition and integration of technology by our security forces, national police and the security sector. The Defence and Security cluster will predominantly focus on this goal.

A.1.3.2 Other Government Policies to Support Development

The national government has devised a number of initiatives aimed at boosting economic growth and creating employment, as outlined in the President's 2019 State of the Nation Address. The CSIR's R&D programme contributes to a number of in various ways, and some examples are outline below:

i) The national energy challenge. CSIR support includes interventions around energy infrastructure and the development of technologies that support the maintenance of energy infrastructure, through a dedicated Energy Research Centre. Furthermore, through work done in this Energy Research Centre, the CSIR is working with the Department of Energy and international organisations to conduct energy demand assessments required for national policy formulation and targeted monitoring.

ii) Contributions to agriculture and the agro-processing value chain. Under the new strategy we have developed a dedicated cluster, Advanced Agriculture and Food. This cluster will focus on advanced agroprocessing technologies, natural and traditional products and precision agriculture.

iii) Mineral Beneficiation. Our interventions include activities around titanium and aluminum beneficiation and beneficiating polymer nanocomposites, and these go a long way in contributing toward the creation of new industries based on our mineral wealth.

iv) Industrial Policy Action Plan (IPAP). Our interventions include support for technology localisation (including programmes like the Aerospace Industry Support Initiative (AISI) and the National Foundry Technology Network (NFTN). Strategic clusters in manufacturing, mining and chemicals will play an important role, as will the CSIR's role in the fourth industrial revolution.

v) Encouraging private-sector investment. A key focus of the new CSIR strategy is to partner more extensively with the private sector and create value propositions that leverage private sector funding.

vi) Support for SMMEs, cooperatives, township and rural enterprises. Our work with enterprise creation and development assists local and provincial government with the development and implementation of sector and local economic development strategies. To this end, the CSIR is working with government, amongst other related initiatives, in the setting up a Business Process Outsourcing Park in Tshwane.

vii) The Fourth Industrial Revolution (4IR). The CSIR conducts research and development in a number of key areas of the 4IR such as robotics, sensors, 3D printing and additive manufacturing, and the industrial Internet of Things, etc. Opportunities abound for organisations like the CSIR, who can assist the country in harnessing this wave to address national priorities and opportunities, as well new industry pressures that arise as result of the advent of these technologies. To this end, the CSIR is working with the Department of Science and Technology to establish The South African Fourth Industrial Revolution Centre (SAFIRC) which is aimed at providing an integrated and comprehensive response to the African and, specifically, South African challenges in this space.

viii) Support for Strengthening of the Capacity of the State – In his 2019 State of the Nation Address, the President highlighted the need to strengthen the capacity of the State to address the needs of the people, and highlighted significant progress that has been made in restoring policy certainty on, among other things, crafting the path towards *mobile spectrum allocation*. The CSIR is developing technologies that enable flexible management of and access to radio frequency spectrum, and continues to work with the Department of Telecommunications and Postal Services on policy aspects related to the implementation and regulation of radio spectrum management.

ix) Support for growth in Tourism – a key highlight by the State President in the SoNA 2019 is the concerted effort by government in ensuring growth in the tourism sector, and thus making a contribution in economic growth of the country. The CSIR has developed and deployed, with key stakeholders in government and the private sector, technologies that contribute significantly to the fight against Rhino-poaching, and thus help to ensure the sustainability of the tourism sector.

x) The National Health Insurance (NHI) – the State President announced that, "after extensive consultation, the National Health Insurance Bill will soon be ready for submission to Parliament." The CSIR has been working with the National Department of Health to prepare the way for the roll-out of the NHI through development and implementation of the National Health Patient Registration database.

A.1.3.3 DST Strategic Plan: 2015-2020 and Draft 2018 White Paper for Science, Technology and Innovation

The DST Strategic Plan 2015-2020 notes a three-phase process envisaged by the NDP, leading up to 2030, of the rising contribution and blossoming importance of innovation to growing the South African economy. The CSIR will continue to support the goals of the DST strategic plan, which include industrial development, economic diversification, improved SME competitiveness, and human capital development.

A second key policy document is the new White Paper for Science, Technology and Innovation (Draft, 2018). As a guiding document to South Africa's intent and approach to developing and utilising the NSI, this White Paper is critically important. It is to be the basis used to convince government and society that science, technology and innovation should be elevated and prioritised as a key mechanism for development, economic growth and poverty alleviation in South Africa, the region and the continent. It calls for greater collaboration, increased private sector involvement, increased capacity across the innovation value chain, and increased resourcing. Through its new strategy, the CSIR aims to support these aspirations through greater collaboration, particularly with private sector; increased research capacity (particularly research translation infrastructure and capacity); and increased resourcing through actively targeting private sector and foreign investment funding.

The new white paper places greater emphasis on the enabling environment in and around the NSI, particularly in the context of increased involvement of private sector and civil society, support of SMMEs, financial incentives, policy guidance with respect to procurement and private sector investment in RD&I. In this respect the CSIR has a number of programmes that target SMMEs (Enterprise Creation for Development, Industry Innovation Programme) and will continue to support government in evidence-led policy development (e.g. energy regulation, industrial policy, fourth

industrial revolution policy, ICTs and telecommunication standards).

A further aspect that the CSIR believes is necessary and in which it believes it can play a significant role in is the strengthening of the country's regulatory and standardisation environment (SABS, SARPHA, agricultural products etc.) in light of improving efficiencies and preparing for responsible adoption of (new) local and international technologies.

Finally, the CSIR will support the DST and the NSI in the critical area of skills development. We will continue to assist the higher education system with postgraduate training and in this aspect will strive to provide much needed supervisory capacity for postgraduate studies. The CSIR is also well positioned to play a key role in preparing young graduates for transitioning into the world of the practice of scientific and technological careers by providing them with the necessary experience.

A.2 Strategic Clusters

A.2.1 Overview of Strategic Clusters

In light of South Africa's position, and given that the CSIR needs to prioritise its finite R&D resources, the foundation of the CSIR Strategy defines priority industries.

These industries:

- Present the greatest potential for socioeconomic impact according to a robust set of economic and social criteria that are both forward looking and reflective (Figure A.2); and
- Are, to varying extents, dependent on R&D and thus offer opportunities for the CSIR to pursue.

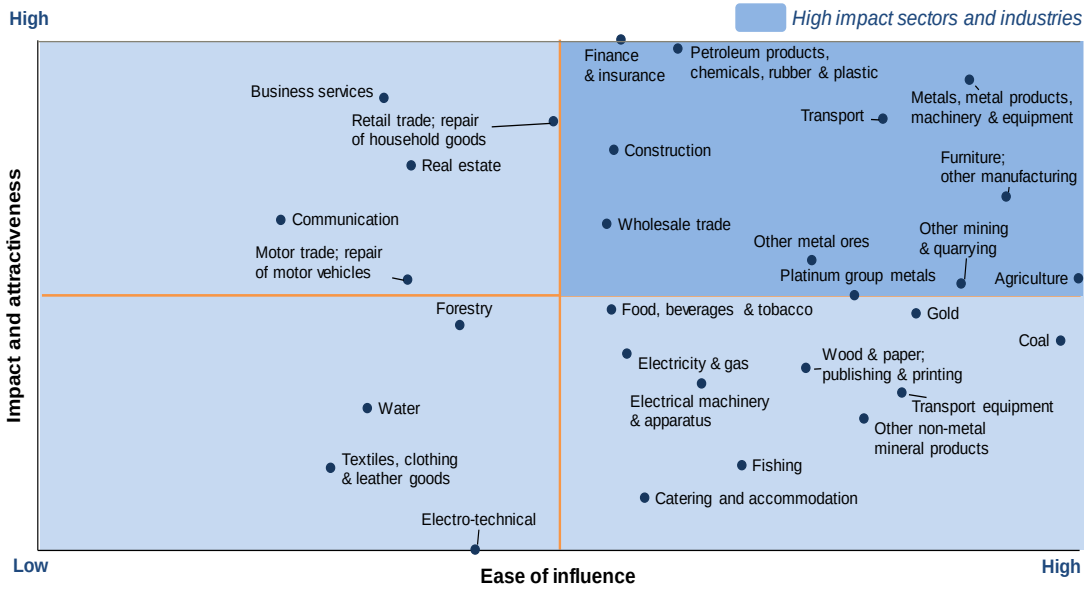

Figure A.2: Assessment output of South Africa's high-impact industries (A.T. Kearney)

Due to the national priorities underpinning education, health, defence and security and utilities including energy and water, these industries are by default considered priorities for South Africa. Figure A.3 summarises the industries that constitute the CSIR's prioritised industries.

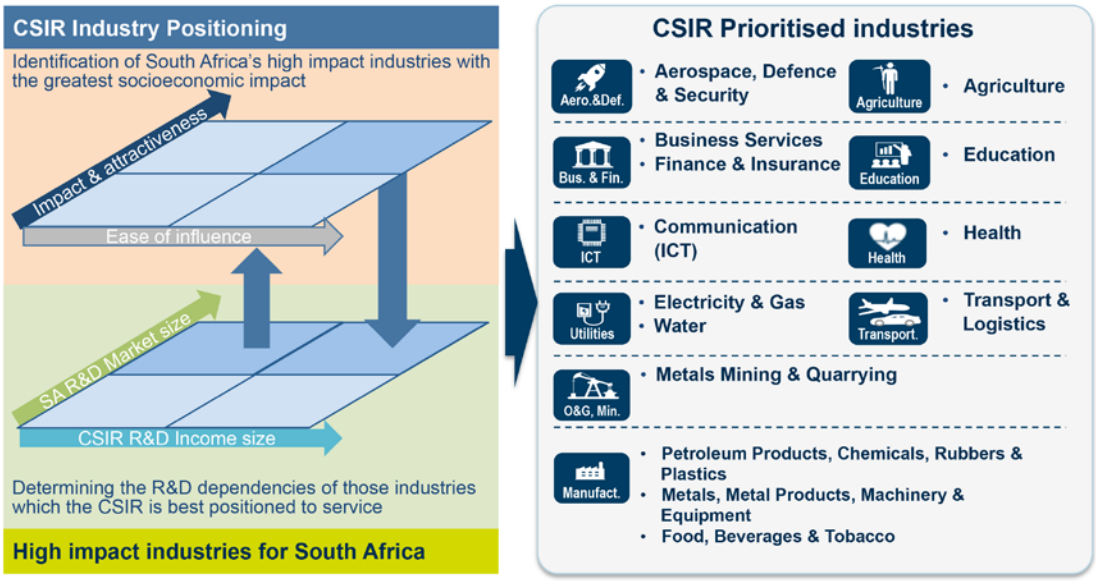

Figure A.3: The CSIR's prioritised industries (A.T. Kearney)

The CSIR requires a platform to influence these industries through its R&D efforts. Given its global relevance, technology constitutes the largest platform from a CSIR perspective to realise impact across industries. The CSIR Strategy, in defining its technology focus, thus also considers how technology will impact industries.

Given the vast (and growing) number of technologies available, the assessment of the impact of technology on sectors/industries also considers the fourth industrial revolution (4IR) technology areas that are expected to have the greatest transformative and disruptive effect (Figure A.4).

This does not imply that other technology areas are irrelevant, but rather that, aligned with the objective of radically impacting industries, the CSIR will align its efforts along these transformative 4IR technology areas. Non-4IR technology areas still fall within the CSIR's scope, but these technology responses focus on the priority industries and align with industry trends.

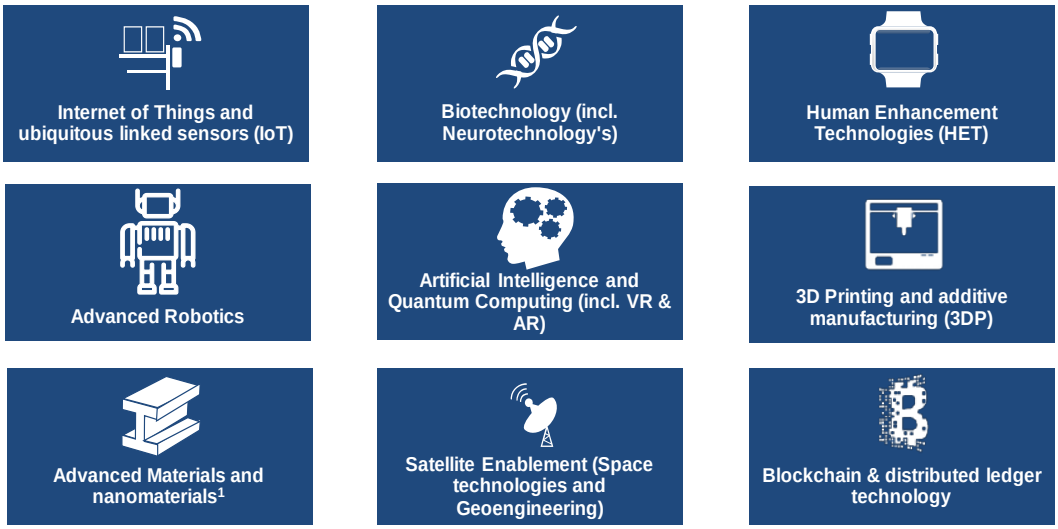

Figure A.4: Transformative 4IR technologies (A.T. Kearney)

An isolated industry and technology view may be limiting as technologies and industries continuously converge and evolve. To amplify the impact from these technology-industry convergences, the CSIR Strategy, buttressed by detailed industry competitive analyses, defines clusters that group clear synergies across technologies and industries.

Nine synergetic clusters (Table A.1, and described in more detail below) form the basis of the CSIR Strategy.

Table A.1: CSIR Strategy prioritised technology sector clusters

1. Future production	Improve the performance and sustainability of relevant industries to make production and processing lines more automated, modular and responsive
a) Chemicals	Apply disruptive and innovative (bio)-chemical conversion technology to create a dynamic African chemical industry with access to forward-looking and modern digitised production processes
b) Manufacturing	Strengthen the middle tiers of the value chain (fabrication and assembly), and develop strategic capabilities to address high-value industries, facilitating supply chain integration technological advances, through Industry 4.0 technologies
c) Mining	Modernisation of mines via mechanisation and automation and ultimately, fully autonomous operations, is the envisaged path that will bring change to processes, technologies, skillsets and social and environmental impacts associated with current and future mining practices
2. Advanced Agri- and Agroprocessing	Harness the opportunities afforded by transformative technologies to develop the agricultural industry and associated processing activities and in turn using these opportunities as a catalyst for rural development and inclusive growth
3. NextGen Health	Continuous personalised healthcare and timely, personalised interventions through connected intelligent medical devices, artificial intelligence algorithms to predict risk factors and create new preventive clinical paths (synthetic biology interventions, telemedication)
4. Logistics	Connected, and robotised logistics and infrastructure to maximise the efficiency and productivity associated with transport and logistics; this is especially important for a resource-extraction country that is spatially divided

5. Defence and Security	Enabling integrated national defence and security solutions in South Africa, by being pre-emptive and adaptive through hardened intelligence defence and security offerings, linking into global supply chain markets
6. NextGen Institutions	Enabling the digital transition of South Africa's enterprises and institutions that support effective service delivery, improve transparency and accountability, and cultivate a connected platform that supports industrial and societal advancement; ultimately, improving the ease and effectiveness of doing business
7. Smart places	Smarter resource, infrastructure and service developments directed towards enabling competitive manufacturing environments and sustainable economic growth, through integrated and holistic planning and trade-off modelling

A.2.1.1 Future of Production: Chemicals

The *Future of Production: Chemicals* cluster addresses the challenges and opportunities of the petroleum products, chemicals, rubbers and plastics[1] sectors. It applies disruptive and innovative combinations of biological and chemical ((bio)-chemical) conversion technologies to improve efficiencies across the chemicals value chains, develops greener processes, produces high-value novel chemical entities and advanced materials to create a dynamic African chemical industry with access to forward-looking and modern digitised production processes.

In South Africa, the chemicals sector is of considerable economic importance as it is an apex industry, contributing to downstream value chains both internal and external to the industry and adding 2.7% to GDP (2013). The domestic chemical sector was born out of the exploitation of diamond and gold mining, leading to the establishment of an explosives industry. Eventual competition and apartheid era sanctions led to diversification with plants expanded to include coal-to-liquids production, chlor-alkali, speciality and fine chemicals sectors. The strong correlation between chemical and manufacturing output suggests, from an industrial policy perspective, that at a macro level, any domestic acceleration of deindustrialisation will act as a brake on chemical sector growth, while strong performance in manufacturing growth will potentially create a boom and growth impetus for the chemical sector. In addition, the sector employed just under 80 000 workers (2014) and these investment effects thus also have the possibility to drive job creation. As an example, in the United States of America it is estimated that each chemical industry job generates 7.5 jobs elsewhere in the economy.

The chemicals industry is facing a number of challenges that constrain its expansion; these include the market size (small local markets, competitiveness issues, barriers to trade, and loss of key protective tariffs); input supplies (shortages for water and energy, and increased pricing affecting competitiveness); feedstocks (reliance on imported raw materials, and lack of downstream value

[1] Sectors are listed as per the nomenclature of Stats SA.

addition), labour matters (rigid labour law, frequent industrial action, and above inflation wage escalations); the cost of doing business (port costs, levies and taxes); regulatory stringency (environmental regulations and administrative burden) and skills shortages. In addition, a number of competitiveness issues that constrain the establishment of a local pharmaceutical manufacturing industry have been identified. These include structural/policy issues, such as stringent environmental regulations, immature regulatory system; competitive position (price-sensitive market vs low prices of imported products); donor-sourced medicinal products, and consumer perception toward imported products.

This cluster aims to improve the competitiveness of the chemical industries in South Africa by providing novel technologies that expand the product portfolio from the local chemical industries, supports the local production of pharmaceuticals and advanced materials, and improves the efficiencies of mineral conversions processes to support value addition to South Africa's mineral resources.

A.2.1.2 Future of Production: Manufacturing

The *Future of Production: Manufacturing* cluster addresses the challenges and opportunities of the *Metals, Metal Products, Machinery and Equipment* sector. The structure of the industry is tiered, with very few and mostly foreign-owned original equipment manufacturers (OEMs), and a variety of players at various hierarchical levels in their supply chain. The cluster aims to strengthen the middle tiers of the value chain (fabrication, engineered products and materials and assembly of simple to complex systems); develop strategic capabilities to address high-value industries; facilitate supply chain integration technological advances; and make production and processing lines more automated, modular and responsive through Industry 4.0 technologies.

The metals, metal products, machinery and equipment sector contributes significantly to the economy as can be seen from the following data:

- 2.48% of GDP;
- ~99 000 jobs;
- 18% of all exports; and
- 15% of all imports.

The engineering industry has a high macro-economic impact and contributes not only directly to the GDP, but also indirectly via all its related industries. Examples include:

- Machinery and equipment: R269 billion through the manufacturing of large mechanical systems in open cast mining, machine tools and robotic systems; impact on the competitiveness of many other industrial sectors and serve as a platform for entry into advanced industries.
- Automotive: Contributed 7.5% of GDP (2015), 33% of manufacturing output and 14.6% of South African exports and is the largest industry in the manufacturing sector with 113 000 direct and indirect jobs.
- Aerospace: R23 billion, of which R3 billion is non-defence exports, high-level systems design and integration capabilities that provide a platform for growth to other sectors.

Although the contribution of the engineering industry is significant, it is facing multiple challenges that contribute to South Africa's declining economic growth. These include:

- Limited capability for assembly of complex subsystems, and for systems integration;
- Limited adoption of automation and emerging technologies – still very dependent on manual labour;
- The sector is highly geared, increasing its risk exposure;
- External competitors (e.g. China) have been eroding South Africa's domestic and international markets;
- Inefficient processes and capability shortfalls have resulted in above-average waste production;
- Limited design of original products;
- Underdeveloped product and process testing, qualification and certification;
- Exporting ore, importing specialist steels, alloys and advanced materials;
- Reliance on materials imports to develop downstream industries; and
- Limited collaboration between public and key private sector players to create partnerships to leverage resources and scarce skills.

The metals, metal product machinery and equipment sector and associated engineering play a critical role in enabling growth by driving industrialisation and creating more decent, better-paying jobs. Without technology and innovation, industrialisation will not happen, and without industrialisation, development will not happen. Therefore, engineering will always be a key driver as it can serve the three dimensions of sustainability, namely, economic, social and environmental, simultaneously.

The envisaged impact is thus to strengthen the middle tier (SMMEs) and bring competitiveness to high-value manufacturing sectors by leveraging technology advancements and vibrant supply chain improvements, while focusing on machinery and capital equipment. In the long term, the cluster focus is to develop local OEMs, expand exports and capture a larger share of global high-value manufacturing.

A.2.1.3 Future of Production: Mining

The *Future of Production: Mining* cluster addresses the challenges and opportunities of the mining and quarrying[2], non-metal mining, manufacturing and chemicals sectors. The cluster focuses on leveraging the strong history of mining in South Africa through the modernisation of mines via mechanisation and automation, and ultimately, fully autonomous operations, as the envisaged path to improve safety, bring change to processes, technologies, skillsets and social and environmental impacts associated with current mining practices.

The mining industry contributes over 18%, directly and indirectly, to the GDP of South Africa. Mining has been the cornerstone of the economy for more than a century. The high multiplier effects for mining employment (upstream and downstream) suggest that mining will continue to play a critical role in the economy. However, this continuation is highly dependent on the South African mining industry's ability to sustain itself into the future – especially the labour-intensive gold and platinum group metals (PGM) industries.

In addition to the price depression in the gold and PGM sectors, the issues of aging infrastructure, deepening of mines, and longer travel times to underground working areas have impacted on the profitability and sustainability of the sectors. Consequently, with increasing distance from the shaft,

[2] Sectors are listed as per the nomenclature of Stats SA.

actual face time has decreased, thereby accounting for the reduction in production and contributing to escalating costs, and also posing additional threats to health and safety standards.

Through its its multi-, inter- and transdisciplinary capabilities and offerings, the CSIR is ideally suited to provide technological solutions as needed for the revitalisation of mining R&D in South Africa. The overall mining cluster strategy is aligned with the Phakisa outcomes via the South African Mining, Extraction, Research, Development and Innovation (SAMERDI) initiative; and will address the challenges in occupational health and safety facing the mining sector as a partner to the Mine Health and Safety Council (MHSC). Such challenges include thematic areas to address occupational health and safety, covering, but not limited to, mine engineering, lab testing, rope testing, human factors, occupational diseases, airborne pollutants, fires and explosions, machinery and transport, rock bursts, rockfalls and silicones.

A.2.1.4 Advanced Agriculture and Food

The *Advanced Agriculture and Food* cluster addresses the challenges and opportunities of the agriculture, and food and beverage processing sectors. It applies cross-cutting technology and business model innovation in partnership with relevant public and private sectors to strengthen the agricultural industry and associated agro-processing value chains. Best-in-class technologies and business model innovations are applied as catalysts to strengthen both commercial and rural agri-production in pursuit of rural development and inclusive economic development.

The agricultural sector, along its value chain, is a key contributor to the South African economy. The sector contributes 21% of manufacturing GDP (R80.9 billion) and 21% of manufacturing jobs. Agriculture constitutes 1.76% of GDP; and food, beverages and tobacco is 2.87%, representing 942 000 jobs. The sector constitutes 12% of all exports (net exporting position), and 8% of all imports. Similar to South Africa's mining sector, the agricultural sector is characterised by high labour intensity. It has a positive and growing trade balance of R17 billion.

Although the industry has the potential to address the trade deficit and also tackle the triple challenge of unemployment, poverty and inequality, it is not without trials. Some of the pain points identified through engagements with industry are:

- Lack of inclusion of rural and small-scale farmers into the mainstream sector and economy, resulting in limited impact on rural development and growth.
- Unpredictable climate change and the resulting impact on disease outbreak to crop yields, which will impact food security and food safety, eventually leading to intermittent supply of crops and raw materials.
- High post-harvest losses due to the lack of access to agroprocessing in close proximity to the primary production site.
- Poor weed control and soil health contributing to declining quality produce or loss in volume for resale.
- Slow product innovation cycles making it difficult for industry to meet customer needs.
- Limited automation or mechanisation and lack of appropriate agro-processing technologies, which result in the sector lagging behind in competitiveness.
- Inadequate funding instruments for start-up agri-businesses.

- Fluctuating or even advancing stakeholder needs require that the industry operates with a flexible innovative business model or enhance specialised analytics and big data to forecast customer trends.
- Trend of convenience and healthy products changes the business model of the industry and its focus areas/products.

The envisaged impact for the cluster is to harness the opportunities afforded by transformative technologies to develop the agricultural industry and associated processing activities and in turn to use these opportunities as a catalyst for rural development and inclusive growth. The cluster will predominantly focus on primary, secondary and advanced conversions of agricultural feedstocks to higher value products. This cluster will leverage existing interventions and expertise including agroprocessing product and process development, bioprocessing and biorefinery platforms, business model development and innovation for rural communities, food safety testing, and the development of unique products from indigenous plants. This will be strengthened by the adoption of digital, smart ICT and robotic technologies to support operational efficiencies, cost reduction and export readiness.

A.2.1.5 NextGen Health

The *NextGen Health* cluster addresses the challenges and opportunities presented by pharmaceutical production, biomaterials, ICT, and electro-technical sectors to improve health outcomes and to drive a local healthcare industry. It focuses on improvement of access to healthcare, incorporates synthetic biology and state-of-the-art diagnostic and treatment technology, with advances in artificial intelligence to provide integrated digital health solutions. Thus it ensures that appropriate treatments are delivered at an appropriate time and place for the patient.

The local health technology sector has not yet reached critical mass as a supplier to either South Africa's public health system or as a contributor to African and other international markets. This is in contrast with the local pharmaceutical industry, which, with multinational engagement, local manufacturing and distribution, accounts for more than 70% of sub-Saharan Africa's annual pharmaceutical production. This growth is especially evident in competitively priced generic drugs, including first-line antiretrovirals. At present, more than 90% of South Africa's medical devices are imported, and this impacts South Africa's trade balance negatively. By creating a local industry that provides high-quality, competitively priced medical devices, government departments such as the Department of Health and National Treasury will be in a better position to procure locally from South Africa, improving the trade balance and stimulating local growth.

The use of information systems in health (or eHealth) has been globally acknowledged as a critical element of achieving universal health coverage. This was acknowledged by the World Health Assembly in resolution WHA58.28 (2005): *"eHealth is the cost-effective and secure use of ICT in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research".* While there has been some progress with respect to the implementation of eHealth in South Africa, the National eHealth Strategy has highlighted two critical challenges:

- Prevalence of manual (non-automated) systems in South Africa; and
- Where automated systems exist, there is a lack of interoperability between those systems (National Department of Health, 2012).

This cluster aims to improve the healthcare industry in South Africa by providing national integration to facilitate and stimulate innovative technology development that will address the three pillars of healthcare, namely the health system, burden of disease and social determinants. The cluster will predominantly focus on the application of continuous personalised healthcare and timely interventions through connected intelligent medical devices and artificial intelligence algorithms, to predict risk factors and create new preventative clinical paths. The cluster features three strategic capability platforms designated: health information systems, medical devices and diagnostics, and precision medicine for pharmaceutical treatments.

A.2.1.6 Smart Logistics

The *Smart Logistics* cluster addresses the challenges and opportunities of the transport and logistics; transport equipment; infrastructure; public services; oil and gas and mining sectors. The cluster seeks to improve overall economic competitiveness by improving the ease of doing business, and enabling other sectors from the perspective of logistics and supply chain management. The strategic intent is to work with the transport, wholesale and retail sectors (the logistics sector) to enable South Africa to be a global leader in the provision of a safe, reliable, effective, efficient, and fully integrated logistics in support of the sustainable growth of the country's strategic industries. An efficient logistics sector contributes significantly to reduced cost of doing business in the country and improves the competitiveness of products and operations across all industries.

The deregulated nature of the sector has resulted in destructive competition at a micro-logistics level, manifested through practices such as poor maintenance of vehicles, poor labour practices, and overloading of vehicles. Subdued capital investment to expand the capacity and quality of rail infrastructure has increasingly resulted in the shift of goods from rail to road, consequently leading to road network bottlenecks in the vicinity of ports, and increased frequency and severity of road crashes. Low levels of efficiencies in ports, customs, and within the supply chain practices of individual firms, translate to poor macro-logistics performance. In fact, South Africa's Logistics Performance Index, published by the World Bank, has increasingly worsened relative to major trading partners. High levels of unproductive vehicle kilometres, in the form of empty return trips, contribute to increased greenhouse gas emissions. Often this happens because of little collaboration between micro-logistics actors and lack of appropriate communication infrastructure to facilitate such collaboration.

To improve logistics competitiveness across South Africa's strategic industries, improvements are required across the value chain (inbound, operations and outbound logistics) to constantly monitor and reduce logistics costs. This will require deliberate interventions in the form of improved data management in the logistics sector to match the forms of supply to demand and reduce inventory costs, reduce delivery lead times and increase asset productivity. Improved data management in the form of increasing data availability in real time, interoperability of data platforms across different actors in the value chain, and appropriate packaging of data and data analytics for end users will be value transformative to the sector's performance. The development of macro-logistics network models to help manage network bottlenecks to improve network reliability and demonstrating the ability of various technology and management tools to improve safety of operations to influence the adoption of appropriate macro-level policies will be essential.

The envisaged outcome is a connected and robotised logistics system, including infrastructure, to maximise the efficiency and productivity associated with transport and logistics. This is especially important for a resource extraction country that is spatially divided, with raw materials centres located far away from areas of value addition and consumption. Exporting the know-how in the logistics sector to other parts of the African continent to effectively service the ever-growing urban consumer economies, and to facilitate efficient and effective inter-Africa trade, is a significant opportunity for SA's logistics sector.

A.2.1.7 Defence and Security

The *Defence and Security* cluster focuses on these two sectors and intends to build resilient defence and security capabilities for South Africa to ensure secure borders and enable the safety of all inhabitants, while fostering a secure platform for business to conduct industrial/economic activities. Considering that the sector is a major contributor to expanding and deepening the national skills base and furthering national industrialisation policies, generating foreign currency earnings from equipment exports with related services, and creating employment, as well as other national benefits, it is clear that the South African defence and security sector is key to the strategic security of the republic's sovereignty and ensuring the safety of its inhabitants. The sector also plays a strategic role in contributing to economic prosperity.

The defence sector employs over 70 000 people. It is a net exporter (62% of output is exported), despite its relatively small contribution to GDP (R15bn). The South African population face escalating crime rates. With a staggering 349% increase in business robberies over the past 11 years, these crime rates also adversely affect the economy. The cost of violence in South Africa is 22.3% of GDP. The safety and security industry employs more than 758 740 people (>368 210 in the private sector). It is predicted that the global cybersecurity market will grow at 10,7% between 2017 and 2023 (20,41% predicted for Africa). Cybersecurity risk and its adverse impacts have increased drastically, both globally and in South Africa over the past decade. South Africa is considered to be one of the countries that is worst affected by cyber-attacks, costing the economy an estimated R5 billion a year (Fripp, 2014).

The sector's numerous challenges include:

- A cybersecurity industry dominated by several dominant players that are unable to meet agile/new security threats;
- Significant global cybersecurity skills shortages;
- A lack of cybersecurity awareness that impacts organisations and civil society negatively;
- Increased criminal attacks on key national infrastructure, such as that managed by Eskom and Transnet, as well as cash-in-transit heists;
- Lack of integrated security solutions;
- Deficient private security industry regulations, risking its militarisation and abuse of force;
- Low national defence spending at 0.98% of the GDP;
- Decreasing R&D budget for the South African defence industry;
- Inadequate cross-cutting manufacturing technologies;
- Lack of collaborative R&D across related technology domains;
- Limited focused R&D funding; and
- Fluctuating defence demand.

The envisaged outcome is thus to enable integrated national defence and security solutions in South Africa, by being pre-emptive and adaptive through hardened intelligence defence and security offerings, linking into global supply chain markets.

A.2.1.8 Next Gen Enterprises and Institutions

The *NextGen Enterprises and Institutions* cluster addresses the challenges and opportunities of public institutions and private service enterprises, state-owned entities, municipal services, notary services, insurance banking etc. It will enable the transition of South Africa's public institutions into a digitalised era that will support effective (public and private) service delivery, improve government transparency and accountability, and cultivate a connected platform that supports service provision, and industrial and societal advancement.

South Africa is ranked 82nd out of 130 in the ease of doing business index (WBG, 2018). This is supported by findings in the global IT report, which states that in the *Use of ICT for Economic and Social Impact*, the country did well in the business category by obtaining a ranking of 30 out of 130, while the country did not do so well in the government category where we obtained a score in the lower hundreds of the 130 countries assessed (World Economic Forum, 2016). Pain points affecting public institutions include:

- Absence of policy coordination/alignment mechanisms by/in government departments and state institutions;
- Fragmentation in systems and inability to access or integrate data;
- Poor connectivity and high costs as a result of underdeveloped or underutilised ICT infrastructure, considering that the digital divide is still a significant challenge;
- Privacy and security as key prohibitors for digitising public institutions;
- Paper-based processes and systems; and
- Current financing, which is limiting the magnitude and scope of institutional digitalising and integration.

Modernisation within the public sphere will have a positive impact on industrial development in terms of the ease of doing business (e.g. applications, permits, visas, processes) and the confidence resulting from the transparency and reliability in public sector information.

The envisaged impact is for the CSIR to be the enabling force behind the transition of South Africa's public institutions into a digitalised era that will support effective public service delivery, and improve government transparency and accountability and cultivate a connected platform that supports industrial and societal advancement. The CSIR will focus predominantly on building digital tools and systems, efficient data generation and acquisition as well as data processing and analytics in line with emerging trends to transition from traditional paper-based services to fully digital services, ranging from information provision through digitally enhanced and supported offerings to full conclusion of a public service.

A.2.1.9 Smart Places

The *Smart Places* cluster addresses the challenges and opportunities of public institutions, transportation and logistics, utilities, ICT, business and financial services, education, and health sectors. It aims to effect smarter resource use, infrastructure and service developments directed towards enabling competitive manufacturing environments and sustainable economic growth. In addition, it will improve the ease and effectiveness of doing business. Lowering the cost of transport and communications; improving availability and reducing the cost of water and electricity while fixing roads and infrastructure are minimum requirements.

Well-functioning infrastructure and an efficient built environment are crucial to socioeconomic development and poverty alleviation. Creating Smart Places is important as it is a proven enabler that allows industries to have wider economic impact and reach. While infrastructure alone will not lead directly to best-in-class manufacturing, a serious lack of infrastructure or a steadily decaying infrastructure will negatively impact a nation's manufacturing competitiveness and create serious obstacles for the supply chain networks of manufacturers (WEF 2018). Addressing this challenge will help to ensure sustainable growth in the future.

Climate change and resource-use trade-offs are also impacting on industrial activity in South Africa. From this perspective, the two priorities are creating sustainable economic opportunities derived from the natural resource endowment of South Africa and reducing the risk of costly and misinformed decisions on natural resource and environment related issues.

Interventions proposed include measures to reduce input cost for manufacturers; options to invest in catalytic infrastructure projects, such as a new pipeline to bring natural gas from Mozambique into South Africa, using South African steel and pipe to lower the cost of natural gas; and supporting municipalities with the capacity to deliver and maintain infrastructure, as these are in the first line of service delivery.

Smart interventions support prudent resource use through trade off modelling, ensure connectivity between resources and enabling industries that have a large economic impact and reach (e.g. health, education, transport, ICT, electricity), and ensure productivity and growth across multiple industries. Without enablers, the economy will have segmented players operating independently and not leveraging each other's strengths.

Smart interventions will include smart maintenance, which is an imperative for sustaining public service offerings and will strengthen quality, performance and interactivity through ICT and innovation. The CSIR's response will cover the full value chain, and is predicated upon harnessing the opportunities afforded by transformative technologies to develop smarter resource use, infrastructure, and service developments directed towards enabling competitive industrial environments and sustainable economic growth. Current relevant programmes related to smart infrastructure include smart spatial planning (Earth Observation and IT), intelligent systems as well as advanced materials and processes. Relevant municipal programmes include science, engineering and technology solutions for infrastructure delivery as well as capacity and capability-driven local economic development.

A.2.2 Business and Operational Models

A.2.2.1 Business Model

The renewed CSIR business model aims to close these gaps so that the organisation can capture the opportunities identified in the strategy. In line with the CSIR's strategic direction to amplify the 'I' in CSIR, the key purpose of renewing the CSIR's business model is to increase income and increase relevance to the private sector. The business model enables the CSIR to enhance its way of doing business through the following measures:

- **Deepening partnerships with HEIs**

Formal partnerships with HEIs will include short- and long-term defined areas of collaboration and supporting KPIs. The CSIR will proactively seek opportunities to co-locate at universities across South Africa or will invite universities to co-locate on the CSIR campus. Increasing joint and collaborative R&D projects with HEIs remains a priority.

- **Deepening partnerships with industry**

The CSIR's business development capabilities will be strengthened and business development activities will be clarified and coordinated by embedding these into the operating model and strengthening the requisite capabilities. Compelling value propositions (e.g. shared innovation centres) will be developed as part of pursuing the development of new partnership agreements with the target public, private and innovation partners identified for each cluster. Informal partnerships will be developed by promoting secondments and the mobility of CSIR staff to industry.

- **Increasing focus on innovation**

The CSIR aims to introduce innovation-focused services targeted at helping clients develop and implement ideas while going beyond the provision of science and technology only. These services will require that innovation capability gaps are addressed through upskilling, partnering or hiring of staff with the required complementary skills. The CSIR will adopt open innovation practices such as shared innovation centres and open innovation or open access platforms.

- **Improving physical proximity to industry**

The mobility of CSIR staff will be increased and the organisation's proximity to industry improved through the introduction of secondments as a service. Co-location with industry on the CSIR's campus will include offering discounted rental charges for the leasing of land and buildings on its campus to high priority customers; and introducing spaces such as shared innovation centres that will attract industry to co-locate with the CSIR on its campus. The location of future physical infrastructure will be carefully considered to make the CSIR more accessible to industry.

- **Enhancing portfolio of services**

The CSIR will aim to enhance its portfolio of services by increasing its focus on the later stages of the technology readiness level (TRL) scale and increasing its income from technology transfer.

- **Balancing a CSIR R&D programme and strategic cluster alignment perspective**

See Section A.2.2.2 below

A.2.2.2 Operating Model

The primary purpose of the operating model is to enable the execution of the organisation's strategy through the identified core business offerings. Additionally the operating model design aims to address areas of improvement in the organisation. To best enable the strategy and address key challenges, organisational design best practices applied by other RTOs and service offering firms were considered. A detailed assessment of the organisation's value proposition identified the following strengths and weaknesses:

Key Strengths	Clearly **distinguishes core & support functions**	• The organisation has sufficient clarity around the distinction between core and support functions
	Allows for **clearly defined accountability at operational level**	• All accountability is fully contained within the Operating Units. Each Operating Unit is responsible for the monitoring and reporting of performance, including P&L and operational performance
	Has **Business Development capabilities** focused on SOEs	• Existing capabilities and resources to develop a limited number of strategic customer relationships, mostly focused on state owned entities
Areas for Improvement	Does not adequately support **customer relationship development to drive CSIR's industrial objective**	• R&DI activities are not industry oriented, preventing the strengthening of existing and potential industry relationships. BD responsibilities lie within the OU, are not well defined and often lack capability • Does not support coordinated private sector interaction
	Does not adequately support **commercialisation of core R&DI** offerings in industry & private sector	• Does not enable the commercialisation of R&DI initiatives. Inappropriate commercial skillset within the OUs & typically focused on public sector
	Promotes **siloed, independent OUs disabling cross-functional collaboration & efficiency**	• Does not allow for inter-unit collaboration, encouraging a siloed way of working with limited integration and coordination • No permanent structure to enable collaboration. Currently ad hoc RDI programmes support some degree of collaboration
	Allows for **duplication of functions across OUs** creating inefficiencies	• Features duplication of functions across multiple units, not effectively utilising people & financial resources, e.g. NLC & DPSS • CSIR's supporting functions are currently not organised optimally
	Does **not support the agility, flexibility and adaptability** required of an RTO	• Rigid with complex governance structures and approvals, hindering the organisation's ability to respond to evolving customer needs. No direct line of reporting between leadership and core business activities

Figure A.5: Assessment of current strengths and weaknesses in the CSIR value proposition

To retain the key strengths and address the organisational weaknesses, the following design principles were considered:

- **Enable the strategy, mission and vision:** Translate the CSIR's renewed strategic directions into directed multi-disciplinary research and technological innovation with a stronger industry focus
- **Promote customer-centricity and market focus:** Support coordinated relationship building with the private and public sectors to enable greater understanding of their needs and driving commercial relevance
- **Enable collaboration:** Enable collaboration across multiple departments, reduce the silo mentality and drive integrated solutions that fulfil customer needs
- **Promote efficiency and agility:** Improve business performance through more effective use of resources, enabling of a less bureaucratic organisation and promoting responsiveness to customer needs
- **Elevate core business representation:** Have sufficient representation from core business functions at a senior leadership level, enabling empowered accountability and driving collaboration
- **Endorse implementation and leadership buy-in:** Support a manageable transition from the as-is to the to-be model and support the successful, sustainable execution of the renewed strategy

A renewed operating structure has been defined to address the design principles mentioned above (Figure A.6:). Key changes in this structure include:

- **Divisional group executives** to address the representation of core business at executive leadership level;
- **Divisional level business development and commercialisation** to promote better stakeholder relationship management, focused commercialisation, efficiency and agility;
- **Research, development and industry advisory panel** to ensure that our work is relevant and responsive to industry and national needs; and
- **Cross cutting research centers** that house capability that can be applied across the CSIR.

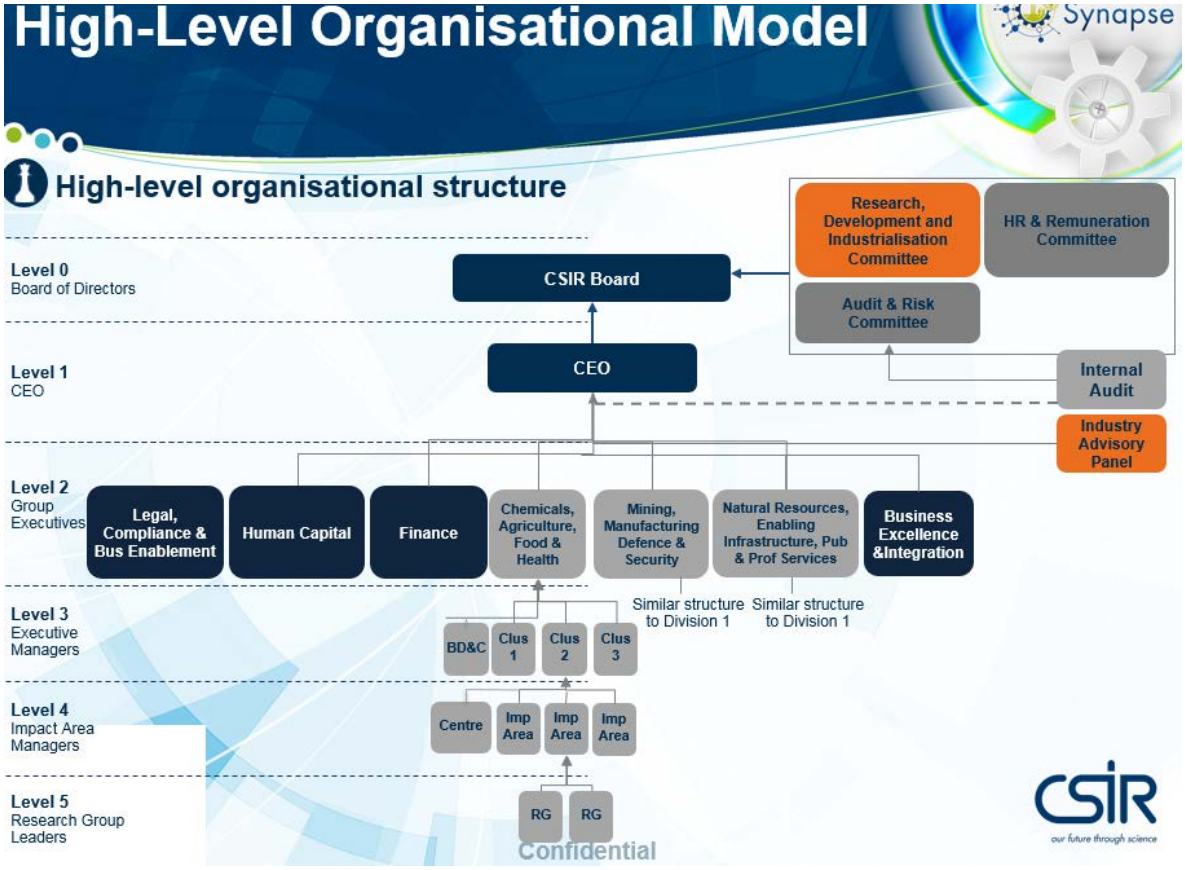

Figure A.6: Renewed operating model of the CSIR (Imp Area – Implementation Area; RG – Research Group)

From a technology and sector focus point of view, the renewed CSIR operating model and structure focus on three divisions, namely (a) Chemicals, Agriculture, Food and Health (b) Mining, Manufacturing, Defence and Security and (c) Natural Resources, Enabling Infrastructure, Public and Professional Services (Figure A.A.7). A division is a market-facing unit – the 'structural home' of clusters, centres, impact areas and research groups that share complementary competences to promote collaboration and drive efficiency, and that share synergies in process, products and solutions. The division enables inter- and intra-divisional collaboration as appropriate, and has a broad, external overview of the industries targeted for CSIR impact to ensure our response remains relevant. These span several industries and involve collaboration with a host of public and private sector stakeholders, funding partners, industry associations, higher education institutions, and other innovation partners. Each division is composed of three of the strategic clusters discussed in A.2 and appropriate research centres. Research centres in the CSIR are areas where research and technology in specific areas is consolidated and further developed into deep world-class capabilities

to support multiple areas of application across the organisation. Centres are housed in clusters where the relevant competences are most established, but capabilities are deployed across all areas where they are required in the CSIR and the National System of Innovation (NSI).

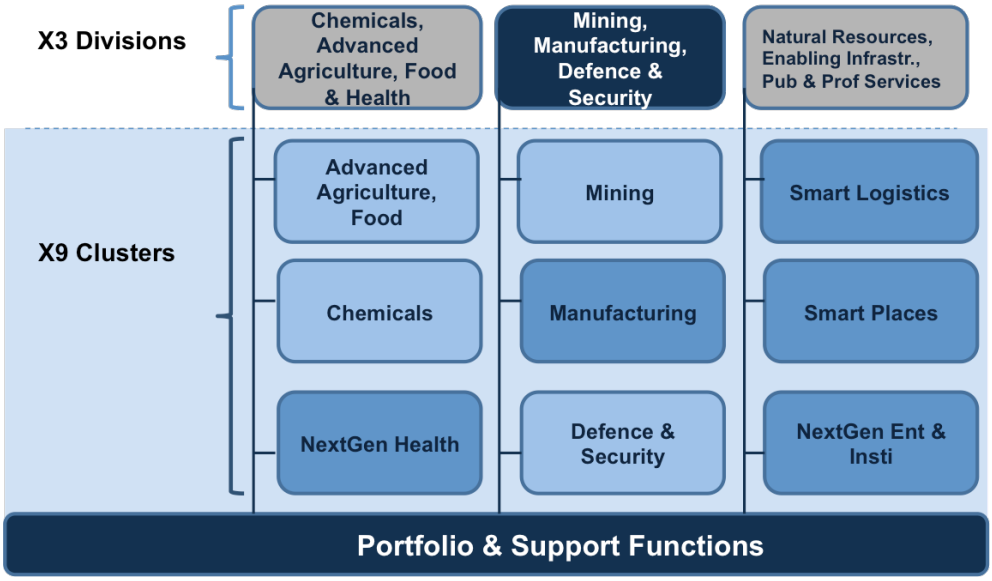

Figure A.7: CSIR Operational Divisions and Strategic Clusters

A.3 Strategic Objectives

SO1: Conduct research, development and Innovation, localise transformative technologies and accelerate their diffusion.

SO2: Collaboratively improve the competitiveness of high-impact industries to support South Africa's re-industrialisation.

SO3: Drive the socioeconomic transformation through RD&I which supports the development of a capable state.

SO4: Build and transform human capital and infrastructure.

SO5: Diversify income, maintain financial sustainability and good governance.

A.3.1 SO1: Conduct research, Development and innovation, localise transformative technologies and accelerate their diffusion

The convergence and the pace of new technologies are fundamentally disrupting industries and require localised RD&I. This strategic objective will be achieved through accelerating the innovation, localisation and diffusion of transformative technologies in South Africa's high-impact industries through high quality RD&I.

A.3.1.1 Strategic Programmes

Under the ***mining (development and) operations cluster***, the CSIR will focus on processes ensuring efficiency so that mines can maximise the recovery of the mineral wealth in a safe and sustainable manner. It will focus on input resource optimisation, modernised mining engineering and non-explosive rock breaking. The CSIR will build on current programmes on geophysics and rock engineering, mining engineering, sensor development and robotics and automation. CSIR priorities include the optimisation of current mining; advanced orebody knowledge; mechanised mining; non-explosive rock breaking; and real-time information management systems. Overall, the cluster will endeavour to improve upstream and downstream linkages between mines and domestic industrial stakeholders by promoting innovation, technological advances and R&D.

Chemicals product development will focus on the development of specialty powders, nano-materials, and specialty alloys, building on the Titanium Acceleration Master Plan and the South African Aluminium Industries Roadmap, among others.

In the ***post-mining landscapes***, the cluster will aim to facilitate effective closures and rehabilitation of mining sites to minimise environmental impact.

Precision agriculture will contribute to the development of more competitive industry and rural economies by supporting agricultural production through earth observation, climate change modelling, big data, and data analytics to support land use planning and to monitor pests and diseases. Precision agriculture tools, including equipment telematics, will also be harnessed to improve farm operations. This platform will harness existing programmes in precision agriculture such as robotic crop monitoring (Smart Farm initiative) to improve operations, increase efficiencies while preserving quality, animal tagging and health monitoring.

A*groprocessing* seeks to modify and facilitate the transfer of fit-for-purpose 'urban' agro-processing technologies into rural settings, developing value-added processing of crops, including high-value indigenous plants. The programmes will incorporate the development of advanced capabilities for food safety testing efficiency and accuracy as well as automated production line technologies. The cluster will also focus on the development of flexible and innovative business models suitable for the rural economy. Existing interventions in this area include product and process development, value addition to indigenous plant resources through processing, and development and implementation of community-based business models through the agriparks initiative. The CSIR will continue to focus predominantly on product and process development and upscaling of manufacturing technologies to bridge the gap between research and product manufacturing.

A*dvanced Agro-processing* will scout for best-in-class process technologies for localisation and diffusion, and will include integration of existing agroprocessing activities with modern bioprocessing and bio refinery technologies as well as modern digital technologies. Programmes will also include automated and intelligent production, optimised smart packaging development and integrated supplier development. The programme will build on existing interventions such as the Bio refinery Industry Development Facility and the Bio manufacturing Industry Development Centre, which are important components of this integrated approach. Other relevant existing industries include produce (not product) lifecycle management, smart factory and logistics.

Medical devices and diagnostics will develop a thriving local medical devices and diagnostic industry and position South Africa as a key exporter of these technologies. The CSIR will focus

predominantly on synergistic molecular and integrated diagnostics that are designed to meet the ASSURED needs of the developing world, mobile healthcare coordination and new payment systems. Existing interventions in this area include the implementation of product lifecycle management and advanced manufacturing support. New interventions focus on facilitating and accelerating the commercialisation of medical devices and diagnostics, through the provision of advanced materials for health applications, product testing infrastructure, incubation, regulatory and smart logistics support. The CSIR will continue to develop existing programmes and capabilities applicable to this platform, including materials and systems technology (lateral flow and diagnostics, micro-fabrication, nano-sensors and battery technology).

Data will focus on authentic, secure and distributed data acquisition and management (task-specific), digitisation and digital twinning. Interoperability standards and frameworks, and digital exchanges are critical for this platform.

Analytics will include a focus on artificial intelligence (AI) to inform decision-making, AI-enabled data processing and analytics to drive autonomous decision-making as well as generic/non-task specific AI. Integration and scaling will benefit from current speech systems in local languages and data science analytics.

The **Thematic programme** is a competitive fund that supports one- or three-year projects that are of strategic relevance to the organisation. This programme will be reviewed and aligned with the new organisational existing strategy. New projects will be aligned to the themes of the renewed strategy.

A.3.1.2 Emerging Strategic Initiatives

Precision medicine for pharmaceutical treatments will develop innovative technology platforms and African-specific testing to reduce development time, save on investment costs and lower barriers to market entry. It will focus on precision medicine, companion diagnostics and stem cell technology to discover protein-biomarker treatments, predict adverse drug reactions, develop novel models of disease and investigate nanotechnology for targeted drug delivery and precision treatments.

The health cluster will leverage existing precision medicine RD&I initiatives to grow tele-medicine, novel individual and population specific disease treatments, and clinical integration. The existing Biomedical Translational Research Initiative and National Centre for Nano-structured Materials will remain critical enablers of this platform.

Pharmaceutical innovation technology will enable a dynamic African pharmaceuticals manufacturing industry with access to critical and modern drugs through innovative and world-class processing technology aimed at leapfrogging current batch manufacturing with continuous manufacturing technology. The CSIR will focus predominantly on upscaling locally developed and inbound processing technologies to bridge the gap between research and development and product manufacturing. Existing interventions in this area include process modelling and development, with specific focus on chemical process development, and process engineering and modelling. New interventions will focus on setting up demonstrator projects to initially develop both small molecule and biologic oncology drugs, establishing international knowledge exchange programmes, establishing ‘open labs’ for translational research and the scale-up of process routes, with technology transfer mechanisms in place to localise international processes. The long-term vision of the platform will focus on the development of fully automated end-to-end green production processes.

A.3.1.3 Ring-fenced DST Initiatives

A.3.1.3.1 Implementing the national ICT Roadmap

Ring-fenced Parliamentary Grant (PG) is used across our key focus areas and ICT RD&I interventions. The investment is aligned with the ICT RD&I Roadmap and utilised to ensure CSIR contribution to RD&I that brings the country closer to the goals of the ICT RD&I Roadmap. The capabilities responsible for delivery of these activities have been realigned in the new strategy for greater efficiency. For example, all capabilities for e-Government have been grouped under the NextGen Institutions and Enterprises Cluster:

Digitalisation of Government. The CSIR will pursue three key strategic activities: ***e-Government***, ***eHealth*** and ***Oceans and Coasts Monitoring***. The organisation will maintain the focus in these areas as per the national Roadmap.

Digitalisation of Industry. Development of technology building blocks and proof of concepts of end-to-end solutions in a few specific industrial sectors. This objective will be enhanced under the new strategy, with a concerted focus across the organisation on disruptive technologies, such as those embodied under the fourth industrial revolution).

ICT Sector Growth and Transformation. Enable flexible management of and access to radio frequency spectrum. A related challenge is the availability of low-cost and flexible network and radio equipment and associated infrastructure deployment models to support emerging business models. A dedicated data science centre will pursue this objective.

Information Security. Under the new strategy all information security related competencies, such as cybersecurity and biometrics, have been grouped into an Information Security Centre within the Safety and Security cluster.

A.3.1.3.2 The National Laser Centre

The National Laser Centre aims to develop and apply novel laser application across a variety of sectors. The centre is involved in early-stage research (development of novel lasers and applications) through to late-stage research (additive manufacturing, prototyping) and developing service-based solutions (laser-based refurbishment and engineering). Activities can be summarised as:

- Additive manufacturing - Develop and transfer novel technologies to advance the competitiveness of the South African manufacturing industry through efficient final part production, and superior manufacturing system performance.
- Laser materials processing - Develop and transfer manufacturing processes to reduce operational costs and improve efficiencies for the manufacturing, transport and power- generation industries through the improvement of material properties of structural or functional equipment, or the material processing of raw material or production components in industrial processes.
- Enterprise creation and development - The Photonic Prototyping Facility provides the necessary infrastructure, skills and expertise for the prototyping and product development of photonics

technologies, which will lead to competitive offerings being available for transfer to established industry and new or emerging SMMEs.

- The Rental Pool and African Laser Centre programmes are principally directed programmes that seek to train a corps of top laser researchers with postgraduate qualifications as key drivers. These programmes directly support South Africa's international research and innovation competitiveness while responding to the country's social and economic challenges. It does this by providing cutting-edge laser equipment and diagnostics to HEIs, supporting the operational and maintenance aspect of the equipment, and also providing mobility support for South African researchers to collaborate with counterparts from the African continent.
- The programmes of the national laser centre will be integrated to the new photonics research center within the manufacturing cluster.

A.3.1.3.3 The National Integrated Cyberinfrastructure System

The National Integrated Cyberinfrastructure System (NICIS) is a national cyberinfrastructure system that enables, supports, enhances and contributes to the performance of the national science ecosystem as a whole.

NICIS promotes scientific and industrial development through the provision of high performance computing capability (CHPC), high speed network capacity (SANReN), a national data intensive research infrastructure (DIRISA) and a human capital development pillar integrated horizontally into globally connected systems and hierarchically into a local system providing seamless access to the research and teaching community.

This integrated cyberinfrastructure enables national socioeconomic development through new forms of scientific and industrial development, the solving of previously intractable computational challenges of national importance, harnessing the Big Data[3] revolution, enabling national and international science and education collaboration through high speed networking, and supporting South Africa's role and positioning in Grand Science endeavours such as the Square Kilometre Array (SKA) initiative.

The key strategic objectives of NICIS are to:

- Sustain a world class and relevant national integrated cyberinfrastructure system for Science and Technology.
- Enable and promote eScience in South Africa.
- Position South Africa to take part in, host and lead large scale global research and science projects (e.g. SKA and CERN experiments).
- Provide thought leadership to South Africa's evolving cyberinfrastructure strategy and activities, and facilitate the uptake of advanced cyberinfrastructure.
- Foster the development of human capacity in cyberinfrastructure and its application, and contribute to the transformation of this sector.

[3] Technological, conceptual and methodological capacity to manipulate massive amounts of data is becoming an important driver of techno-economic development, impacting on a wide range of economic sectors, including manufacturing, biotechnology and pharmaceutics, and the financial services sector; this development has become known as the "Big Data" revolution

A.3.2 SO2: Collaboratively improve the competitiveness of high impact industries to support South Africa's re-industrialisation

South Africa has undergone de-industrialisation over the last decade. This strategic objective seeks to improve the competitiveness of SA's high-impact industries through RD&I in a collaborative manner with partners, thereby contributing to the re-industrialisation of the country.

A.3.2.1 Strategic Programmes

Biochemical conversions will apply disruptive and innovative (bio)-chemical conversion technology to create a dynamic African chemical industry with access to forward-looking and modern digitised and greener production processes.

The CSIR's strategic response includes scouting for technologies that are aligned with the cluster focus areas for localisation and diffusion; merging fundamental industrial biotechnology with green chemistry; and converging information technology with chemistry, synthetic biology and metabolic engineering in line with the envisaged impact for the chemical and allied industries. The CSIR will continue to develop existing programmes and capabilities aligned with biochemical conversion, notably the Biorefinery Industry Development Facility and the Biomanufacturing Industry Development Centre.

Advanced materials aims to develop modified or advanced types of materials that have been engineered to provide superior performance across one or more characteristics. It will expand niche and specialty chemicals categories, generate novel inputs for advanced materials, green production methods and improved process efficiencies for existing and new products.

The cluster will leverage existing RD&I initiatives to grow polymers and composites programmes as inputs for advanced materials, and will develop new or modified materials, while introducing green production methods and focus on process efficiencies. The existing National Centre for Nano-structured Materials, focusing on nano-catalyst design and polymers, and the Titanium Centre of Competence remain critical enablers of this platform.

Engineered materials focuses on raw material beneficiation, especially titanium, aluminium and platinum group metals; import replacement of specialty metals and alloys, advanced polymers, plastics and next-generation composites and fibres; the testing and qualification capability for new material; and nurturing end-to-end value chains working collaboratively with the end users. It will innovate across the materials value chain, exploiting Industry 4.0 technologies, as well as develop novel advanced materials to provide local industry with a globally competitive edge. For this platform, the CSIR will develop nano-particle-enhanced metal alloys and composites; formulate advanced polymers; as well as next-generation composites, fibres and alloys. Existing interventions that can be leveraged include the nano materials initiative; work done with respect to lightweight and titanium alloys, polymers, nano-composite thermoplastics; and nano-, natural fibre-, and metal-matrix composites.

Parts fabrication aims to strengthen parts fabrication and manufacturing capabilities to increase exports, expand design capabilities and intelligent technologies for manufacturing equipment and

machinery, establish testing and certification capabilities to qualify new fabrication processes, improve the production mix flexibility, and streamline internal logistics as well as improve the responsiveness of the supply chain. Interventions in this area include advanced fabrication and monitoring, and developing integrated factories where issues of materials processing, planning and control, and materials handling are considered. Full integration of computer-aided design and computer-aided manufacturing will be brought to bear in the factory and supply chain. Existing CSIR programmes and capabilities focus on titanium laser additive manufacturing, titanium metal injection moulding, mould and tool making, the foundry initiative, and laser-enabled manufacturing.

Inbound and outbound logistics operations will include integrated supply chain design, testing, modelling and optimisation, remote sensing to determine global commodity movements, driverless vehicles and unmanned aerial vehicle (UAV) solutions for UAV-autonomous delivery (last mile logistics) and related technologies, real-time tracking, monitoring and management of fleet, infrastructure and commodities systems and platforms.

A.3.2.2 Emerging Strategic Initiatives

The CSIR aims to support the development and integration of complex subsystems, the development of advanced factory systems and supply chain integration capabilities through streamlined internal logistics to improve production efficiencies and to facilitate integration into global OEMs. It will develop agile supply chains, and contribute to increasing product exports and global market presence. The CSIR will focus on improving global supply chain integration capabilities and will establish product life-cycle management (PLM) as a supply chain integration platform. It will focus on product and systems development in advanced industries. The organisation's existing PLM and factory optimisation capabilities will be leveraged.

A.3.3 SO3: Drive the socioeconomic transformation through RD&I which supports the development of a capable state

Economic and social development in South Africa has been constrained by the challenges of inequality, unemployment and poverty. The CSIR aims to play a pivotal role in the socioeconomic transformation of South Africa through RD&I and contribute to supporting the development of a capable state and enabling government to drive the socioeconomic transformation of South Africa through RD&I.

A.3.3.1 Strategic Programmes

Health information systems will apply interoperable health information systems for continuity of care and patient-centric healthcare delivery. The CSIR's strategic response ensures an appropriate and up-to-date standards framework for eHealth systems, provides technical guidance for the

implementation of standards, establishes national certification of standards' compliance and establishes national shared ICT infrastructure for health data exchange.

The CSIR's strategic response includes a health normative standards framework and shared national ICT infrastructure, with an additional focus on data mining using digital and cognitive technologies to produce insights and trends for health system planning. The existing eHealth capabilities of interoperability of health information systems and information security remain critical enablers of this platform.

Cybersecurity offers analysis, modelling and decision support to strategic partners in solving complex crime problems, including cybercrime; non-visual and visual crime-sensing systems; deep and machine learning; big data crime analysis in crime prevention domain implementations; bandwidth enhancement in integration of crime prevention network communication systems; identity authentication to combat cybercrime; and basic design and development of security systems to compete with large, multi-national companies. These initiatives build on the national cybersecurity capability programme.

Civil security offers command and control capabilities for crowd management; sensor systems for homes, businesses and critical infrastructure that will enable authorities to identify and react quicker to criminal activities; integrated security solutions for infrastructure security; and security solutions for the cash-in-transit industry. These interventions build on the numerous security cluster capabilities and decision support tools.

Logistics operations will focus on automated consumables management and procurement optimisation, as well as fully automated and intelligent warehouse management systems and technologies. These initiatives will leverage current programmes, which include Smart Vehicles (purpose-designed vehicles and data interoperability and intelligent monitoring), Road Transport Management System (SABS standard developed for this purpose), Decision Support which is inclusive of spatial planning and urban/rural decision support systems, and transport models for various cities as well as the Transnet modernisation programme focusing on real-time monitoring and control of fleet; and intelligent operations such as *IntelliPorts.*

Digital systems will include integrated platforms to digitise public institutions, intergovernmental/societal platforms in the medium term and quantum computing in the long term. Foundational information, infrastructure and programmes will include biometrics and digital identifiers, cyber security, advanced software development and registries.

The ***(hard and soft) infrastructure*** interventions include capacitating all spheres of government to fix and improve all aspects relating to smart places; enabling smarter connected resources and infrastructures; and revolutionising the way of doing business and delivering services through, for example, new business models and flatter organisational structures. Telecommunications interventions will include Dynamic Spectrum Systems and Network Virtualisation Platforms (5G).

A.3.3.2 Emerging Strategic Initiatives

Integrated Water Research Centre

South Africa is defined as a water scarce country. Both water availability and water quality are major challenges, particularly due to climate change, pollution, industrial effluent, acid mine drainage and salinisation caused by irrigation. More than 10% of South Africans still do not have access to potable water. Water infrastructure in South Africa is rated of poor quality by the South African Institution of Civil Engineering, leading to major losses and water quality problems. The CSIR will develop an integrated water research centre with the aim to:

- Develop coherent water resource decision-support frameworks and address gaps in assessments, technologies, tools and techniques. These include integrated hydrogeological decision-support tools and water risk assessment measures to promote and improve the health of freshwater ecosystems.
- Develop a portfolio of solutions for water treatment and the detection of contaminants. Specific solutions could include rapid pathogen detection technology; novel adsorbents for water treatment; and sea and freshwater buoys to monitor water quality.
- Develop guidelines for norms and standards for water and sanitation services.
- Develop portfolio solutions for smart and efficient water infrastructure management. This could include the integration of a range of technologies to enable the continuous monitoring, diagnosis, control and optimisation of the water distribution network.

Under the new strategy, these objectives remain relevant. The competencies relevant to water research have been grouped into the Water Resource Management centre within the Smart Places Cluster. Over the coming year, the centre will define the required capability and specific objectives to achieve impact.

A.3.3.3 Ring-Fenced DST Initiatives

South African Fourth Industrial Revolution Centre

The South African Fourth Industrial Revolution Centre (SAFIRC) shall be established to create an integrated and comprehensive response to the African and, specifically, South African challenges highlighted in the National Development Plan (NDP) as well as those that are new and emerging, by leveraging the current wave of technological revolution. The proposed centre will assist with the coordination of research, innovation and conformance standards testing to enable Africa to effectively tackle its socioeconomic challenges and consequently become competitive participants in the global economy. Specifically, the centre aspires to:

- Become the collaborative platform for South Africa to effectively take advantage of the fourth industrial revolution for growth;
- Build a national capability in evidence-based policy formulation and regulatory support, relating to the adoption of converging and transformative technologies;

- Be the driver, in collaboration with partners in the NSI, as well as the public and private sectors of the innovation and or adoption of disruptive technologies for the benefit of Africa;
- Assist in strengthening the enabling environment for the development, commercialisation and uptake of disruptive technology; and
- Catalyse industry transformation.

Due to the globalised nature of the economy, South Africa and Africa as a whole will need to actively collaborate internally and externally to remain competitive. To this end, the proposed collaborative platform, SAFIRC, shall harness the collective innovation potential of the NSI, the private sector (for technology supply and adoption) and public sector partners, along with international partners who have demonstrated leadership in the domain of transformative technologies and the fourth industrial revolution. These are entities such as the World Economic Forum and the International Telecommunication Union.

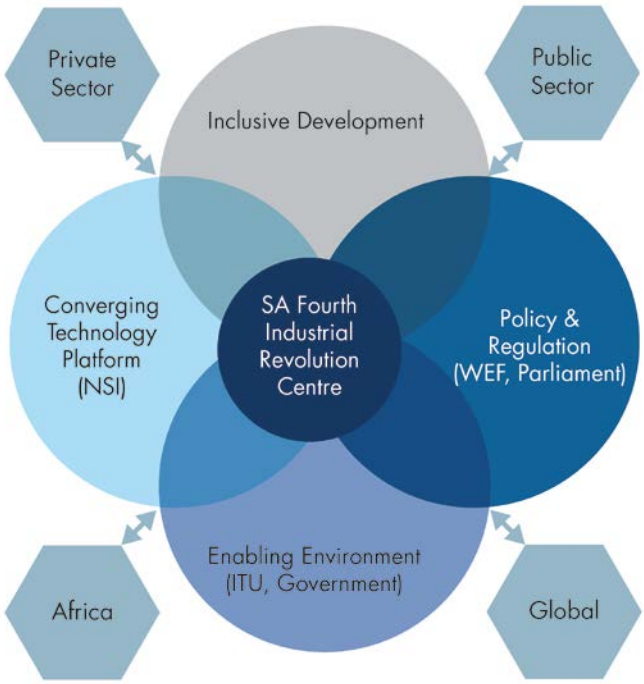

Figure A.8: Focus areas of the SAFIRC.

A.3.4 SO4: Build and transform human capital and infrastructure

There are limited capabilities to leverage the opportunity of new technologies impacting all industry sectors and society. This strategic objective seeks to build and transform the required human capital and infrastructure to drive industrialisation and the advancement of society. It emphasises the need for targeted capability development to leverage emerging technologies and capabilities

A.3.4.1 Overview of Human Capital Portfolio

A.3.4.1.1. Build and transform human capital strategic objective

The new CSIR strategy aims to reposition our efforts to amplify the “I” in CSIR. In addition, the CSIR needs to continuously respond to the changes in the external environment and has therefore embarked on a journey towards a high performance culture. One of the main aims of the culture change is to build a skilled, motivated, high-performing and diverse workforce.

The continuous efforts to professionalise our human capital will enable a greater understanding of our stakeholders in the NSI as well as build a workforce ecosystem that is inspired and espouses our values. The ability to accelerate socioeconomic prosperity through research, development, localisation of transformative technologies and innovations will improve South African lives, while a critical measure of success will be the level of a motivated workforce.

‘Building and transforming human capital and infrastructure’ to achieve a skilled, high-performing and diverse workforce that is required to drive industrialisation and the advancement of society is the key strategic objective that anchors how the human capital function will support organisational and organisational culture change.

An optimal organisational design will ensure adequate capacity through a diverse and transformed workforce, with relevant skills and a suitable competence profile. We will continue to attract and build a skilled, motivated, high-performing and diverse workforce that enables us to deliver on our strategy. We have spread the relevant initiatives out over the short, medium and long term so that we can develop our capacity from a diverse talent ecosystem. These initiatives are multi-faceted and encompass improvements to the pipeline development programmes, a strong focus on leadership development, succession planning, performance management, innovative approaches towards sourcing, developing and retaining talent, and creating prospects for the long-term growth of our people. We are also repositioning our employee value proposition and reward and recognition aspects to include tangible and intangible benefits that reinforce a culture of high performance across all functions, portfolios and divisions.

To attain a motivated, high-performing and diverse workforce, the McKinsey 7 S model will be employed to frame our culture-change approach. This simple change model focuses on seven key elements (strategy, structure, systems, shared values, staff, skills, style and systems) of organisational cultural change that the CSIR will focus on over the short, medium and long term.

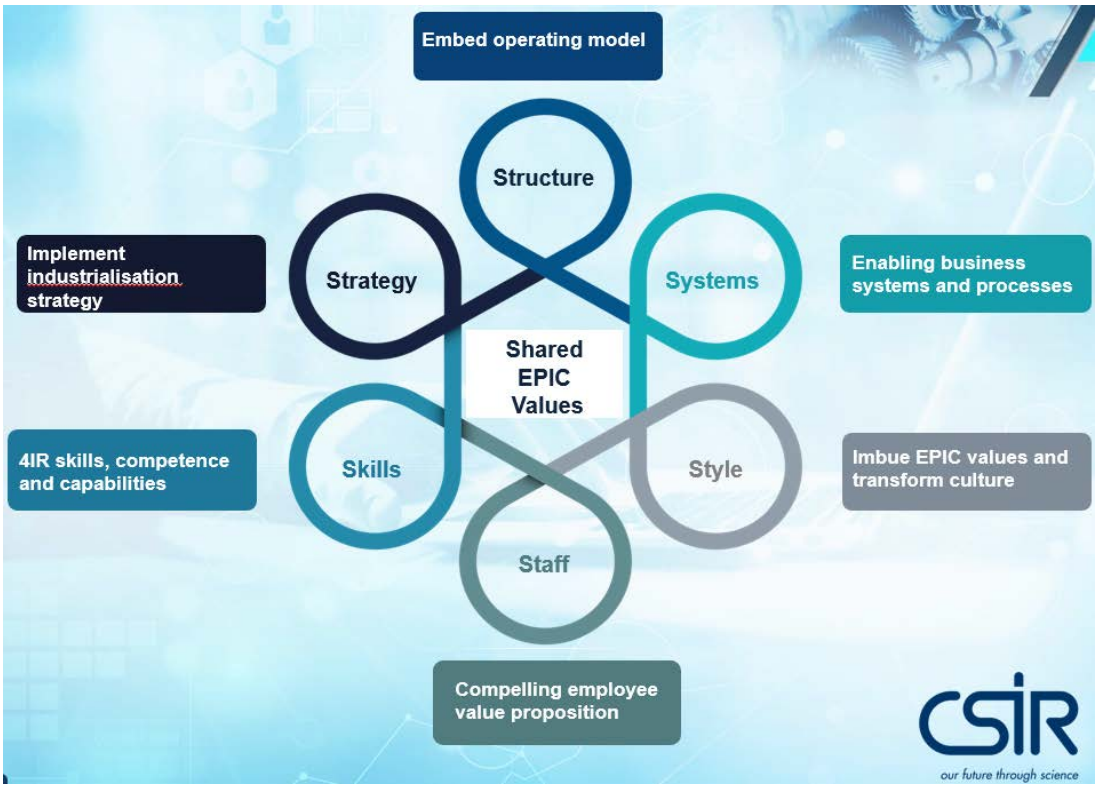

Figure A.9: McKinsey 7 S model to frame our culture-change approach

The interventions we are implementing to build, strengthen and transform our human capital are as follows:

Shared values

- Culture/behaviour – Implement interventions aimed at reiterating and entrenching the importance and the impact of living the values on a continuous basis;
- Continuously improve policies, procedures and business processes aligned to a high-performance culture. Ensure that our policies and procedures and our management approval framework are aligned to empowering and motivating our workforce.

Systems

- Define and review the CSIR's human capital systems that are required to support the high-performance culture. The CSIR has various systems, therefore we need to review these systems and tools to ensure that they are working in a collaborative manner and serve as an enabler of a high-performance culture.

Structure

- Review and adjust the structure to encapsulate skills and competences that will support the strategy;
- Shape and implement an agile organisational design required for a fit-for-purpose workforce.

Skills

- Focus on diversifying the skills and competence of the workforce across various dimensions while attaining transformation targets;
- Develop and entrench a competency framework focusing on technical, leadership and functional competencies;
- Create an agile workforce ecosystem that exposes staff to the broader NSI to deepen insight, knowledge and understanding of the workings of various industries by collaborating with strategic partners in the NSI.

Style

- Develop and institutionalise leadership and behavioural competencies across the organisation;
- Manage the leadership pipeline and succession planning for the CSIR. The intervention will facilitate the development of talent pools for the critical/scarce skills that the CSIR requires for business continuity and to create opportunities for long-term career growth; and
- To ensure a motivated, energised and engaged workforce, senior leadership will embark on key activities and programmes designed to help ensure high employee engagement levels.

Staff

- Reposition the pipeline for greater effectiveness by creating a comprehensive graduate-trainee and internship programme pool to replenish the workforce with professionals working toward professional registration and meaningful experience;
- Continue to grow the number of qualified professionals through our pipeline and our involvement with professional bodies, sector education and training authorities, funding agencies, government departments and universities;
- Introducing 360° evaluation to encourage a culture of giving and receiving feedback; and
- Automating the performance management process and making provision for non-financial recognition and rewards; with the emphasis on managing poor performance.

To effectively address the key organisational cultural interventions above, the CSIR requires competent leaders who will champion change and inspire confidence.

Our competitive advantage is in our human capital. Therefore, attracting and retaining scarce and/or critical skills that are in demand across the economy requires robust recruitment and retention strategies that enable us to compete in the war for talent in the labour market. A renewed employee value proposition – not only in terms of remuneration and benefits but also development opportunities and career growth for the fourth industrial revolution – will be critical for our success.

A.3.4.2 Strategic Infrastructure Programmes

A.3.4.2.1 Overview of infrastructure renewal and development objectives

To achieve the CSIR's new vision, research and general infrastructure renewal and development are key in scientific discovery and producing solutions for industry and society. Our scientific infrastructure includes laboratories, testing facilities, scientific instruments and equipment, and pilot plants needed for research and technological innovation. Our research and development infrastructure is housed on our campuses in Cape Town, Durban, Johannesburg, Pretoria and Stellenbosch.

In the past, the CSIR has invested significantly in equipment and facilities that support scientific development and it is expected that this trend will continue as new areas of research also continue to evolve with time. The CSIR has with support from government embarked on the development of five research and development facilities that provide capability for industrial innovation initiatives such as prototyping, upscaling, pilot manufacturing and testing that allow research to be translated into market-ready products. These facilities include the Prototyping Photonics Facility, the Biomanufacturing Industry Development Centre, the Biorefinery Industry Development Facility, the Nanomaterials Industrial Development Facility, and the Nano-micro **Device Manufacturing**

Facility.

The consequences of the strategic repositioning of the CSIR are that the size and shape of the CSIR will evolve over time. In order for the CSIR to effectively implement its Strategy, it therefore requires modern and appropriate facilities and research infrastructure, and an appropriate, safe and secure environment within which to do its work. Therefore, infrastructure renewal and development is one of the organisation's strategic objectives to ensure business continuity and to support the research programmes and growth.

As a Science Council, the CSIR's facilities and infrastructure and its location directly impact on the work conducted and the organisation's accessibility to the wider research community. There is a continuous need for the provision of facilities that best serve the needs of the wider research community and enable the achievement of world-class research work in line with the CSIR strategy.

In addition to ongoing investments in research equipment and general CSIR facilities and in order to support the CSIR new strategy and industry development needs, the CSIR has embarked on significant long-term strategic interventions in support of infrastructure renewal and development namely, the Energy Autonomous Campus and the CMP.

A.3.4.2.2 CSIR strategic long term infrastructure planning framework – The Campus Master Plan

Given the reduced level of resources available, sharp prioritisation of investment is paramount. This requires difficult trade-offs between investment in new infrastructure and maintenance of existing facilities and infrastructure. The CSIR has developed a long term planning framework - the CMP- to guide the CSIR in making thoughtful, well-informed choices about infrastructure development and renewal in the years ahead for delivering on its future R&D needs.

The framework is rooted on rigorous Capital Investment Planning, projects portfolio management and asset management approach in order to prioritise capital investment in line with the organisational Strategy. The CMP serves as a blueprint that will guide infrastructure development and capital investment plan in the next 10 years to ensure research infrastructure and the built environment is developed in an integrated manner. The framework provides the CSIR and broader stakeholder community with a planning framework within which the long-term development of infrastructure can be executed.

Objectives

- Facilitate a smooth transition from the current to the research campus of the future;
- Enable a knowledge economy and acknowledge the importance of knowledge clusters;
- Support open innovation where outside knowledge is absorbed and a meeting place for talents and best researchers is provided;
- Align campus renewal priorities with current and future RD&I needs and opportunities, and new research areas arising from the new Strategy;
- Pursue an overall development approach that integrates campus planning objectives to continue creating and supporting an innovation ecosystem while fostering fruitful collaborations between CSIR and industry; and
- Support a high tech campus and sustainability.

A phased Implementation Plan has been formulated to ensure the successful implementation of the CMP. The Implementation Plan includes a Roadmap that details the different catalytic phases and precincts to be targeted during different phases of implementation.

A five-year Capital Investment Plan (CIP) translates the CMP vision into the physical needs of the campus, assessing building conditions, and projecting space needs based on programmatic requirements and available campus capacity. The five-year CIP details the capital projects recommended for implementation and funding in the short to medium term, and is the basis for the allocation of the annual capital budget and commitments in determining what will be executed in the next financial year.

The CSIR cannot sustain its capital programme on debt or internal funding alone, and shall rely on significant state funding support and successful fundraising for capital projects. Our capital investment is expected to be supported from financing sources such as:

- Gifts/grants from the public and the private sector;
- Public Private Partnerships to leverage private sector investment;
- Limited internal funding to fund the highest prioritised deferred maintenance and facility renewal needs, focusing on those projects with the greatest life safety impact and on preserving and protecting our core buildings and infrastructure; and
- Debt financing subject to limits imposed through the CSIR Borrowing Plan.

A.3.4.2.7 Strategic Infrastructure Programmes

The Energy Autonomous Campus

The long-term aim is to create an Energy Autonomous Campus at the main Pretoria campus by supplying energy from the three primary energy sources, namely, solar, wind, and biogas from biogenic waste. The power generators will be combined with electricity and heat storage, integration of electric and hydrogen-driven vehicles, power-to-liquid and power-to-gas processes, demand-side management and energy-efficiency measures. The other CSIR campuses across the country will gradually become part of the programme, where in the long- term supply and demand will be virtually balanced across all CSIR campuses, which will form a Virtual Power Plant.

Two existing photo-voltaic (PV) power plants generating 1MW of power have already been installed. Further interventions will include the installation of 1.9MW of rooftop PV, a feasibility study for the installation of a wind turbine (3MW) on the CSIR main campus, a feasibility study for the installation of a Biogas plant (3MW), the implementation of demand side management solutions to reduce demand by 10%, a feasibility study for energy storage options for the CSIR campus including Power-to-Power, Power-to-X and Power-to-Heat, and a feasibility study for the CSIR Campus Smart Grid Development.

The Gateway to Science and Innovation

The “Gateway to Science and Innovation Centre” is being established at the CSIR main campus in Pretoria to support the CSIR’s scientific and industrial development mandate. The Centre is intended to be a national facility that provides a platform to improve and strengthen engagement with relevant stakeholders in the STI community in order to foster innovation and economic growth.

The envisaged outcomes from the successful implementation of the Centre are:

- Increased translation of the CSIR's and partner R&D institutions' technological outputs into products and services for the market;
- Increased number of new start-ups and industry partners commercialising public sector technologies;
- Increased number of high-tech jobs created through technology transfer;
- Prolific awareness and enhanced profile of South African SET activities and infrastructure;
- Increased investment in R&D by the private sector; and
- A thriving SA economy.

The Centre will provide an exciting environment that will attract young people, students, small and medium enterprises, research and technology organisations and a broad spectrum of other parties with an interest in innovation and scientific development. Various activities, programmes and services will be run with the aim of developing skills, encouraging innovation and promoting the development of new enterprises.

The centre will also serve as a gateway to the modern laboratories and research infrastructure, skills and services dedicated for small and medium enterprises. The Centre shall provide access to the research infrastructure, business networks, laboratories in R&D centres, establishing contacts with the scientific community, consulting, aid in technology transfer and commercialisation. The development of the centre will further be a catalyst to deepen engagement with industry and to stimulate cooperation between science and industry creating conditions for enhancing the competitive edge of local high tech companies. The Precinct inclusive of the centre is destined to become one of the most important venues for innovation in the City of Tshwane and in South Africa.

During the 2018/19 period, the feasibility study for the Centre was completed. The CSIR also focused on developing partnerships and support to grow this vision, with various opportunities for all levels of contribution and investment.

In the next financial year, the focus will be on refining and developing the full Business Plan and raising funds for the development and operations of the Centre.

Centralised, shared core facility for multidisciplinary research

Planning is underway to create a large-scale multidisciplinary/interdisciplinary research facility for advancing research through diverse relationships. The shared research facility is intended to serve as a valuable equipment and resource hub for researchers from the CSIR and other organisations including academic, government labs, and industry, who are at the leading edge of scientific discovery. The research facility shall provide access to technologies, equipment, services, and expert consultation, on a fee or reimbursement basis, to enable, facilitate, or enhance the research mission of the CSIR. This facility will provide open access to specialised instrumentation and expertise that enable scientific users from universities, national laboratories, and private industry to carry out experiments and develop theories that could not be done at their home institutions.

The project is currently at the planning stages. In 2018/19 the development of the shared laboratory model including benchmarking study was undertaken. The next steps are to undertake detailed feasibility studies and develop the funding strategy and plan. Furthermore, the CSIR will engage strategic stakeholders to co-invest in the development of the facility.

A.3.4.3 Ring-fenced DST research infrastructure / facilities initiatives

A.3.4.3.1 The National Integrated Cyberinfrastructure System

The National Integrated Cyberinfrastructure System (NICIS) is a national cyberinfrastructure system that enables, supports, enhances and contributes to the performance of the national science ecosystem as a whole.

NICIS promotes scientific and industrial development through the provision of high performance computing capability (CHPC), high speed network capacity (SANReN), a national data intensive research infrastructure (DIRISA) and a human capital development pillar integrated horizontally into globally connected systems and hierarchically into a local system providing seamless access to the research and teaching community.

This integrated cyberinfrastructure enables national socioeconomic development through new forms of scientific and industrial development, the solving of previously intractable computational challenges of national importance, harnessing the Big Data[4] revolution, enabling national and international science and education collaboration through high speed networking, and supporting South Africa's role and positioning in Grand Science endeavours such as the Square Kilometre Array (SKA) initiative.

The key strategic objectives of NICIS are to:

- Sustain a world class and relevant national integrated cyberinfrastructure system for Science and Technology;
- Enable and promote eScience in South Africa;
- Position South Africa to take part in, host and lead large scale global research and science projects (e.g. SKA and CERN experiments);
- Provide thought leadership to South Africa's evolving cyberinfrastructure strategy and activities, and facilitate the uptake of advanced cyberinfrastructure; and
- Foster the development of human capacity in cyberinfrastructure and its application, and contribute to the transformation of this sector.

A.3.5 SO5: Diversify income, maintain financial sustainability and good governance

South African public sector spend in research and development is constrained but remains a country focus. RD&I needs are changing and there is increased competition in the RD&I sector. This strategic objective seeks to improve the CSIR's financial sustainability by diversifying revenue sources and optimising the business model to achieve competitiveness supported by good (efficient and sound) governance.

[4] Technological, conceptual and methodological capacity to manipulate massive amounts of data is becoming an important driver of techno-economic development, impacting on a wide range of economic sectors, including manufacturing, biotechnology and pharmaceutics, and the financial services sector; this development has become known as the "Big Data" revolution

A.3.5.1 Financial Management

Effective financial management is paramount to the CSIR's ability to deliver on its mandate and strategy, whilst ensuring compliance with relevant statutory requirements. The provision of accurate and timely financial information to external stakeholders, customers and CSIR management enables the organisation to meet its financial performance targets and to improve long term financial sustainability, while maintaining good governance and financial compliance. The CSIR has a sound track record with regards to receiving unqualified audit reports from the Auditor-General, which it strives to maintain.

To this end a dedicated team of finance professionals is retained to support the CSIR in meeting its key performance indicators and delivering to the mandate while ensuring that continued good financial governance practices are in place. In order to effectively partner support the CSIR, the Finance team is structured with specific focus areas and key service offerings:

- **Operational Finance:** teams deployed throughout the business form part of the operational management structure and actively assist with the execution of the strategy and business plans through the budgeting, reporting and forecasting activities. Where gaps or risks are identified, the finance team assists management with the development and implementation of action plans to optimise available resources to achieve the agreed outcomes, while providing guidance on compliance with all relevant financial legislation, financial policies and procedures, and ensuring that financial risk is managed within acceptable limits.

- **Central Finance**: providing specialised financial support services such as the CSIR treasury function (which is highly regarded by stakeholders and operates similarly to a financial institution within the approval of the South African Reserve Bank) and statutory functions that support financial reporting, payroll, accounting, tax and other finance related legal and administrative matters.

- **Finance Projects and Initiatives:** focused on driving innovation and continuous improvement of financial support through financial application enhancement, business process improvement and analytical and reporting tools development that will enable the organisation to transition from traditional paper-based processes and services to be fully automated and integrated across the CSIR.

A.3.5.2 Marketing and public engagements

The DST's Science Engagement Framework aims to improve the promotion of science through public engagement activities.

The department encourages public and private companies involved in the science, engineering and technology (SET) sector to promote public knowledge, appreciation and interest in science.

The CSIR is one of the leading science and technology research, development and implementation organisations in Africa, and plays a crucial role in South Africa's SET initiatives by

undertaking multidisciplinary research, technological innovation, as well as industrial and scientific development, to enhance industrial competitiveness and improve the quality of life of all South Africans.

It is thus important that the organisation embraces the Science Engagement Framework, showcase and communicate effectively regarding the value it adds in addressing socio-economic challenges, encourage and promote the understanding and uptake of science, engineering and technology careers.

Science engagement in the CSIR's context refers to all the organisation's efforts to engage with the general public about its capabilities, Human Capital Development programmes to attract the youth to enroll in the fields of science, technology, engineering, and mathematics (STEM), sharing of knowledge and expertise between the CSIR scientists/researchers and other scientists or organisations, as well as outreach and awareness activities.

The CSIR will continue to enhance its public engagement activities and the table below shows some of those engagements.

Activity	**Description**
Public outreach programme	The CSIR partners with public and private organisations to showcase its work, promote science and engineering generally, and STEM careers in particular. Exhibitions and workshops are prominent features of this programme. The CSIR also participate in public outreach programmes including visiting schools to promote science, participating at science festivals such as Sciefest and Sasol TechnoX
Tailored exhibitions	The organisation will continue to participate at selective exhibitions that are relevant to its areas of focus, to showcase its work to stakeholders and potential partners or collaborators.
Site visits and tours	The CSIR regularly hosts South African and international delegations from public and private sectors, to showcase its capabilities and share information and knowledge. Often, the interactions with these delegations result in partnerships or collaborations.
CSIR career days	Tailored events targeted at Grade 10 -12 learners from rural schools. The CSIR scientists and researchers showcase their work and share experiences with learners. Some of these career days are hosted at the CSIR campuses across the country and also at the schools.
Community media partnerships	Partnerships with community media around the country to promote science by profiling young black scientists in vernacular languages to

	expand our reach to youth in remote parts of the country. This partnership also exists with the SABC vernacular radio stations such as Ukhozi FM, Lesedi FM, Thobela FM and Phalaphala FM to mention just a few.

Notwithstanding the successful implementation of some of the activities outlined above, the CSIR plans to broaden its science engagement initiatives. Firstly, to continue playing its role in the implementation of the DST's science engagement framework; and secondly, to ensure that more people are aware about the organisation and its role in the National System of Innovation (NSI), as well as how it contributes towards changing the lives of South Africans.

Other initiatives include:

- CEO lectures: These would be platforms hosted on a regularly basis and feature prominent South African and international scientists delivering lectures to a large audience, which may comprise the CSIR employees and the public.
- The CSIR Roadshow/Scientist@Work initiative: The CSIR plans to visit communities/schools to demonstrate "science in action" and show how it can be used to solve the problems that many communities are facing.
- The CSIR scientists/researchers would deliver free lectures to the general public on science and engineering topics related to the organisation's projects. This initiative may involve collaboration with a science education organisation, which has mobile demonstration equipment.
- The CSIR Laboratories at universities: The CSIR and universities, particularly those located in rural provinces/communities would explore possibility to make laboratories available for use by schools in those communities.
- Technology demonstration days: The CSIR will invite and host stakeholders from industry, public and private sector, RD&I organisations and universities to showcase technologies that are ready for commercialization and can make a difference to relevant industries.
- Additional plans include identifying partnership, membership and sponsorship opportunities with suitable organisations to increase the participation of the CSIR in initiatives aimed at promoting business and increasing investment in South Africa.

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The centre will also serve as a gateway to the modern laboratories and research infrastructure,

skills and services dedicated for small and medium enterprises. The Centre shall provide access to the research infrastructure, business networks, laboratories in R&D centres, establishing contacts with the scientific community, consulting, aid in technology transfer and commercialisation. The development of the centre will further be a catalyst to deepen engagement with industry and to stimulate cooperation between science and industry creating conditions for enhancing the competitive edge of local high tech companies. The Precinct inclusive of the centre is destined to become one of the most important venues for innovation in the City of Tshwane and in South Africa.

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In the next financial year, the focus will be on refining and developing the full Business Plan and raising funds for the development and operations of the Centre.

Stakeholder Engagement

The CSIR engages internal and external stakeholders who play a critical role in our vision of accelerating socio-economic prosperity in South Africa through leading innovation, and ultimately delivering on our mandate. The CSIR appreciates and places business value on maintaining healthy relationships with the organisation's broad range of stakeholders who not only influence, but are also affected by the CSIR Strategy. In engaging stakeholders, the CSIR also seeks to raise its profile in the various stakeholder categories in order to profile its work and its relevance to industry and society. The new strategy of the organisation requires that the CSIR enhances its stakeholder engagement efforts in order to socialise the new vision, strategy, underpinning operating model as well as the intended outcome. The new CSIR mission and value statement define collaboration as central to the new CSIR business model and requires the organisation to take a strategic and structured approach to stakeholder relations to socialise the new strategy. Our stakeholder engagement plan also takes its cue from the White Paper on Science, Technology and Innovation launched in 2018, which seeks to enhance an innovation culture, inclusivity, transformation and linkages in the NSI, among other objectives.

The CSIR stakeholder engagement plan allows us to create a common understanding of stakeholder engagement. It provides a set of principles and values to which the CSIR commits in the management of its stakeholders. It identifies, categorises and prioritises our stakeholders, defines the engagement models for the different stakeholders and provides a concrete high-level plan with timelines and expected outcomes of stakeholder engagement activities.
The CSIR's commitment towards stakeholder engagement is to strive to establish, build and maintain healthy relationships by:

- Demonstrating respect for stakeholders;
- Delivering on promises and keeping to our commitments;
- Pro-actively engaging and responding timeously to stakeholders' concerns;
- Acting with integrity and in good faith in our stakeholder dealings;
- Being transparent and keeping stakeholders informed; and
- Behaving as team players, collaborating and partnering with stakeholders in addressing socio-economic development.

The CSIR in its external stakeholder engagement plan will include a variety of platforms, including;

- A dedicated industry advisory panel to provide market insights to help shape the CSIR strategy and programmes,
- Stakeholder breakfasts with CSIR leadership at organisational or cluster level (as appropriate) and the CEOs and directors general of public institutions and captains of industry, funding and relevant civic organisations,
- Bilateral engagements with leadership of critical stakeholders, and multilateral engagements with industry associations,
- The CSIR Conference, conferences and workshops organised by other parties locally and internationally,
- CSIR open days that open the organisation to learners to stimulate their interest in science and position the CSIR as an employer of choice,
- Industry open days where specific industry players are invited to technology showcase events, among other platforms.

The CSIR is people-centred and as such places a premium on engaging its staff and keeping them motivated, while enabling them to be brand ambassadors for the organisation externally. The CSIR has thus planned a variety of platforms for engagement with Team CSIR outside of their immediate working environments, including quarterly engagements between the CSIR leadership and the broader organisation, brownbag lunch conversations with the CEO and the Executive, support to various communities of practice and since the approval of the new strategy by the board, driving a robust change management process.

The stakeholder engagement plan is underpinned by a robust communication strategy which is currently being revisited to support the realisation of the vision and intent of the new strategy. The new strategy under development also seeks to drive the NSI-wide drive to improve science communication while driving the CSIR's priorities. Historically, the CSIR has used a variety of platforms for internal and external communication, including the "Ideas that Work" campaign, in which advertising in mass media was employed to improve CSIR awareness levels. In formulating the new communication strategy, traditional tools such as ScienceScope and other printed matter, the website at www.csir.co.za, sector-specific presentations and workshops and the CSIR Conference will be re-visited and assessed for their suitability to reach target audiences with our messages, while new and alternative engagement tools will also be evaluated.

A.3.5.2.1 Strategic Objectives

The marketing and communication team will serve as the public voice of the organisation; creating campaigns that lead to positive brand awareness through **connecting** with both internal and external stakeholders to **identify** their needs and create opportunities for the CSIR to **grow** its businesses/industry/careers.

The marketing and communication department's specific objectives are to:

- **Raise the profile of the CSIR**
  - Specifically, this means **develop and implement** an Integrated Marketing and Communication campaign in support of the organisation's new strategic trajectory and to market CSIR capabilities.

- **Establish a strong media presence** to drive positive perception about the organisation. This is a proactive role encompassing the implementation of suitable media strategies and tactics to maximise the CSIR's content-richness for not-paid-for coverage.

- **Outreach** activities to enhance the brand of the CSIR and promote public understanding of science, especially amongst the youth.

- **Create engagement opportunities between the CSIR and its stakeholders**

  The significant and influential role that stakeholders play in the success of an organisation can never be underestimated. Therefore, it is important for organisations to identify and correctly classify their stakeholders, in order to manage the relationship reciprocally and preserve the organisation's reputation.

  In this area, the CSIR plans to host a number of open days targeting different stakeholders in the private and public sectors. The open days are a marketing tool to showcase the CSIR's infrastructure, its people, skills and capabilities.

  Additional plans include identifying partnership, membership and sponsorship opportunities with suitable organisations to increase the participation of the CSIR in initiatives aimed at promoting business and increasing investment in South Africa.

- **Build and strengthen the employee-brand relationship**

  - Successfully implement the change management plan to assist the organisation's (employees) smooth transition after the change process.

A.3.5.3 Governance

At the CSIR, Corporate Social Responsibility (CSR) is part of our ethos and it is entrenched in our value system. We consider it our obligation to carefully consider the interests of our customers, employees, the communities within which we operate, our shareholder, and the environment to ensure that we consider the social and environmental consequences of our business activities. This year, in support of the CSIR's corporate citizenship strategy, critical emphasis will be placed on the following initiatives:

- The establishment and effective implementation of a compliance function under the leadership of a chief compliance officer to more effectively manage risks associated with compliance, business ethics and fraud prevention;
- Maintenance and enhancement of safety, health, environment and quality (SHEQ) performance;
- Measuring and reporting on the CSIR's carbon emissions and implementing strategies to reduce the CSIR's carbon footprint over time; and
- Contributions to B-BBEE based on the dti codes of good practice.

Implementation of a compliance function

The absence of a structured compliance function within the CSIR has been defined as a shortcoming in the organisational support resource offering. Elements of compliance are scattered in various operational and support areas without a defined strategy or value proposition. The establishment of a centrally structured compliance function has been approved by the Executive Committee and will consolidate the resources associated with:

- Business ethics;
- Privacy law compliance;
- Company secretarial and governance services;
- Trade compliance; and
- B-BBEE.

The Chief Compliance Officer (CCO) is a newly proposed position to be structured at a group management level, charged with the coordination of a compliance strategy and service offering. This will allow compliance outcomes to take a central role and create an opportunity to promote and embed a compliance culture within the organisation.

Emphasis will be placed on access to resources that can define the regulatory environment with certainty and translate it into actionable policy, procedure and process for the benefit of the organisation. The compliance function will also focus on:

- Conducting regular assessments;
- Monitoring controls and policies;
- Reporting compliance shortcomings and remedial action to the regulators; and
- Strengthening the CSIR's ability to embed an effective combined assurance model by apportionment of responsibilities based on the three lines of defence, where the first line typically comprises the business (operational management), the second line the control functions (enterprise risk management and the compliance function) and the third line assurance in the form of internal audit.

Maintenance and enhancement of SHEQ performance

During the previous financial year, the CSIR highlighted the need for urgent intervention in order to improve the state of health and safety on all CSIR campuses. The underlying issues identified included:

- Increased health and safety incidents;
- A changing health and safety risk profile;
- Health and Safety practices and management system not institutionalised;
- Lack of appropriate and effective monitoring of performance; and
- Health and safety objectives not well articulated.

In order to build on the initiatives launched in 2018, the CSIR has revisited the SHEQ's mandate, vision, mission and strategic objectives. The journey to demonstrate that the CSIR cares and commits to zero harm to the CSIR community and the areas in which it operates, has begun, and will be further matured and developed in response to the SHEQ risk environment.

The CSIR will continue to establish and integrate appropriate safety, health, environmental and quality management practices into all operations. This will be achieved by the development and roll out of a targeted education and communication campaign to instil an organisation-wide and strongly embedded culture of accountability for safety, health, environmental, and quality outcomes, driven by a committed leadership and management.

Risk mitigation measures and strategic interventions have been developed to reduce and/or manage SHEQ risk and these are continuously being refined and matured in the pursuit of zero harm.

Measuring and Reporting on the CSIR Carbon Emissions

In support of the CSIR's corporate citizenship strategy, the CSIR strives to become carbon neutral and ensure that emissions that are created in business operations are neutralised through the purchase of a carbon offset.

As a first step towards this long-term goal, the CSIR has launched an initiative to measure its emissions, align its reporting practices with the National Greenhouse Gas Emission Reporting Regulations that came into effect on 3 April 2017, and to ensure that the CSIR provides stakeholders with relevant, up-to-date and accurate information on its emissions profile.

Through this initiative, the CSIR seeks to gain a greater understanding of the emissions produced as a result of business activities and how to manage and reduce this risk as part of the CSIR sustainability strategy. The CSIR believes that carbon effectiveness has the potential to offer untold value to the organisation. Not just because reducing our impact on the environment is the morally correct thing to do, but also because carbon management makes excellent business sense and carbon foot printing can add significantly to the CSIR's bottom line over time and in turn enhance its ability to support the development of a capable state.

BEE Status

The CSIR strives to maintain a Level 3 B-BBEE status this year. The organisation will continue to focus on the implementation of its transformation and employment equity plans in line with its human capital development strategy.

The CSIR will also continue to have greater focus on attracting and/or developing enterprises with credible B-BBEE credentials. Furthermore, the CSIR seeks to use disability equity quotas to promote, manage and enhance the role that people with disabilities play within the organisations. To this end, the CIR will launch a disability-focussed learnership programme in 2019.

A.3.5.4 Risk Management

The CSIR's risk management plan is provided in Annexure D. The CSIR takes a broad view of risk management, and the risk management plan addresses risks in the areas of:

- Research: Shortage of skilled staff in the market, falsifying and poor research output, obsolete research equipment;

- Business: Decrease in public sector funding, contracting risks, exposure to global market and foreign exchange;
- Operational: Change management associated with revised strategic direction and operating model, reorganisation of operating areas no longer financially feasible, loss of institutional memory, business interruption due to power failures and aging infrastructure;
- Fraud: Financial fraud/misappropriation of assets and inappropriate contracting; and
- Environment, health and safety: Compliance to relevant regulations.

A consolidated risk register has been prepared and is available for review.

The organisation's Fraud Prevention Plan presented in Annexure E is key to the mitigation of risk. In addition, the Materiality Framework (Annexure F) identifies significant risks that need to be addressed through appropriate controls. The major risks that may have significant bearing on the organisation and the execution of its plan as well as key and high-level controls to mitigate these are monitored on an ongoing basis. In compliance with the King IV, the CSIR Board of Directors will receive assurance regarding the effectiveness of the risk management plan based on a combined assurance model.

A.4 Strategic Partnerships

The CSIR appreciates the need to manage relationships with the broad range of stakeholders who are affected by the CSIR strategy - stakeholders that will impact on the CSIR's ability to deliver on the strategy and grow. The CSIR sees business value in having healthy stakeholder relations that enable us to enhance our partnerships and realise our vision of accelerating socioeconomic prosperity in South Africa through leading innovation.

The CSIR's commitment towards stakeholder engagement is to always strive to establish, build and maintain healthy relationships by:

- Demonstrating respect for stakeholders;
- Delivering on promises and keeping to our commitments;
- Pro-actively engaging and responding timeously to stakeholders' concerns;
- Acting with integrity and in good faith to all our stakeholders;
- Being transparent and keeping stakeholders informed; and
- Behaving as team players, collaborating and partnering with stakeholders in addressing socioeconomic development.

The new CSIR Strategy will require significant stakeholder buy-in to achieve the impact envisioned in the strategy. The new CSIR mission defines collaboration as central to the new CSIR business model and requires the CSIR to take a strategic and structured approach to stakeholder relations to socialise the new strategy. Therefore, we have initiated the development of a stakeholder engagement plan, which will enable the CSIR to strategically position its new strategy and enduring value proposition in the CSIR's current and future stakeholder community. The stakeholder engagement plan seeks to:

- Focus on engagement that will have the biggest impact on the CSIR strategy and operations;
- Develop strategic insights from stakeholders' sectors and elicit constructive inputs on the new strategy from stakeholders;

- Enhance existing and develop new stakeholder relationships to amplify efforts to deliver relevant RD&I solutions to build a capable state, improve South Africa's competitiveness, and contribute to socioeconomic growth;
- Understand and manage stakeholder expectations;
- Identify common strategic innovation programmes between the CSIR and stakeholders; and
- Streamline processes to define and lead cost-effective stakeholder engagement activities.

Africa Collaboration

The CSIR as premier RD&I institute on the African continent should assist in developing inclusive and transformative solutions for African Socio-Economic development. Challenges on the broader African continent will impact negatively on the quality of life of people of South Africa and resolving Africa's challenges is thus well aligned with the CSIR's mandate.

The CSIR strategic intent is to expand the CSIR footprint across Africa to leverage the existing RD&I capabilities and develop new capabilities, driving socio-economic development through continental and global cooperation. The CSIR will assist the African System of Innovation by creating an active innovation network to transform Africa, tapping into the collective wisdom across Africa to transform Africa. In doing so, the CSIR will also contribute to the strengthening of the continent's excellence and attractiveness in research and innovation, and the realisation of the political and developmental intent and objectives of our government and the African Union (AU). The CSIR currently have research and Technology (RTO) and Higher Education Institutes (HEI) partners in Algeria, Botswana Egypt, Ghana, Kenya, Namibia, Rwanda, Tanzania, Uganda, Zambia and Zimbabwe.

The CSIR is working through its membership in WAITRO to establish a network of African RTOs, with support from the DST. The aim is to identify issues of common interest to African RTOs and their countries, and seek to address these through various channels, including the WAITRO global network. A working group was established for this network at the WAITRO 2018 Congress in Malaysia, led by the CSIR. In the 2019/20 financial year plans are afoot to formalize this group's activities, and lay out a programme of action for the medium to long-term.

South Africa, through the CSIR has been selected to host the 2020 WAITRO Biennial Congress, when WAITRO will be celebrating its 50th Anniversary. The CSIR has received strong support from the DST's Multilateral and Africa Cooperation Directorates in this regard, and intends to continue working with the DST to make the hosting a success. It is worth noting that the CSIR also turns 75 in 2020, which is worthy milestone in our history.

A.5 Monitoring and Evaluation

A.5.1 CSIR Measurement Framework

Our measurement framework seeks to monitor our short-term progress towards meeting these strategic objectives, as well as assessing whether the long-term substance of these aims is being achieved. The two components of our measurement framework are:

- A set of *annual* performance indicators across the five strategic objectives. These form part of our Annual Performance Plan and we will, on a quarterly basis, report on progress towards meeting these targets. In addition to setting targets for the upcoming financial year we also set five-year targets for these indicators.
- A set of longer-term measures that focus more clearly on the outcomes and, potentially, the impacts of our efforts across the five strategic focus areas. The data required to support these measures may be collected on an irregular or ad hoc basic.

These two sets are complimentary parts of a system that seeks to understand whether or not we are meeting our strategic objectives – in the short-term to ensure that we are making progress, and in the long-term to verify that we are heading in the right direction.

- Impact planning, monitoring, evaluation and learning, leads to a number of tangible deliverables, and these may be recorded in the annual plans. Deliverables include the tracking of R&D outcomes, the planning of impact assessments, delivery systems modelled and analysed for bottlenecks and leverage points, new solutions and transfer of knowledge (new offerings to be developed), and plans for improving

Divisions and clusters' capability for increasing RD&I outcomes and impact. Some of the main processes across the CSIR in support of impact assessment include; impact planning, monitoring and evaluation of outcomes and impact, and reporting and communicating on the results of monitoring and evaluation.

When we look at best practice with regard to the level of evaluation effort measured against the number of projects or programmes, what stands out is that the monitoring of all inputs and most outputs takes place. However, when it comes to outcomes evaluation, there is a need to prioritise and look at what has potentially the greatest value for money, because only some outcomes will be captured in studies that evaluate and measure against carefully selected indicators. On the other hand, for impact evaluation, both resources and political imperatives play a key role in choice or prioritisation, and thus the number of impact evaluations (studies/assessments) to be done annually by each Division.

Results-based monitoring involves the collection of information on how effectively the project/programme/intervention is performing – and demonstrates whether a project is achieving its stated goals [e.g. outputs are important because they describe the link between activities and the desired benefit(s) for participants or target populations where outcomes (direct or within some time) are the effects of programme or project outputs – referred to as the expected change as a consequence of a previous process.

This forms the basis for detailed operational plans to be produced, outlining intended outcomes and impact, which will result in outputs that come about from inputs and activities that the organisation engages in. When these operational plans are implemented, they will produce a set of outputs and outcomes, leading to intended impact.

It is important to note that each stage of the M&E system forms a feedback loop to each previous stage in order improve and refine that stage, and ultimately the system overall. This explicitly supports complex environments where there is a continual reflection (centres around the idea of moving development cyclically, rather than trying to do everything all at once) that is built into the system. In order to complete the Planning and Impact Framework Process and improve upon it, there is feedback to the strategy, where this information from the M&E is used to refine and improve the strategy, and then the cycle begins again, in an ongoing cycle of feedback and improvements. This feedback process as described in the Result Based Management framework is what we will be using in the CSIR context.

The key sets of direct deliverables as an output of the Planning and Impact Framework being implemented within CSIR are the following:

- A planning and impact database for capturing and tracking both planning, monitoring and impact work;
- An annual operating divisional and cluster result-based work plan. The key indicators (variables) contained within this work plan will be finalised in a participatory manner and agreed upon with the relevant division and cluster, together with the RD&I planning section. This body of work should as far as possible include an overall impact statement with a related outcome statement and some specified indicators. Drafting an output statement that entails relevant indicators and key quarterly activities linked to milestones will complete the process;
- Quarterly tracking of agreed outputs (activities, key milestones and capturing of relevant data/information (photos, articles or Meta research etc);
- A budgeted monitoring and evaluation plan for each significant R&D programme. At planning stage such an exercise will provide insight into the resource allocation and challenges to be expected; and
- A close-out feedback communication loop should be accommodated by having a reference to a table containing the matrix of programme/development or outcome reports, authors and indication of the audience.

Some outcomes and expected impacts as a result of CSIR RD&I programmes being well planned and evaluated:

- Delivery systems modelled, analysed for bottlenecks and leverage points;
- New solutions and knowledge to be transferred (new offerings to be developed);
- Plans for improving the divisions and cluster capability for increasing RD&I outcomes and impact;
- Knowledge transfer – in support of decision-making, capability development;
- Technology transfer - licensing of IP and new enterprises;
- Skills development and transfer via training and lecturing;
- Scientific and engineering contribution to knowledge base via publications; and
- Industrial development impact.

An important component of implementing the new system is to develop relevant new KPIs (indicators) to augment the existing KPIs – specified as outcome and impact indicators. This should be done by formulating KPIs, setting targets (with resource constraints specified) and reporting on them. It is important to note that they will only be used in the performance assessments of divisions and clusters when there is sufficient confidence that the system is reliable and predictable.

For impact assessment a number of key processes can be investigated for KPIs. These are:

- Impact planning, e.g. the quality of logic models developed
- R&D, e.g. the number of solutions where stakeholders are part of the development and assessments of the suitability of solutions;
- Knowledge and technology transfer, e.g. solutions successfully taken up; and
- Impact assessments, e.g. the number of impact assessments completed

A.5.2 Additional Indicators

During the course of the 2019/20 financial year, the CSIR will develop and test an additional set of performance indicators to refine the measurement of the impact of our work in support of industrial development. Our intent is to ensure that the indicators are well-defined, that the targets are set appropriately, and that the evidence for the indicators will meet the standards set by the Auditor-General. If these conditions are met these indicators will be included in the 2020/21 Shareholder's Compact.

SO 1: Conduct research, development and innovation, localise transformative technologies and accelerate their diffusion
Publications in high impact sectors as per Strategy
Licence agreements with start-ups and spinouts
SO 2: Collaboratively improve the competitiveness of high impact industries to support South Africa's re-industrialisation
New spinouts from CSIR technologies
SO 3: Drive the socioeconomic transformation through RD&I which supports the development of a capable state
SMMEs in rural areas and townships
SO 4: Build and transform human capital and infrastructure
Track CSIR culture transformation journey
Employee engagement survey
Customer satisfaction survey
Diversify the workforce ecosystem
Primary vs secondary appointments
Number of joint appointments
Number of secondments
Number of rotations
Number of exchanges
Number of visits
Diversify and transform the workforce

Establish a baseline of competence profile and mix of the workforce
Profile development and innovation professionals at senior levels relative to pool
Profile business development professionals at senior levels relative to pool
Profile functional professionals at senior levels
Professional registration of the workforce: Pr. Eng: CFA: CA: CIA: Pr Nat Sci: HR:
Thrive toward equitable workforce with respect to race, gender and disability. Track BBBEE Scorecard on EE and management control
Diversify and transform pipeline
Qualification profile of workforce: PhD, Masters, Hons, BTech, NDip (NFQ level)
Profile of candidates in graduate training, internship, learnership, in-service initiatives
Profile of undergraduate bursars relative to workforce
Profile of postgraduate bursars relative to workforce
Investment in learning and development initiatives relative to levy-able amount
Thrive towards a diverse and skilled workforce. Track BBBEE Scorecard on skills development
SO 5: Diversify income, maintain financial sustainability and good governance
Investment in RD&I Infrastructure (%)

A.6 KPI Targets

Table A.2: CSIR Key Performance Indicators: 2019/20 – 2024/25

Indicator	Target 2018/19	Forecast 2018/19	Target 2019/20	Target 2020/21	Target 2021/22	Target: 2023/24
SO 1: Conduct research, development and innovation, localise transformative technologies and accelerate their diffusion						
KPI 01: Publication equivalents	480	399	420	441	463	511
KPI 02: New priority patent applications filed	-	-	5	7	9	13
KPI 03: New patents granted	15	11	13	14	15	18
KPI 04: New technology demonstrators	50	56	66	69	73	80
KPI 05: Number of technology licence agreements signed	-	-	24	25	26	29
KPI 06: Number of localised technologies	-	-	12	13	13	15
SO2: Collaboratively improve the competitiveness of high impact industries to support South Africa's re-industrialisation.						
KPI 07: Number of joint technology development agreements being implemented for industry	-	-	39	41	43	47
KPI 08: Number of SMMEs supported	-	-	92	97	101	112
SO3: Drive the socioeconomic transformation through RD&I which supports the development of a capable state						
KPI 09: Number of reports contributing to national policy development	-	-	24	25	26	29
KPI 10: Number of standards delivered or contributed in support of the state	-	-	16	17	18	19
KPI 11: Number of projects implemented to increase the capability of the state	-	-	54	57	60	66
SO 4: Build and transform human capital and infrastructure						
KPI 12: Total SET staff	1860	1672	1 619	1 651	1 684	1 752
KPI 13: – Percentage of SET staff who are Black	62	62	62	63	64	67
KPI 14: – Percentage of SET staff who are Female	37	36	36	37	39	42
KPI 15: – Percentage of SET staff with a PhD	20	20	22	24	26	30
KPI 16: Total Chief Researchers	23	15	15	17	20	25
KPI 17: – Percentage of Chief Researchers who are Black	13	7	13	18	25	32
KPI 18: – Percentage of Chief Researchers who are Female	13	20	13	18	20	28
KPI 19: Total Principal Researchers	210	199	209	219	230	254
KPI 20: – Percentage of Principal Researchers who are Black	27	28	28	33	36	41

KOI 21: – Percentage of Principal Researchers who are Female	20	18	18	20	21	24
KPI 22: Number of exchange programs with industry	-	-	8	8	8	8
KPI 23: PPE Investment (Rm)*	61	61	95	120	150	200
SO 5: Diversify income, maintain financial sustainability and good governance						
KPI 24: Total Income (Rm)	2740	2707	2859	3075	3321	3803
KPI 25: Net Profit (Rm)	0	-49	9	60	74	114
KPI 26: SA Public sector income (% Total Income)	55	55	55	55	55	48
KPI 27: SA Private sector income (% Total Income)	6	8	8	8	9	15
KPI 28: International contract income (% Total Income)	8	6	8	8	8	15
KPI 29: B-BBEE Rating*	3	3	3	3	2	2
KPI 30: Recordable incident rate*	-	-	2	2	2	2
KPI 31: Audit opinion	-	-	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion

A.6.2 KPI Descriptions

KPIs provide an understanding of performance in terms of inputs, outputs, efficiencies, and to some extent provide lead indicators of the outcomes and impact that are required for the CSIR to fulfill its mandate. The question of whether or not the CSIR is meeting its strategic objectives related to achieving outcomes and impact cannot be resolved by KPI assessment alone, and requires a process of programme evaluation as described in the National Evaluation Policy Framework. The strategic objectives provided in the CSIR strategic plan make specific statements on planned outcomes that will serve as the basis for future evaluation of performance in this regard.

The CSIR KPIs provide a basket of measures that reflect various aspects of organisational performance. The targets that are set reflect, in the context of limited resources, a strategic choice about the areas in which greatest impact can be achieved.

KPI 1: Publication Equivalents

Indicator Title	Publication Equivalents
Definition	Publication equivalents consist of peer-reviewed journal articles, conference papers, book chapters and books.
Purpose	Research publications are a measure of the CSIR's research quality, capabilities and outputs. The impact of the quantity and quality of peer-reviewed research publications is a contribution to the scientific knowledge base.
Performance assessment	The CSIR considers a performance above 95% of the target as acceptable. Performance in excess of the target is a positive result. Publication equivalents are part of a portfolio of scientific and technological outputs. The *CSIR guideline for the allocation of publication equivalents and accreditation of journals* is used as the guideline for evaluation.
Data source	Data is entered into the CSIR TOdB which provides the information for reporting.
Data responsibility	CSIR Information Services
Method of calculation	The number of publication equivalents assigned to each type of publication (value in parentheses) is: peer-reviewed journal article (1); peer-reviewed conference proceedings (0.5); book chapter (1); book (minimum of 1 and maximum of 10, based on length of book); and editing a book (1). The publications are counted over the calendar year preceding the year in which the financial year end.
Limitations	Authors submit publications for inclusion in TOdB via WorkFlow. There may be some under-reporting if individual authors do not submit their manuscripts for inclusion. However, there are measures in place to automatically include publications whose authors are affiliated to the CSIR.
Type of indicator	Output
Exclusions	Publications not submitted to the TOdB will not be allocated publication equivalents

KPI 2: New Priority Patent Applications Filed

Indicator Title	New Priority Patent Applications Filed
Definition	Number of priority patent applications filed in the financial year
Purpose	Priority patent filings serve as a pipeline indicator of patent families. It is the first patent application filed for a particular invention.
Performance assessment	The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source	Correspondence from the patent attorneys and/or supporting documentation from the relevant patent offices.
Data responsibility	CSIR Licensing and Ventures Office.

Method of calculation	Count of priority patent applications where there is proof in writing from a patent attorney and/or patent office that the patent application concerned has been filed in the financial year. Only co-owned patent applications or patent applications in the name of the CSIR are counted.
Data limitations	None
Type of indicator	Output

KPI 3: New Patents Granted

Indicator Title	New Patents Granted
Definition	Patents granted by a national authority in countries with an examining office.
Purpose	Patents provide a lead indicator of impact through commercialisation. The patents granted in multiple countries reflect the potential market size for and value of the technology. Patent prosecution and maintenance are very costly. The decision of whether to patent, where to patent and in how many countries to file applications is driven by the requirements of a carefully considered commercialisation plan in each instance, including factors such as competition, market size and strength of the intellectual property.
Performance assessment	The CSIR considers a performance above 80% of the target as acceptable. Performance in excess of the target is a positive result and patents granted in multiple countries may lead to a result substantially greater than the target. The CSIR target is to achieve at least 15 granted patents annually, recognising that this target may be exceeded substantially in some years, as a result of awards in multiple countries. The time taken for a patent to be granted after filing is unpredictable and can range from one to eight or even more years. The unpredictability arises from the processes within the examining offices and the possibility of one or more office actions, each of which leads to further correspondence with the relevant patent office and consequently delays in obtaining grant. Different patent offices also have different processing times, and processing time depends on factors such as how many pending applications they have at any point in time. Therefore, the number of pending CSIR patent applications in any given year does not provide a reasonable baseline for establishing a precise target for subsequent years.
Data source	Correspondence from the patent attorneys and supporting documentation from the relevant patent offices.
Data responsibility	CSIR Licensing and Ventures Office
Method of calculation	Count of patents where there is proof in writing from a patent attorney and/or patent office that the patents concerned have been granted in the financial year. For patents granted in multiple countries, each country filing counts as a separate patent. However, when patents are recognised by a subsidiary authority of a patent office (as in the case where individual European Union countries recognise a patent granted by the European Patent Office) we will only count one instance of the patent. In cases where notification of a patent is only received after the results for the financial year have been completed, that patent will be included in the subsequent financial year's results. Only co-owned patents or patents in the name of the CSIR are counted.
Limitations	South Africa and many African countries do not have patent examining offices. Therefore patents filed in these countries are not counted for this KPI. However, technologies with specific South African and African application may be patented in the relevant countries.
Type of indicator	Output
Exclusions	None

KPI 4: New Technology Demonstrators

Indicator Title	New Technology Demonstrators
Definition	A technology demonstrator is: • An intermediate output of a research and development project or an intermediate output derived from existing knowledge gained from research and/or practical experience; • An output at a Technology Readiness Level (TRL) 6 or higher, and in the case of medical devices and pharmaceuticals, at TRL level 5 or higher; and • An output that performs and compares favourably to existing technologies/products/processes.
Purpose	Measure an intermediate output of research and development activities with the potential to be developed further into technology packages that can be transferred to various markets for socioeconomic impacts
Performance assessment	The CSIR considers a performance above 85% of the target as acceptable. Performance in excess of the target is a positive result. Technology demonstrators are part of a portfolio of scientific and technological outputs that are produced from the same capacity platform.
Data source	Technology demonstrators are submitted by units for adjudication by the Technology Demonstrator Evaluation Panel. The panel uses the CSIR Technology Demonstrator Evaluation Framework as the guideline for evaluating submissions. This framework is based on international standards/trends in the field of technology demonstrator evaluation and assessment of the maturity of technologies. The framework provides: • Technology demonstrator evaluation criteria; • Guidelines for submissions; • Guidelines for appointment of the panel; • Guidelines for appealing the decision of the panel and • Guidelines for the management of Technology Demonstrator evaluation activities.
Data responsibility	CSIR R&D Office
Method of calculation	Count of technology demonstrators approved by the Technology Demonstrator Evaluation Panel using the Technology Evaluation Framework.
Limitations	None
Type of indicator	Output
Exclusions	None

KPI 5: Number of Technology Licence Agreements Signed

Indicator Title	Number of Licensed Technologies
Definition	A technology licence consists of various rights granted to another party to use the CSIR's IP for commercial and/or social exploitation and benefit. IP may be transferred by means of licensing to an existing party, or to a new start-up established for the purpose of further developing, marketing and/or commercialising the IP.
Purpose	Technology licences are an indicator of the uptake of CSIR IP in the market by private and/or public sectors
Performance assessment	The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result. Technology licences lead to the commercialisation, by other parties, of the CSIR's scientific and technological outputs produced from the overall RD&I portfolio,

Data source	• Technology licences are approved and granted in accordance with relevant legislation and the CSIR Commercialisation and Approval Frameworks. • Technology licences .are proposed and negotiated with other parties by CSIR divisions together with the Licensing and Ventures Office. The Commercialisation Framework outlines the CSIR's preferences with respect to technology transfer and the various licensing terms to be considered.
Data responsibility	CSIR Licensing and Ventures Office
Method of calculation	Number of licence agreements signed
Limitations	Technology licences serve as a proxy indicator for the commercialisation of CSIR IP.
Type of indicator	Output
Exclusions	Only full licence agreements negotiated and concluded with another party are counted. This KPI excludes: • Instant Access Licences; • Evaluation agreements (or similar); and • Enterprise Agreements such as with the Biomanufacturing Industry Development Centre.

KPI 6: Number of Localised Technologies

Indicator Title	Number of Localised Technologies
Definition	A localised technology is a technology that has been invented or commercialised outside of South Africa and that has been or will be introduced into South Africa for commercial or scientific benefit. The technology may have a licence for the right to use IP for commercial benefit. This may have further terms and conditions attached which include but are not limited to licence fees, linkages to foreground and background IP, timeframes, geographical and territorial aspects etc. Linked to this process is the identification of local manufacturing partner that will be developed to adopt the technology for diffusion and then commercial production. A localised technology could also represent the local development of a technology that is currently being imported into the country. This would represent "import substitution". The process would involve local R&D combined with product and/or material development into a product or system. The local development could be a stand-alone product or a sub-assembly that operates within a large system. During this development process, local know-how and/or IP that could also result in the filing of a patent will be created. Through this process, the design and manufacturing processes will be developed. This development can be conducted with an industry partner and therefore the transfer of technology will be between the CSIR and the partner or a partner can be developed post the development process.
Purpose	Accelerate re-industrialisation and prevent the need to 'reinvent the wheel'. Develop local products that can be used and perfected in the South African context and environment, which can then also be exported to other countries.
Desired performance	Leverage CSIR resources for maximum industry impact.
Performance assessment	The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source	Technology licences and agreements are proposed and negotiated with external clients by units together with the Licensing and Ventures office. The CSIR Technology Licensing Framework is used as the guideline for evaluation. The framework provides: • Guidelines for terms and conditions; and • Guidelines for submissions.
Data responsibility	CSIR Clusters and Divisions
Method of calculation	Number of technologies localized
Limitations	None

Type of indicator	Output
Exclusions	Excludes a general list of technologies developed by CSIR R&D. Technology should be introduced and transferred for local commercial or scientific benefit

KPI 7: Number of Joint Technology Development Agreements being implemented for Industry

Indicator Title	Number of Joint Technology Development Agreements being Implemented for Industry
Definition	A joint technology development agreement with an industry partner which outlines the RD&I activities jointly conducted by the CSIR and an industry partner under a written contract, where each party brings needed capability for the development of the technology.
Purpose	Accelerate re-industrialisation through joint R&D activities with partners from industry
Desired performance	Targets are set based on projections of joint technology agreements planned in all Clusters. The long term objective is to achieve maximum impact by working with industry to improve the competitiveness of industry.
Performance assessment	The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source	Technology development agreements are proposed and negotiated with external clients by divisions supported by the Licensing and Ventures Office. These agreements are kept by the Legal Office of the CSIR. The CSIR Technology Licensing Framework is used as the guideline for evaluating. The framework provides: • Guidelines for terms and conditions; and • Guidelines for submissions; Additional evidence of the existence of joint teams can include: • Minutes of joint meetings • Joint R&D outputs (R&D reports, papers, patents, CAD models, technology test reports, etc.)
Data responsibility	RD&I Office
Method of calculation	Number of signed contracts for joint technology development Number of active technology agreements
Limitations	• This definition of the KPI does not differentiate between large joint projects involving many SET base members, and small teams • This definition does not prescribe a minimum ratio of hours contributed by each party (this ratio will change as projects progress through TRL levels)
Type of indicator	Input
Excluded	• Pure contract R&D where there is no joint technical team with an industry partner, or TEI • Projects where the CSIR does general R&D capacity building in industry, where this is not part of a specific product for commercialisation, or manufacturing process to be implemented in industry • Joint R&D work of exploratory nature with no specific industry development plan (this is captured in other KPIs, e.g. patent output, journal papers, etc.)

KPI 8: Number of SMMEs Supported

Indicator Title	Number of SMMEs Supported
Definition	Support provided by the CSIR to SMMEs through the implementation of interventions that contribute to SMMEs becoming more productive, efficient and sustainable. The National Small Business (NSB) Act, 1996 (Act 102 of 1996), defines a 'small business' as follows: … a separate and distinct business entity, including co-operative enterprises and nongovernmental organisations, managed by one owner or more which, including its branches or subsidiaries, if any, is predominantly carried on in any sector or sub sector of the economy mentioned in column I of the Schedule. Small businesses can be classified as micro, very small, small or medium enterprises, following a complex set of thresholds... The NSB Act further categorises small businesses in South Africa into distinct groups, namely; survivalist, micro, very small, small and medium, hence the use of the term "SMME" for small, medium and micro-enterprises. However, the terms 'SMME' and 'SME' are used interchangeably in South Africa. The SME definition uses the number of employees (the most common mode of definition) per enterprise size category combined with the annual turnover categories, the gross assets excluding fixed property. SMME range: The definition for SMMEs encompasses a very broad range of firms, some of which include formally registered, informal and non-VAT registered organisations (the dti, 2008). Small businesses range from medium-sized enterprises, such as established traditional family businesses employing over a hundred people, to informal micro-enterprises. The latter includes survivalist self-employed persons from the poorest layers of the population. The upper end of the range is comparable to the small- and medium-sized enterprises (SME) segment found in developed countries. In South Africa, a large majority of SMMEs are concentrated on the very lowest end, where survivalist firms are found (Berry, 2002). These firms can take the form of street trading enterprises, backyard manufacturing and services, and occasional home-based evening jobs. The informal sector comprises almost exclusively of SMMEs; those classified as survival entities have very little growth potential and are less likely to hire staff (the dti, 2008).
Purpose	Contribute to socioeconomic development and industrialisation.
Desired performance	Targets are set based on projections of projects planned in all clusters. The long-term objective is to achieve maximum impact by assisting SMMEs to improve their competitiveness.
Performance assessment	The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source	CSIR project reports and SMME annual reports
Data responsibility	CSIR divisions and clusters
Method of calculation	The number of signed contracts The number of interventions implemented
Limitations	Access to SMME annual reports
Type of indicator	Output
Exclusions	None

KPI 9: Number of Reports Contributing to National Policy Development

Indicator Title	Number of Reports Contributing To National Policy Development
Definition	Evidence-based policy development support provided to various arms of government.[5]
Purpose	To assist government with evidence-based policy development and decision-making that can benefit from a significant SET input.
Desired performance	Targets are set based on projections of projects planned in all Clusters. The long term objective is to achieve maximum impact by assisting in increasing the capability of the state.
Performance assessment	The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result. Policies are only counted if there is external evidence that the policy has been adopted/accepted.
Data source	Evidence can include: • Departmental or organisational sign off on the policy and related reports is filed; • Minutes of policy development team meetings; • Draft policies; • Reports to government department clients; and • Policy working documents and reports signed off by all participating organisations.
Data responsibility	Divisional Head
Method of calculation	Count of final reports related to new or updated policies adopted by government
Limitations	The KPI as defined here does not account for: • All national policies that do not have the same level of complexity from a SET point of view; and • The effort put in by CSIR (SET hours), some policy development projects require less input than others Proof of acceptance/implementation of standard from external source (Signed off by relevant department, minuted/Gazetted /implemented • None of the data sources identified above have been standardised as yet
Type of indicator	Intermediate outcome (uptake)
Exclusions	• Development of internal policies for government departments, for example general HR policies, quality management policies, general management policies • Contribution to creation or updating of CSIR policies

[5] An example of such evidence-based policy work is the CSIR's input into the integrated resource plan for South Africa. Detailed technical analysis was used to put forward the optimum energy mix for South Africa, and this work will ultimately find expression in the new Energy Policy. A second example is the CSIR-defined sediment quality guidelines that are used to regulate the disposal of sediment dredged in South African ports, in accordance with South African law (Act No 24 of 2008) and in accordance with requirements of the London Convention on the Prevention of Marine Pollution, to which South Africa is a signatory. A third example is a study conducted by the CSIR into spectrum requirements for Wireless Open Access Networks, which has resulted in a proposed policy and policy direction gazetted by the Department of Telecommunications and Postal Services in 2018.

KPI 10: Number of Standards Delivered or Contributed to in Support of the State.

Indicator Title	Number of Standards Delivered or Contributed to in Support of the State.
Definition	New or updated standards adopted by the state and state-owned entities that the CSIR has developed and delivered or contributed to.[6]
Purpose	Support for government policy and regulation; enable standardised practice across economic and social sectors (e.g. interoperability standards, accessibility standards, products or infrastructure standards).
Desired performance	Targets are set based on projections of projects planned in all Clusters. The long term objective is to achieve maximum impact by assisting in increasing the capability of the state. Standards are only counted if there is external evidence that they have been adopted/accepted.
Performance assessment	The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source	Evidence of Departmental or SOE sign off on the standard is filed
Data responsibility	Divisional Executives
Method of calculation	Count of new or updated standards adopted by government. In the case of updated standards, significant changes from previous versions must be demonstrated.
Limitations	Proof of acceptance/implementation of standard from external source (Signed off by relevant department, minuted or Gazetted/implemented as applicable to target department or industry).
Type of indicator	Intermediate outcome (uptake)
Exclusions	None

[6] The CSIR collaborates with the SABS in developing product standards, but develops best practice standards for various government departments. An example is the pothole repairs work conducted for the Department of Transport. This standard on pothole repairs enables the Department of Transport to measure service providers conducting repairs aligned to best practise, leading to a capable state. A second example is where the CSIR has developed the National Domestic Waste Collection Standards for the Department of Environmental Affairs. The Standards have been published in Government Gazette 33935 in 2011.

KPI 11: Number of Projects Implemented to Increase Capability of the State.

Indicator Title	Number of Projects Implemented to Increase Capability of the State
Definition	The CSIR-facilitated implementation of technologies (CSIR-created or otherwise) that improve the efficiency of Government and SOEs.[7]
Purpose	Improved efficiency and effectiveness within and between government department and entities, leading to improved service delivery (across public or private sector). This includes (but is not limited to): • Providing support to departments with the procurement of complex equipment and systems; • Putting complex systems and products into operation in government departments; • Finding and implementing approaches for improving the implementation of systems and products in departments; • Providing training on operation and support of systems and products; • Development and implementation of systems and products in departments; • Providing enterprise architecting support to departments; and • Supporting the upgrade of systems and products.
Desired performance	Targets are set based on projections of projects planned in all Clusters. The long term objective is to achieve maximum impact by increasing the capability of the state. The CSIR considers a performance above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Performance assessment	Number of projects flagged in the Peoplesoft projects system as implementation projects in government departments (see examples above), list to be signed off for each Impact Area by its Manager The CSIR aims to achieve or exceed the annual targets.
Data source	Potential data sources include: • Outputs of relevant projects (reports etc.) are entered into the CSIR TOdB which provides the information for reporting • Relevant projects can be flagged in the Peoplesoft projects system • Project documentation, including milestone reports, project meeting minutes, etc. • Evaluation of the effectiveness and efficiency of the new capability in the relevant government department
Data responsibility	CSIR Division
Method of calculation	Number of projects flagged in the Peoplesoft Projects System as implementation projects in government departments (see examples above), list to be signed off for each Impact Area by its Manager
Limitations	• No grading of impact on the performance of the target government department. • No assessment of the SET level of effort of each project.
Type of indicator	Output
Exclusions	• Diagnostic projects, engineering investigations, root cause analysis. These are important but may or may not lead to implementation projects, the focus of this KPI in on implementation of changes in government departments.

[7] An example is the work done by the CSIR on the National Health Patient Registration System that has been rolled out to more than 25 million people, and illustrates how a CSIR-developed solution has enabled the state to deliver services more efficiently. A second example is the work done by the CSIR to establish a cybersecurity capability for the City of Johannesburg (CoJ), which has resulted in the establishment of the CoJ Cybersecurity Centre in 2018.

KPI 12: Total SET Staff

Indicator Title	Total SET Staff
Definition	SET staff includes staff on the researcher, research and development, research application, and technical career ladders, Research Managers, post-doctoral fellows, post-graduate studentships, interns and staff in fixed positions who primarily work on RD&I projects. Bursars and vacation workers are excluded. Counts include all nationalities, not only South Africans.
Purpose	SET staff is a measure of the CSIR's capacity to deliver on RD&I projects.
Performance assessment	Performance in terms of the number of SET staff is influenced by financial considerations and should be assessed in the context of financial performance. The CSIR considers a performance above 95% of the target as acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target.
Data source	KPI information is extracted from PeopleSoft through an automated process.
Data responsibility	CSIR Human Resources
Method of calculation	Head count of SET staff at the end of the financial year.
Limitations	Human Resources ensures the correct classification of staff in PeopleSoft
Type of indicator	Output/Efficiency
Exclusions	None

KPI 13 & 14: Percentage of SET Staff who are Black and Female, respectively.

Indicator Title	Percentage of SET Staff who are Black and Female, respectively.
Definition	Proportion of Black South African and Female South African citizens in SET staff.
Purpose	These measures indicate the degree of demographic transformation within the RD&I capacity of the organisation.
Desired performance	Targets are set based on projections of transformation planned in all units. The long term objective is to mirror national demographics. The CSIR aims to achieve or exceed the annual targets.
Performance assessment	Performance is influenced by the growth in SET staff numbers and may be negatively affected if the target number of SET staff is not achieved. The CSIR considers a performance within two percentage points of the target as acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target
Data source	KPI information is extracted from PeopleSoft through an automated process.
Data responsibility	CSIR Human Resources
Method of calculation	Percentages of Black South African and Female South African staff of total SET staff at the end of the financial year.
Limitations	Human Resources ensures the correct classification of staff on the Human Resources database.
Type of indicator	Output (Equity)
Exclusions	None

*Black includes those South African citizens who were previously classified as African, Asian or Coloured

KPI 15: Percentage of SET Staff with Doctoral Qualification

Indicator Title	Percentage of SET Staff with Doctoral Qualification
Definition	Proportion of SET staff who have a doctoral level qualification.
Purpose	The qualification profile is an indicator of the quality of SET capacity
Desired performance	Targets are set based on the projected growth in SET staff. The long-term aim is for the proportion of PhDs to exceed 30% of all SET staff. The CSIR aims to achieve or exceed the annual targets.
Performance assessment	Performance is influenced by the growth in SET staff numbers and may be negatively affected if the target number of SET staff is not achieved. A performance within one percentage point of the proportion of PhDs will be considered as acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target.
Data source	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Percentage of SET staff with doctoral level qualifications at the end of the financial year.
Limitations	Human Resources ensures the validity of data and that evidence of the qualification is on file.
Type of indicator	Output
Exclusions	None

KPI 16: Number of Chief Researchers

Indicator Title	Number of Chief Researchers
Definition	Number of Chief Researchers
Purpose	Chief Researchers constitute the most senior research level within the CSIR, and are a critical component of the science leadership cohort within the SET base. Chief Researchers include SET staff classified as chief researchers, chief engineers, chief project managers or chief knowledge applicators. The number of researchers at this level is an indicator of the quality of SET capacity
Desired performance	Targets are set based on the projected growth in SET staff. The long-term aim is have at least 30 Chief Researchers in the CSIR.
Performance assessment	Promotion or appointment at these senior research levels is based on individual performance as measured through the CSIR Career Ladder process. A performance of above 90% of the target is considered acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target
Data source	Head count of the number of chief researchers at the end of the financial year.
Data responsibility	CSIR Human Resources
Method of calculation	Count of the number of SET staff who are classified as chief researchers at the end of the financial year.
Limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output
Exclusions	None

KPI 17 & 18: Percentage of Chief Researchers who are Black and Female, respectively.

Indicator Title	Percentage of Chief Researchers who are Black and Female, respectively
Definition	Percentage of chief researchers who are Black South African, and percentage of chief researchers who are Female South African.
Purpose	These measures measure the level of demographic transformation within the chief researcher level.
Desired performance	Targets are set based on the projected growth in SET staff. The long-term aim is to steadily grow the proportion of Black South African and Female South African chief researchers.
Performance assessment	Promotion or appointment at these senior research levels is based on individual performance as measured through the CSIR Career Ladder process. A performance of within five percentage points for the proportion of Black South African and Female South African chief researchers is considered acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target
Data source	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Percentage of Black South African and Female South African chief researchers at the end of the financial year.
Limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output
Exclusions	None

KPI 19 Number of Principal Researchers

Indicator Title	Number of Principal Researchers
Definition	Number of Principal Researchers
Purpose	Principal Researchers constitute a senior research level within the CSIR, and are a critical component of the science leadership cohort within the SET base. Principal Researchers include SET staff classified as Principal Researchers, Principal Engineers, Principal Knowledge Applicators, Principal Project Managers or Research Group Leaders. The number of researchers at this level is an indicator of the quality of SET capacity
Desired performance	Targets are set based on the projected growth in SET staff. The long-term aim is have at least 290 Principal Researchers within the CSIR.
Performance assessment	Promotion or appointment at these senior research levels is based on individual performance as measured through the CSIR Career Ladder process. A performance of above 95% of the target is considered acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target
Data source	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Count of the number of SET staff who are classified as Principal Researchers at the end of the financial year.
Limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output
Exclusions	None

KPI 20 & 21: Percentage of Principal Researchers who are Black and Female, respectively.

Indicator Title	Percentage of Principal Researchers who are Black and Female, respectively
Definition	Percentage of principal researchers who are Black South African, and percentage of principal researchers who are Female South African
Purpose	These measures measure the level of demographic transformation within the Principal researcher level.
Desired performance	Targets are set based on the projected growth in SET staff. The long-term aim is to steadily grow the proportion of Black South African and Female South African principal researchers.
Performance assessment	Promotion or appointment at these senior research levels is based on individual performance as measured through the CSIR Career Ladder process. A performance of within 3 percentage points for the proportion of Black South African and Female South African principal researchers is considered acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target
Data source	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Percentage of Black South African and Female South African Principal Researchers at the end of the financial year.
Limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output
Exclusions	None

KPI 22: Number of Exchange Programmes with Industry

Indicator Title	Number of Exchange Programmes with Industry
Definition	Programmes for the exchange of staff with the potential to create opportunities and contracts. This can be defined as a cooperative activity between industry participants seeking to reduce or eliminate expenditures of resources by sharing information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment.
Purpose	The purpose is to share domain level knowledge or system and process information.
Desired performance	Understanding of business environment leading to joint agreements and working relationship.
Performance assessment	Collaboration, knowledge-sharing, innovation, productivity and diversity of skills
Data source	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Number of exchange programmes between the CSIR and industry
Limitations	Industry partner might not provide technical information
Type of indicator	Output
Exclusions	None

KPI 23: Investment (Rm) in Property, Plant and Equipment

Indicator Title	Investment in Property, Plant and Equipment
Definition	The amount invested in the CSIR and government grant funded property, plant and equipment for a financial year.
Purpose	The CSIR needs to develop and maintain world-class facilities and equipment to provide the quality of RD&I that is expected of it. This indicator provides a measure of the CSIR investment in research infrastructure.
Desired performance	The CSIR annual target is based on 4% of total income, which the CSIR aims to achieve or exceed.
Performance assessment	Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. Investment in property, plant and equipment will be deliberately curtailed if total income and margin targets are perceived to be at risk. The CSIR considers a performance above 95% of the target as acceptable. The budget target may be exceeded substantially, arising from additional grant funding. This is a successful result and is not the consequence of an inappropriate target.
Data source	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finances
Method of calculation	Value of investment in property, plant and equipment is the amount of CSIR and grant additions for the year. This information is obtained from reports in the fixed assets system as well as the CSIR trial balance. Reconciliation is done to analyse the movement in the property, plant and equipment balance and to break this down between additions, disposals and depreciation. This breakdown is also disclosed in the year-end annual financial statements.
Limitations	None
Type of indicator	Outcome
Exclusions	None

KPI 24: Total Income (Rm)

Indicator Title	Total Income
Definition	Total income is the total operating income earned. This includes revenue declared on R&D contracts (contract R&D income), income derived from licences and royalties, Parliamentary Grant received through the Science Vote, and other income. Interest income is not included in the definition of total income.
Purpose	Total income reflects the ability of the CSIR to ensure financial sustainability. Growth in total income indicates growth in the outcomes and impact achieved by the CSIR.
Desired performance	The CSIR annual target is the figure for total income in the annual budget, which the CSIR aims to achieve or exceed. Future targets are set to ensure growth in excess of inflation.
Performance assessment	Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. The CSIR considers a performance above 95% of the target as acceptable. Exceeding the budget target is a successful result and is not the consequence of an inappropriate target.
Data source	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finances
Method of calculation	The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None
Type of indicator	Output
Exclusions	None

KPI 25: Net Profit (Rm)

Indicator Title	Net Profit
Definition	Profit for a financial year which is calculated as total operating income; less total operating expenditure (including the performance bonus accrual); plus net finance income.
Purpose	Net profit is a key indicator of financial sustainability and the ability of the organisation to manage its expenses according to the affordability determined by income levels.
Desired performance	The CSIR annual target is the figure for net profit in the annual budget. The CSIR aims to achieve or exceed the net profit target.
Performance assessment	Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. The CSIR considers a performance above 95% of the target as acceptable. Exceeding the budget target is a successful result and is not the consequence of an inappropriate target.
Data source	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finances
Method of calculation	The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None
Type of indicator	Output
Exclusions	None

KPI 26: South Africa Public Sector Income (% Total income)

Indicator Title	South African Public Sector Income
Definition	South African public sector income is the total income earned from South African public entities. This includes revenue declared on R&D contracts (contract R&D income), Parliamentary Grant received through the Science Vote and any other forms of funding received from South African public entities.
Purpose	South African public sector income reflects the degree of public income in the CSIR. A reduction in South African public sector investment in conjunction with growth in total operating income is a key indicator of income diversification and impact in other sectors.
Desired performance	The CSIR annual target is the percentage of South African public sector income included in the annual total operating income budget, which the CSIR aims to achieve or reduce. Future targets are set to ensure increased income diversification and impact in other sectors.
Performance assessment	Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. The CSIR considers a performance above 95% of the target as acceptable. Reducing the budget target is a successful result and is not the consequence of an inappropriate target.
Data source	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finances
Method of calculation	The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None
Type of indicator	Output
Exclusions	None

KPI 27: SA Private Sector Income (% Total income)

Indicator Title	South African Private Sector Income
Definition	South African private sector income is the total income earned from South African non-public entities. This includes revenue declared on R&D contracts (contract R&D income) and other income received from South African public entities. licenses, royalties and interest income is not included in the definition of South African private sector investment.
Purpose	South African private sector income reflects the degree of private investment in the CSIR. Growth in South African private sector investment is a key indicator of income diversification as well as strategic alignment to and growth in the outcomes and impact achieved by the CSIR within the South African private sector.
Desired performance	The CSIR annual target is the percentage of South African private sector income included in the annual total operating income budget, which the CSIR aims to achieve or exceed. Future targets are set to ensure increased income diversification and impact in the South African private sector.
Performance assessment	Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. The CSIR considers a performance above 95% of the target as acceptable. Exceeding the budget target is a successful result and is not the consequence of an inappropriate target.
Data source	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finances
Method of calculation	The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None
Type of indicator	Output
Exclusions	None

KPI 28: International Contract Income (% Total Income)

Indicator Title	International Contract Income
Definition	International Contract Income is the total income earned from foreign customers. This includes revenue declared on R&D contracts (contract R&D income) and other income received from foreign entities. Licenses and royalties are not included in the definition of International investment.
Purpose	International Contract Income reflects the global relevance of the CSIR. Growth in International investment is a key indicator of income diversification as well as the relevance and impact of the CSIR within the global economy.
Desired performance	The CSIR annual target is the percentage of International income included in the annual total operating income budget, which the CSIR aims to achieve or exceed. Future targets are set to ensure increased income diversification and impact in the global economy.
Performance assessment	Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. The CSIR considers a performance above 95% of the target as acceptable. Exceeding the budget target is a successful result and is not the consequence of an inappropriate target.
Data source	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finances
Method of calculation	The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None

Type of indicator	Output
Exclusions	None

KPI 29: B-BBEE rating

Indicator Title	B-BBEE rating
Definition	The CSIR's assessment of its B-BBEE status is based on the Broad-Based Black Economic Empowerment Amendment Act, 2013 (Act 46 of 2013). All targets and definitions are derived from the Codes of Good Practice as published by the Department of Trade and Industry.
Purpose	The CSIR B-BBEE policy seeks to support socioeconomic transformation of society, within and outside the CSIR, by changing the demographic profile of meaningful and productive participation in the country's economic activity.
Desired performance	The CSIR will aim to achieve a Level-2 qualification from the current Level-3. Any score higher than Level-2 would be considered a positive result.
Performance assessment	The CSIR would not consider failure to reach a target owing to amended Codes of Good Practice targets as a negative result. Improving on the target is a successful result.
Data source	There are multiple sources of information from which the CSIR assessment is compiled and verified by external audit.
Data responsibility	CSIR Management Services
Method of calculation	B-BBEE rating is based on a certificate that is issued after an external auditing process. The B-BBEE certificate indicates the CSIR's status with regards to a number of measurements as indicated in the B-BBEE Codes of Good Practice. The B-BBEE rating is a composite score that is made up of the following components: • Management and control; • Skills development; • Preferential procurement; • Socioeconomic development; and • Equity ownership
Limitations	The external audit ensures there is no subjectivity in the B-BBEE assessment.
Type of indicator	Output (Equity)
Exclusions	As the CSIR is a Government Business Enterprise, Equity Ownership does not contribute to the B-BBEE Rating score.

KPI 30: Recordable incident rate

Indicator Title	Recordable incident rate
Definition	Number of recordable cases x 200 000 divided by number of hours worked. A recordable incident is a work related injury or illness that results in one or more of the following criteria: (i) Death. (ii) Loss of consciousness. (iii) Restricted work or transfer to another job. (iv) Days away from work. Medical treatment beyond first aid
Purpose	RIR indicates the effectiveness of health and safety management system within the organisation in a year.
Desired performance	The CSIR aims to achieve its annual target of a RIR less than 2 (equivalent to 50 recordable incidents/ cases) through identifying H&S risks and implementing proactive health and safety interventions in order to reduce the number of recordable incidents/ cases.

Performance assessment	The organisation will continuously monitor its H&S performance and demonstrates leadership and management commitment that would result in improved health and safety culture as part of its vision to achieve a state of zero harm and ensure compliance with the applicable legislation (s) and best practice and supporting guidelines.
Data source	The information for the health and safety KPIs is obtained from the CSIR SHEQ systems.
Data responsibility	CSIR SHEQ
Method of calculation	The RIR is an indication of the percentage of employees exposed to work related injury or illness and classified as recordable incident per year. It is calculated by the number of recordable cases x 200 000 divided by number of hours worked.
Limitations	None
Type of indicator	Output
Exclusions	None

KPI 31: Audit Opinion

Indicator Title	Audit Opinion
Definition	The CSIR's assessment of Clean Audit is based on the definition of the Auditor-General; "the financial statements are free from material misstatements (in other words, a financially unqualified audit opinion) and there are no material findings on reporting on performance objectives or non-compliance with legislation"
Purpose	The CSIR will aim to present all the affairs of its financial statements fairly in all material aspects. This opinion embodies the assumptions that the CSIR will observe compliance with generally accepted accounting principles and all statutory requirements. Such a view implies that any changes in the regulatory requirements and accounting policies, their application and effects, will be adequately determined and disclosed.
Desired performance	The CSIR would like to maintain a Clean Audit outcome at the end of each financial year.
Performance assessment	The CSIR Internal Audit Services will continuously provide audit assurance in different areas of the organisation over the financial period with the Auditor-General providing the final statutory audit as required by the Act.
Data source	Report of the Auditor-General as published in the annual report
Data responsibility	Internal Audit
Method of calculation	A Clean Audit is based on the overall opinion of the Auditor-General after the performance of the annual statutory audit.
imitations	None
Type of indicator	Output (Report)
Exclusions	None

Annual Plan: 2019/20

Contents

B.1 Operational Plan Overview

The operational plan depicts the specific activities for the 2019/20 financial year which respond to the organisation's longer-term strategic objectives as described section A.3. These long-term objectives are broken down into more focussed objectives per intervention area as listed in this section. The annual plan is realised through the operational structures (clusters, impact areas, etc). Each of the strategic interventions per strategic objective is listed under the cluster that will be responsible for it (e.g. a strategic intervention responding to Objective 1 is the implementation of Health Information Systems). The specific 2019/20 activities for this intervention are therefore listed under the activities of the NextGen Health cluster in Strategic Objective 1. It must be noted that while clusters and Interventions may span a number of Strategic Objectives, they have been described under the Strategic Objective where they predominantly focus (e.g. Interventions in the Manufacturing Cluster are listed under SO1 as the activities of that cluster are predominantly involved in technology development and localisation for the manufacturing sector as a whole. However, when implemented, those technologies should affect the outcomes envisaged through SO2).

This operational plan should also be read in conjunction with the strategic plan (Section A). For the sake of brevity the strategic intent of each cluster and programme is not repeated here.

B.2 SO1: Conduct research, development and innovation, localise transformative technologies and accelerate their diffusion.

The convergence and the pace of new technologies are fundamentally disrupting industries and require localised RD&I. This strategic objective will be achieved through accelerating the innovation, localisation and diffusion of transformative technologies in South Africa's high impact industries through high-quality RD&I.

B.2.1 Strategic Programmes

B.2.1.1 NextGen Health

Long-term Objective	2019/20 Objectives
Health Information Systems	
Develop and commercialise integrated health information systems and digital solutions to support and inform health systems planning and treatment interventions.	• Establish a reference microbiome map of 1000 South African individuals, mapped against the NIH established map • Develop integrated herbal product meta-database for decision support • Develop National Health Laboratory Services (NHLS) data analytics and governance framework development

Medical devices and diagnostics platform	
Support the growth of the medical devices and diagnostics industry through accelerated development of innovative patient centric solutions to provide access to equitable health care for everybody	• Develop a companion diagnostics for diagnosing adverse drug effects based on patient genetic profile • Identify industry partners for the laser based HIV-diagnostic tool • Build, characterise and optimise the optical trapping system for specific analysis of HIV-1 infected cells and integrate the custom built luminescence, Raman Spectroscopy and single molecule imaging rigs to the optical micro-manipulation setup • Create of the Medical Devices Product Innovation Platform (MD-PIP) - Product Life-Cycle Management (PLM), Quality Management System (QMS), Business Intelligence (BI) and "Information Value Loop" (IVL) systems implemented • Design and implement the miniaturised printed circuit boards of the version 3 breath analyser • Microsphere POC diagnostics - Development of Universal capture and separation systems for stabilisation of biomolecules from clinical samples (i.e. blood, urine)
Precision Medicine	
Develop and commercialise precision medicine and drug development tools to aid and inform health practitioners and disease management solutions	• Diversification of Miniaturised array drug screening applications: o Miniaturised compound library production printed and validated; and o High-throughput approaches to precision oncology treatment selection • Application of novel Malaria drug screening assays for disease eradication and exploit the novel biochemical mechanisms to create new effective drugs against resistant strain infections. o Application of high-throughput drug screening technologies to identify novel drug candidates from chemical library provided by industrial partner o Identification of novel malaria-eliminating drugs for further development through academic and industrial partners • Stem-cell based genome engineering screening tools o Optimisation of stem cells derived 3D liver-like cells for screening applications

B.2.1.1.1 Synthetic Biology and Health Sciences

Long-term Objective	2019/20 Objectives
Translation of Synthetic Biology R&D with the aim of introducing a strong focus on developing bioengineered tools that will bring precision medicine tools closer to the industry	• Expand and package high-throughput screening platform to support local pharmaceutical R&D. • Establish a bioengineering capability with a clear focus on developing engineered cellular systems and precision medicine tools that will aid drug development • Develop a microbiome screening platform to enable early screening programmes, linked to data modeling programmes that will inform predisposition to specific therapeutic areas and inform treatment interventions • Provide cutting-edge, cost efficient, yet high throughput tools for screening drugs against specific genetic profiles.

B.2.1.2 Future of Production: Manufacturing

Long-term Objective	2019/20 Objectives
Light Metals	
Design, manufacture and test metallic mill products and components through powder metallurgy, casting and fabrication processes	• Technology development in support of the establishment of a new Titanium Metal Industry sector with the Titanium Centre of Competence (TiCoC) as the implementation vehicle • Technology development to support improved global competitiveness of our existing aluminium Industry
Technology Localisation Implementation Unit (TLIU)	
The TLIU focusses on assisting industry to introduce new and state-of-the-art technologies. • Supplier development linked to state procurement • Strategic alliances with OEMs and SOCs for localisation activities	• Delivery of 40 Firm Technology Assistance Packages (FTAPs) • Delivery of 1 Sector Wide TAP (SWTAP) • Develop or maintain two OEM partnerships • Placement of 120 students into industry

B.2.1.2.1 Photonics Centre

Long-term Objective	2019/20 Objectives
Laser Engineering Services (LES)	
Develop new laser processing specifications, in the application areas of laser-based refurbishment, laser welding, laser hardening, and specialised laser cutting	• Commercialisation of LES • Provision of laser-based processing services to industry
Laser-Enabled Manufacturing (LEM)	
Research and development of laser based manufacturing processes for metal applications. Main focus areas are in additive manufacturing and laser-based surface engineering	• Additive manufacturing – part fabrication and manufacturing of high-power-high-speed metal 3D printers. • Industrial laser surface engineering support – part refurbishment (hardening, shot peening, cladding)
The Photonics Prototyping Facility (PPF)	
The PPF provides the necessary infrastructure, skills and expertise for the prototyping and product development of photonics technologies, which will lead to new offerings in industry and SMMEs	• Development of two to three prototypes per year in collaboration with industry/ commercial partner • Secure financial sustainability of the PPF • Implement a training programme with PPF internships • Identify a pipeline of future PPF projects

Novel Lasers	
To develop and localise optical and laser subsystems in order to keep locally manufactured additive manufacturing machines internationally competitive	• Construction of complete smaller and versatile prototype AM machines for non-Aerospace applications and process development • >1kW fibre laser by end 2019 • Integration and verification of laser scanners in POC3 and polymer AM platforms • Development of a functioning polymer AM test and evaluation platform • Improved polymer AM demonstrated using in-house developed laser • Regular use of beam shaping scanners in metal AM machines • Beam shaped scanners prototypes transferred to industry through PPF • A local Polymer AM machine prototype with unique and superior optical qualities that addresses AM challenges. Optical subcomponents transferred to the PPF • Fully automatic operation and technology transferred to industry

B.2.1.2.2 Mechatronics, Sensor Sciences and Autonomous Systems

Long-term Objective	2019/20 Objectives
Mechatronic Manufacturing	
• Improve manufacturing competitiveness through appropriate implementation of FIR technologies, solutions and benchmarking. • Development of new cyber physical systems/IoT solutions for human-centred automation • Supporting key local market sectors (Mining, Medical Devices, Agriculture/Agri processing and Transport) with digitisation of manufacturing processes and new product/solution development	• Establish an Integrated 4IR Technology Centre. (PLM and Learning Factory integrated as a key solution for industry) • Mature the digital factory and plant simulation as a new technology platform • Establish co-robotics platform for local manufacturers
Sensor Science & Technology (SST)	
• Focussed on niche sensor solutions to create impact through local manufacturing, export and localisation • Drive Industry 4.0 principles into existing and new sensor device solutions with aim of local manufacture and export to secure funding for this direction	• Develop niche sensor solutions for industry challenges • Hence, create opportunities for new manufacturing activity, exports and localisation • Succeed in supporting at least one localisation opportunity to fruition.

Mobile Intelligent Autonomous Systems (MIAS)	
MIAS conducts focused scientific research in robotics, with an emphasis on mobile intelligent autonomous systems. This includes autonomous localisation and mapping in dynamic and unstructured environments using single and multi-robot systems, and the autonomous manipulation of objects within the work environment.	• Research and development for autonomous ground robots in 3D, GPS-denied environments, including in environments with non-spherical topology (e.g. tunnels and bridges). • Development of autonomous, mobile inspection systems with autonomous recognition and context-aware action capabilities. • Research and development in machine learning applied to autonomous manipulation tasks in intelligent manufacturing

B.2.2 Emerging Initiatives

B.2.2.1 Chemicals

Long-term Objective	2019/20 Objectives
Pharmaceutical Innovation Technology Platform	
Enable a dynamic African pharmaceuticals manufacturing industry with access to critical and modern drugs through innovative and world-class processing technology aimed at leapfrogging the current batch of manufacturing with continuous manufacturing technology.	• Establish a pipeline of young talented scientists to strengthen the South African process development capability for API manufacturing • Proof-of-concept of demonstrator process (TRL 1-3) • Identify drug targets for medium-term platform development • Engage with key stakeholders to establish the CSIR as a key implementation partner to support national and regional pharmaceutical value chains

B.2.3 Ring-Fenced DST Initiatives

B.2.3.1 Manufacturing

Long-term Objective	2019/20 Objectives
National Laser Centre	
Develop and apply novel laser applications across a variety of sectors. Provide access to laser equipment for R&D and skills development	• See also Laser Enabled Manufacturing, Laser Engineering Services and Photonic Prototyping Facility under Photonics Centre (B.2.1.2.1) • Manage the following national programmes: • Through the Rental Pool Programme (RPP) to provide access to the laser equipment base to HEIs on a competitive basis. This programme reduces the risk for R&D at HEIs with respect to acquisition of equipment, maintenance and operational expertise; • Fund 30 projects at HEIs in laser based research; • Support three sub-programmes, The African Laser Centre (ALC)i.e.: Mobility, bursaries and training; and • Support 15 continental research collaborations, 15 post graduate students and five continental training events.

B.2.3.2 National Integrated Cyberinfrastructure System (NICIS)

NICIS is a national cyberinfrastructure system that enables, supports, enhances and contributes to the performance of the national science ecosystem as a whole.

NICIS promotes scientific and industrial development through the provision of high performance computing capability (CHPC), high speed network capacity (SANReN), a national data intensive research infrastructure (DIRISA) and a human capital development pillar integrated horizontally into globally connected systems and hierarchically into a local system providing seamless access to the research and teaching community. The key strategic objectives of NICIS are to:

- Sustain a world class and relevant national integrated cyberinfrastructure system for Science and Technology.
- Enable and promote eScience in South Africa.
- Position South Africa to take part in, host and lead large scale global research and science projects (e.g. SKA and CERN experiments).
- Provide thought leadership to South Africa's evolving cyberinfrastructure strategy and activities, and facilitate the uptake of advanced cyberinfrastructure.
- Foster the development of human capacity in cyberinfrastructure and its application, and contribute to the transformation of this sector.

Outputs of the NICIS programme for 2019/20 are depicted below.

Long-term Objective	2019/20 Objectives
1. 1.6 PF high performance computing capacity (including 600TF GPU), available 90% with 70% average utilisation	1.6PF, 90%, 70%
2. > 3500Gbps total available broadband capacity	> 3500Gbps
3. 8 Pb data storage available with 95% service accessibility	8 Pb, 95%
4. Hold CHPC annual conference (integrated, including SANReN and DIRISA)	NICIS integrated conference in December 2019
5. Support 26 Postgraduate students	26
6. 70 indirect peer-reviewed publications by researchers using NICIS cyberinfrastructure	70

B.3 SO2: Collaboratively improve the competitiveness of high impact industries to support South Africa's re-industrialisation.

South Africa has undergone deindustrialisation over the last decade. This strategic objective seeks to improve the competitiveness of SA's high-impact industries through RD&I in a collaborative manner with partners, thereby contributing to the re-industrialisation of the country.

B.3.1 Strategic Programmes

B.3.1.1 Mining

Long-term Objective	2019/20 Objectives
Maximising Extraction Efficiencies	
To assist with developing the next generation of mining systems that will allow for a socially, environmentally and financially sustainable approach to responsible mining that contributes to the long term development and diversification of the local and national economy.	• Coordinate the SAMERDI Strategy • Integrate mine geophysics to maximise mine economics: - increase profile in-mine geophysics capability; develop mineral economics capability and capacity • Contribute to job retention and socioeconomic development: Identification of opportunities and positioning with relevant funders and industry stakeholders
Mining Occupational Health and Safety	
To improve mine occupational health and safety by providing testing and skills development services and contributing to health and safety related research	• Upgrade and expand facilities at the CSIR Cottesloe regional site in Johannesburg. • Emergency preparedness training offered including self-contained self-rescuer (SCSR) expectation training • Improve the business model of mining labs • Contribute to improving health and safety through participation in Mine Health and Safety Council (MHSC) projects • Support Mine Occupational Safety and Health (MOSH) initiatives • Grow the OHS capacity within the cluster.
Non-metalliferous mining operations in SA and SADC	
To provide research solutions for non-metalliferous mines and mines in other African countries	• Develop the capacity to undertake research and consulting within coal mines and other commodities • Determine mining-related research needs within other African countries • Explore opportunities for building credibility and partnerships with African universities • Increased participation within Coaltech 2020

B.3.1.2 Chemicals

Long-term Objective	2019/20 Objectives
(Bio)-Chemical conversion	
Replacing and/or enhancing current manufacturing processes using novel bio-based solutions and cutting-edge green chemistry approaches. Focus on biochemical conversions processes to produce specialty chemicals for products formulation in areas such as biopolymers, bioplastic, active ingredients for pharmaceuticals, cosmetic and food additives.	• (Bio)-conversion o Identify and license technologies for localisation e.g. succinic acid o Implement R&D and technology localisation • Biocatalysis o Teubes Africa biocatalysis R&D programme progressed o New biocatalysis programme implemented with new client (CPT) • BIDC Programme o Identify and select SMMEs o Implement projects and develop technologies o Transfer technologies for commercial implementation • Localised biomanufacturing o Establish quality systems o Implement biomanufacturing processes for minimum one client (CellRx) • Reagent development from microbial biodiversity o Develop two new reagent products o License technology to CapeBio spinout • Biorefinery

B.3.1.2.1 Polymers, Composites and Nanotechnology Centre

Long-term Objective	2019/20 Objectives
Advanced Polymers and Emulsions	
Reduced mortality as a result of more efficient drugs and diagnostics licensed technologies, increased productivity for industry, spin-out companies resulting in new jobs, less reliance on imports	• Functionalised materials developed in support of chemicals industry (Chitosan, Amphiphillic cellulose, anode materials, water purification membranes) • High-value added chemicals developed in collaboration with industry partners for chemicals sector • Demonstrate improved shelf-life, stability and bioaccessibility of at least two to three actives for pharmaceutical and nutraceutical markets; Development of pharmacological active polymers by chemical conjugation • Development of bio-based polymers in support of additive manufacturing • Set up polymerisation lab-scale process for bio-based polymer (PBS, PLA, others)

Nanostructured Materials	
Develop new materials for plastics industry, development of devices for gas sensing in both health and safety industries, support facilities developed for all stages of product development (basic research, scaling up, manufacturing)	• Do relevant and applied research also informed by industry needs. • Support industry and own R&D projects through the NIDF: Localisation, Optimisation, Scale-up, Toll manufacture, Cost/ Benefit evaluations and commercialisation. • Support relevant stakeholders to achieve their goals. (DS, IIP, the dti, IDC and Plastics SA). • Train industry-ready interns, MSc and PhD and develop Post-doctoral fellows. • Expand and maintain appropriate processing and testing facilities for the RD&I and industry support, towards the establishment of a polymer institute. • Develop, expand and maintain funding sources to ensure sustainability

B.3.1.3 NextGen Agriculture

Long-term Objective	2019/20 Objectives
Agroprocessing	

Advanced agroprocessing technologies to support the competitiveness of businesses, including SMMEs, in the agribusiness sector	• BIDC Programme
	  o Identify and select SMMEs
	  o Implement projects and develop technologies
	  o Transfer technologies for commercial implementation
	• Essential oils Innovation Systems
	  o Source high-yielding biological stock of essential oil plant varieties
	  o Determine the oil yields, oil quality, marketability and possible value additions or improvements of the essential oils
	• Mycotoxin production and testing
	  o Develop and validate mycotoxin manufacturing technology
	  o Feasibility assessment

Indigenous Plant Platform	
Valorisation of biodiversity to support socioeconomic development	• Implement projects and develop technologies for aloe and marula beneficiation • Transfer technologies for commercial implementation

B.3.2 Emerging Initiatives

B.3.2.1 Precision Agriculture

Long-term Objective	2019/20 Objectives
Precision Agriculture	

Development and implementation of advanced precision technologies to enhance agricultural production	• Develop a high-level concept document for sustainable farming systems
	• Engage with TEDA, Agricultural Research Council and other local players to identify potential role in this initiative
	• Engage with international companies and institutions to develop partnerships
	• Identify and engage with local and international funders
	• Climate smart rangeland in support of livestock industry
	  o Near real time rangeland carrying capacity model developed
	  o Simulation/experiment: links climatic factors - grass production and quality
	• Optimise crop production with precision spatial technology
	  o Pilot project selected and initiated: crop production optimising with Copernicus Sentinel's EO

B.3.3 Ring-Fenced DST Initiatives

B.3.3.1 Technology localisations and implementation

Long-term Objective	2019/20 Objectives
Technology localisation and implementation	
With on-going investments in infrastructure in the region of R650 million per annum over the remaining four-year period, the potential to support South African companies to benefit from this opportunity is very significant. The objective therefore has to be to support the development of a competitive South African manufacturing sector that can integrate into the supply chains of the OEMs that are the main contractors to the SOCs in large-state procurement projects. This new strategy is based on a 5-year transformation process that has the following core elements: • Formalising of OEM and other private sector financial support for a restructured and enhanced TLIU • Broadening of the sectoral focus of the TLIU to include: o The conceptualisation, designing, establishment, and operation of Advanced Manufacturing and Technology Development Centres (AMTDCs) located in key manufacturing hubs across South Africa o Provision of support to the pharmaceutical and automotive sectors o Building strategic alignment with the activities of the various Technology Stations (TSs) and Science Councils to enhance efficiencies and increase impact, with the objective of incorporating their activities into that of the TLP • Refining and designing of the business processes, policies and procedures that govern the operations of the TLIU, with the objective of reducing decision-making timelines, increasing efficiency of all staff and enhancing response times • Supporting and implementing existing priority projects • Identification of South African innovations and research topics that can be commercialised into solutions for industries and mega state procurement projects	• Continued delivery of technology transfer and localisation interventions: o Support of 50 Firm Technology Assistance Packages (FTAPs) o Implementation of 2 Sector-Wide Technology Assistance Packages (SWTAPs) o Provision of 1 Technology Development Grant (TDG) • Delivery of holistic Product Development (PD) solutions linked to state procurement initiatives • Support the development of 2 products that will replace products that are being imported into the country • Through the firm technology assistance packages support the o creation of 110 direct new jobs and 420 indirect new jobs o support the local production of 9 products that are being imported through technology and skills transfer programmes with OEMs o develop 17 companies that will export products supported through the FTAP process o Secure co-funding from private sector partners to the value of R20 million • Secure partnerships with at least two international OEMs for technology and skills support • Establishment of two sector specific centres to provide access to high-end technology and specialised testing linked to localisation projects • Provide support to ***the dti*** and SOCs for designated sectors to ensure that these products are developed and manufactured locally to reduce or eliminate the use of foreign sourced products in designated sectors

B.4 SO3: Drive the socioeconomic transformation through RD&I, which supports the development of a capable state.

Economic and social development in South Africa has been constrained by the challenges of inequality, unemployment and poverty. CSIR aims to play a pivotal role in the socioeconomic transformation of South Africa through RD&I and contribute to supporting the development of a capable state and enabling government to drive the socioeconomic transformation of South Africa through RD&I

B.4.1 Strategic Programmes

B.4.1.1 Defence and Security

Long-term Objective	2019/20 Objectives
Industry and market led niche 4IR technology development for future industry competitiveness (Strong alignment with SO1)	
Identify, acquire and develop new industry led niche 4IR technologies with significant industry product competitiveness enhancement potential.	• Identify companies in the safety and security industry that have the potential to become technology development and commercialisation partners, including companies that are already exporting, and which may be impacted significantly by 4IR trends and technologies • Assess the potential impact of future 4IR technologies on the competitiveness of their product lines (Manufacturing Clusterto do this for factory operations and manufacturing processes) • Assess the potential opportunity for new product lines based on future 4IR technologies in their existing markets, and potentially new markets • Determine what future 4IR technologies will likely to be available from open sources • Implement a CSIR-wide 4IR capability assessment, as well as a TEI capability assessment • Use this industry and market information, and national capability information to formulate niche 4IR technologies to be developed • Launch market and industry led 4IR technology development programmes in partnership with TEIs and Industry

Develop new industry and market driven product technology for commercialisation (Strong alignment with SO2)	
• Establish market and industry driven technology development programmes • Significantly improve the cluster's understanding of industry technology needs • Launch new technology development programmes in partnership with the Safety and Security Industry, mostly in line with existing capabilities in the Safety and Security Cluster	• Identify companies in the safety and security industry that have the potential to become technology development and commercialisation partners, including companies that are already exporting • Work with these companies to identify technologies needed to make their current product lines more competitive in export markets • Work with these companies to identify new product lines for export markets and the technologies required to compete effectively in those markets • Develop joint commercialisation and technology development plans for the best opportunities with each company • Promote the plans with potential investors and sign deals for their implementation • Implement joint commercialisation and technology development plans with partners from industry
Improve Product Development capability in CSIR and Industry	
Enable local companies are to access large scale engineering business opportunities, enable them to lead or participate in these programmes.	• Continue with PLM roll out in the division on key contract R&D and commercialisation projects (tbd) in the Division • Build internal PLM capacity in CSIR • Enlist more SMMEs to become part of the NISI programme, implement the agreements between DTI, and the PLM suppliers • Demonstrate PLM functionality to potential industry partners, as platform for joint projects (product development as well as factory performance improvement) • Support PLM implementation in industry with partners to be identified
Holistic and integrated approach to national security	
Address safety and security risks by means of a new holistic integrated approach taking into account how economic and social factors influence National security challenges (e.g. disaster response, border safeguarding, food security, energy security, wildlife crime, etc	• Use the whole of society approach to support the Gauteng disaster management capability building initiative • Continue to work with stakeholders in the wildlife and environmental crime combatting communities (NGOs and relevant Foundations e.g. Peace Parks Foundation) towards implementing holistic solutions developed through the CSIR methodologies
Enterprise Architecting capacity building in the state	
Assist national institutions in the safety and security sector with technology and engineering systems support in order to deliver on their strategic objectives	• Apply the CSIR Enterprise Architecting and Capability Definition approaches to the establishment of the City of Johannesburg Cyber Security Hub • SAPS Enterprise Architecting Capability Establishment (year 3 of a 3 year project) • Mandela Mining Precinct: Real-Time Information Management System (RTIMS) Enterprise Architecting (year 1 of 5 year project) • Department of Correctional Services: migrating current ICT systems into an Enterprise Architecting Framework (year 1 of medium term programme) • Integrated Criminal Justice System: Enterprise Architecting initiative (year 1 of medium term programme)

	• Potential Enterprise Architecting capacity building for DST • SANDF Medical Services: integration of all SANDF medical facility ICT systems • Implement Integrated Security Systems Technology Demonstration Facility at a Transnet site • Department of correctional services: Cell phone tracking demonstrator at a prison
Multi-agency command, coordination, and control	
Support the development of an all-inclusive command, coordination and control solution for multi-agency operation, including the interoperability of systems and data, business processes and systems	• Continue CMore operational support in the Kruger National Park under contract with DEA • Facilitate CMore roll out to all National Parks under contract with DEA (year 1 of 3) • Enhance and maintain the CMore code base, and re-build capacity to do so • Investigate ways to make the CMore capability accessible to smaller, relatively poorly resourced private reserves • Continue towards finding and implementing commercialisation models and partner(s) • Start on the conceptualisation of a next generation system • Develop predictive modeling technology for command and control
South African National Defence Force (SANDF) Air Operations capability	
Support the continuous improvement of the mission effectiveness and efficiency of South African Air Force (SAAF) Air capability.	• Implement the Aeronautics DERI capability under contract from Armscor • Implement Wind Tunnel Testing for Saab Sweden • Develop wind tunnel testing sub-systems for an overseas customer • Develop small gas-turbine technology for overseas customer
SANDF Landwards Capability	
Support the SANDF by developing technologies for supporting a specialised, highly mobile combat capability, including providing high levels of protection against threats such as road side bombs, explosively formed projectiles and improvised explosive devices without reducing mobility	• Implementation of the Landwards Systems DERI capability under contract from Armscor • Continued Logistics Support Vehicle development for the SA Army in cooperation with industry partners • Development of a Mobile Shooting Range for SAPS • Continued testing of blast and ballistics event survivability for industry (at DBEL) • Implement the Landwards Capability Management project for the SA Army (on-going multi-year programme)

SANDF Platform Protection	
Increase the survivability of SAAF and SA Navy platforms against optical (including infra-red) and radar-guided weapons	• Further development of CSIR's Digital Radio Frequency Memory (DRFM) technology and delivery on a number of export contracts • Enhancement of CSIR's SEWES technologies and delivery on local and export contracts • Phased array jammer technology development with an overseas partner • Implementation of the Electronic Warfare DERI capability under contract from Armscor • Early stage work on Electronic Warfare Range Capabilities and Air Adversary Training with overseas partners • Commercialisation of a Hostile Fire Indication Sensor with a local partner • Optical Missile Jamming Code Laboratory subsystems development • Enhancement of the OSSIM system and capacity building for maintaining this system in the medium term
National Surveillance and Situational Awareness	
Identify technology solutions to address potential deficiencies in the national surveillance capability, including maritime environment surveillance, environmental asset protection, peace support operations and border safeguarding	• Development of a Synthetic Radar Aperture (SAR) for UAS with Denel • Multi Static Radar technology development in cooperation with ACSA and Armasuisse • Upgrades and potentially additional Meerkat systems for implementation in the Kruger National Park and beyond • SAR technology development (early stage) for disaster management applications (Gauteng) • Continued development of Common Building Blocks for Radar systems • Development of a medium range optical surveillance system for Border Management applications • Long range optical surveillance technology upgrade for the Meerkat System used in anti-poaching operations • Next phase of the optical wide area surveillance system (WASS) for the SA Navy • Implementation of the Radar and Optical Surveillance DERI capability under contract from Armscor
Special Forces Capability	
We will maintain capabilities to support and maintain a Maritime, Airborne/Landwards and Combating Terorism Special Operations Capability for Special Operations	• Implementation of the Special Forces DERI capability under contract from Armscor • Implementation of Special Forces equipment acquisition programmes (SCAMP) as contracted by Armscor • Further development of novel 3D printing applications in the Special Forces domain as well as potentially in the commercial demolition application domain • Early stage development of integrated intelligence capabilities for Special Forces Command

B.4.1.1.1 Information Security Centre

National Cyber Security Capability	
Contribute to the implementation of the national cyber-security policy by developing a national capability to respond to large-scale cyber threat incidents.	• Implementation of the Cyber Security DERI capability under contract from Armscor • Implement the IWAP contract for the SANDF under contract from Armscor • Develop and implement Cyber Security Technologies for the City of Johannesburg Cyber Security Hub • Commercialise at least one Cyber Security technology demonstrator • Establish a Cyber Security Operations Center (CSOC) testbed for purposes of consolidating CSIR cyber security experts, technology, processes, and establishing a Concept Development and Experimentation facility for cyber security at the CSIR. • Research and develop identity authentication mechanisms for individuals and devices which are critical to information and national security • Develop and sustain - the cyber security DERI capability to continue building a capable state in the Department of Defence • Support the South African National Defence Force (SANDF) in building and sustaining the cyber-warfare capability through the Information Warfare Assistance Programme (IWAP). • Build and support an integrated cyber security capability for the City of Johannesburg (and other local municipalities) • Support the National Cyber Security Hub in operationalising the National Cyber Security Policy Framework (NCPF). • Support the industry and government with the cyber security vulnerability assessments, validation and verification of their information systems. • Build and grow - cyber security skills (human capital) to support government and industry in responding to large-scale cyber security threats and risks. • Enhance and identify partner(s) for commercialising at least one (1) cyber security technology demonstrator.

B.4.1.2 Smart Places

Long-term Objective	2019/20 Objectives
Waste for Development Research	
Provide new scientific evidence and decision support tools for improving waste management, unlocking green economy growth from the solid waste sector, and enabling circular economy development opportunities.	• Filing national waste data and knowledge gaps through targeted quantitative and qualitative studies to inform the adoption of alternative waste management options in support of moving waste up the waste management hierarchy towards recycling, reuse and minimisation opportunities • Roll out and transfer of the CSIR Waste Source Separation technology (SASCOST) model to local municipalities • Testing a framework for benchmarking of solid waste in South African municipalities to support decision making
Building Innovations Materials	
The development of high-performance building and construction material, including high-strength cement blends and geo-polymer products that are “greener” and cheaper.	• Commercialisation of green brick and meta-kaolin cement blends
Earth Observation	
Enhancing remote sensing technology for smart solutions and information delivery for food and water security, forestry, and the Blue Economy	• Development of a monitoring framework of water resource; • Biomass and carbon monitoring for the carbon economy; • Climate smart rangeland monitoring system in support of livestock industry; • Ocean and Coast Information Monitoring System (OCIM) • Development of a precision agriculture and forestry programme
Decision Support and Systems Analysis	
Improve the quantification of planning information by addressing aspects of data collection, data quality assessment, data analysis and modelling (with modelling including, for example, classification, prediction and forecasting models), required as inputs into plans, decisions, budget prioritisations and risk mitigation strategies.	• Household segmentation patterns for demand planning and forecasting purposes • Finalised general methodology • Finalised data collection and sampling procedure • Quantification of spatial and spatiotemporal patterns in environmental and social processes • Framework developed for choosing appropriate spatial causal analysis method
Construction Industry Innovation	

Development and implementation of an industrialised modular building system	• Development of IBT modular system
	  o Development of complete Modular IBT house
	  o Documented processes

Architecture	

A building performance platform to advance the use of context-appropriate science, technology and innovation approaches and solutions in building infrastructure for the improved performance of the shared built environment	• Science technology and innovation for sustainable human settlements
	  o Complete a Ten-year technology roadmap for sustainable human settlements.
	• Infection control studies
	  o Complete a Centre for Disease Control (CDC) contract report
	• Building performance platform
	  o AIR Tool pilot demonstration complete

Biodiversity and Ecosystems Services	
Understanding the interactions between various industrialisation pathways and the biodiversity and ecosystem services that provide the flows of goods required for human well-being	• Develop strategic models and maps of key resource areas in southern Africa. • Develop policy guidelines based on knowledge.
Climate Services and Environmental Health	
Climate change Risk and Vulnerability analysis across different spheres of government and across different sectors	• Complete global and regional forecast systems. • Continued generation of detailed projections of future climate change across the African continent to inform climate change adaptation from national through to local spheres of government. • Application of new urban and air quality modelling technologies over South African cities such as Tshwane • Participation in AR6 of the IPCC and CMIP6 of the WCRP. • Completion of crop yield and streamflow prediction capabilities for southern Africa. • Consolidation of Risk and Vulnerability analysis methodology to apply across sectors such as agriculture, forestry, water, energy, industry and biodiversity. • Continued demonstration of CSIR capacity to formulate climate change adaptation strategies across different spheres of government and across different sectors. • Continued demonstration of CSIR capacity to formulate climate change mitigation strategies across different spheres of government and across different sectors. • Assessments of South Africa's technology needs in a changing climate.
Sustainability Science	
Develop tools and provide decision support for public and private sector actors to enable improved integration of sustainability into development planning, assessment and implementation; so as to achieve sustainable development.	• Develop guidelines and tools for integrating sustainability principles into development planning and implementation • Improved methods and frameworks for sustainability assessment of policies, projects, and products • Provide decision support to enable improved integration of sustainability into development planning and implementation • Roll out and transfer of the CSIR Waste Source Separation technology (SASCOST) model to local municipalities

Sustainable Human Settlements	
Contribute to the development of more sustainable human settlements by providing practical and policy guidance and access to appropriate information with respect to the planning and design of cities, towns and neighborhoods, involving aspects such as settlement layout, housing options and urban land	• Planning and designing effective, efficient, livable, safe settlements • Promote and activate The Neighborhood Planning and Design Guide (Red Book) • Human settlement knowledge management • Establish a training programme to build capacity in the application of the Red Book
Urban and Regional Dynamics	
Generate evidence in support of policy, investment and planning decisions, to realise developmental goals in urban and rural settlements	• Urban growth modelling (intra-settlement focus) • Establishing a national modelling capability to support coordinated planning and infrastructure investment initiatives • Settlement growth modelling (inter-settlement modelling focus) • Social facility accessibility analysis capability (within and between settlements) • Supporting settlement spatial planning process to ensure futureproof settlements as it relates to climate change, shifts in the in the economy and population growth – The Green Book. • Developing the capability to regional economic development planning and interventions

B.4.1.2.1 Energy Centre

Long-term Objective	2019/20 Objectives
Energy Demand	
Assess, test and demonstrate emerging energy-efficient and demand response technologies and systems for deployment in various end-use sectors	• Build capacity to strengthen the ability of government and Energy Services Companies (ESCOs) to develop and implement strategies to accelerate the uptake of energy efficiency • Working with the Department of Energy and international organisations to conduct energy demand assessments required for national policy formulation and target monitoring • Energy Efficiency and Demand Response technology demonstration to facilitate technology development and localisation • Demonstrate and analyse the techno-economic impacts of Direct Load Control (DLC) enabled technologies, such as Electric Vehicles, smart water heaters, space cooling and lighting.
Energy Supply	
Research on Solar PV (system modelling, failure analysis, quality and reliability research); Mapping the wind energy resources in SA; Solar and wind forecasting; and, thermal storage research	• Procure and install a UV chamber, which is the last major capex investment needed to run the reliability programme • Complete ISO 17025 accreditation • Complete C450 reliability programme on one batch of locally manufactured PV modules • Develop simple statistical process control systems for PV monitoring and predictive fault finding • Demonstrate PV + storage modelling for optimising system size

	• 4ir variable renewable energy forecasting
Energy Systems	
Focuses on new ways to plan, design and operate the power system, with a long-term aim to have sector coupling for the entire energy system.	• Energy autonomous campus (EAC) energy system planning and optimisation including CSIR EAC Integrated Energy Plan (IEP) • Further review of strategic national energy plans with high shares of renewables • South African Energy system model with sector coupling – as conceptual study - (2019/20) • Development of an SA grid model for power system analysis
Energy Markets & Policy Research	
Determine the optimum policy/regulatory framework for a sustainable energy future.	• Host workshop with municipalities to understand their procurement needs and obstacles • Engage National Treasury on a scope of work for a study for the tax implication for high penetration of EVs • Engage NERSA and DOE on how a collaborative project may be structured on the future market design for South Africa
Energy Industry	
Informing policy decision by providing analysis of industrial development scenarios and by using science based tools to map out various development scenarios	• Energy Industry manufacturing market intelligence research and SA Positioning • Cost benefit analysis of localisation and determination of optimum local content for energy technologies • Energy SMME Development and capacity building through dissemination of the SMME Guide to Renewable Energy Business.

B.4.1.3 NextGen Institution and Enterprises

Long-term Objective	2019/20 Objectives
Digital Media (Media Mall)	
To enable the democratisation of the TV/Film industry through technology interventions that include SMMEs into the traditional TV broadcasting sector and as a consequence increase employment.	• Micro-billing enablement • Content Digital Rights Management (DRM) • Business development
Digital Architecture and Design	
Conceptualisation, analysis, digital system design and architecting of large scale operational digital solutions and systems that enables competitiveness of South African industries and enterprises .	• Development of Industry 4.0 Digital Technology Blocks

An integrated and multi-sectoral decision support centre	
The establishment of a centre that will, in collaboration with universities and developmental agencies, improve provide decision support services to government departments, local government, and state-owned companies.	• Incubate domain specialists in infrastructure management, water sustainability and environmental management by identifying best practices, keeping up to date with the latest research, industry trends including the 4th industrial revolution, • Package SET solutions available within CSIR and industry to address the current and future service delivery needs of government and industry. • Support and inform government and industry decision making on Environmental Management, Infrastructure Management and Water Sustainability challenges pertaining to the national-scale priority goals and projects. • Support government and industry with the designing and implementation of service delivery related programmes and projects through current and applicable technologies. • Support and implement government priority programmes in the water and environmental sector. • Assist government with GIAMA, GRAP and PFMA compliance and the integration of the compliance operations into a technology platform.
The large-scale deployment of technologies that support service delivery	
Establish a dedicated capability to assess and deliver Incubate service delivery capabilities in two domains.	• eGovernment: Against the challenges identified by the National eGovernment Strategy and Roadmap (2017). The CSIR will focus on ICT solutions for (1) citizen identification and authentication, (2) backend integration of Government systems to improve coordination and synchronisation across Government Departments, and (3) improved citizen engagement and accessible service delivery. • eHealth: regular updates of the Health Normative Standards Framework (HNSF), technical assessment of eHealth systems for conformance to the HNSF, the establishment of an approved eHealth interoperability architecture, and the establishment of foundational shared systems for interoperability • Oceans and Coasts: OCIMS – development of additional oceans robotics for oceans monitoring; Optical/SAR algorithm development, initial model testing and scoping of possible decision support tools in Oceans and Coasts Information Management System Platform

Green Economy Solutions	
Develop tools for embedding sustainability into development planning and creating new knowledge and technologies to unlock marked green economy development opportunities evident in the biomass and waste sectors	• R&D enabling improved integration of sustainability into development planning and implementation • Develop guidelines and tools for public and private sector actors to enable improved planning, measuring and monitoring of green economy development • Provide R&D support guiding the strategic planning and implementation of projects, programmes and policies for green economy development at a local level; focusing on (but not limited to) agriculture, biomass, waste and post-mining landscapes. • Provide new scientific evidence and decision support tools for un- locking green economy growth from the solid waste sector • Launch the forest and waste biomass bio refinery R&D platform • Roll out and transfer of the CSIR Waste Source Separation technology (SASCOST) model to local municipalities

B.4.1.3.1 Data Sciences Centre

Long-term Objective	2019/20 Objectives
ICT for Industrialisation	
Support the long term industrialisation and industrial diversification of the economy, specifically in 4th industrial revolution (Industry 4.0) development in South Africa. Develop an innovative Micro Enterprise Media Engine platform with content ingestion, programme scheduling and timed play-out service for virtual television stations.	• Development of proof of concepts to show the benefits of modernised industrial processes (improved efficiency, reduction in costs and enhanced product-customer interactions). These will lead to more competitive industries as well as new business innovations (additional wealth generation). • Implement a dynamic geo-location based spectrum access system to increase efficiency in access to and use of radio frequency spectrum and toolboxes to enable accessible to operators and developers anytime anywhere • Development of proof of concepts to show the benefits of modernised industrial processes (improved efficiency, reduction in costs and enhanced product-customer interactions). These will lead to more competitive industries as well as new business innovations (additional wealth generation). • Implement a dynamic geo-location based spectrum access system to increase efficiency in access to and use of radio frequency spectrum and toolboxes to enable accessible to operators and developers anytime anywhere • Develop a massive network virtualisation platform for enabling global view, programmability and control of network elements and functions that is operationally accessible to operators anytime anywhere • Develop an open massively scalable mobile IPTV (mIPTV) system that integrates public Internet based media content ingestion, scheduling, broadcasting and video-on-demand (VOD) capabilities. • Continue with the development of an innovative Micro-Enterprise Media Engine (MEME) platform • Software development for the virtualisation of the first set of server components of the MEME platform and the associated automatic deployment engine suitable for cloud infrastructures

Embedded Intelligence Systems	
Build embedded intelligent systems for the IIoT in support of clusters (mining, smart places, next gen institutions)	• RTIMS phase 2 • Rockpulse • Grid emulator
Data Sciences	
Developing infrastructure and algorithms (based on mathematical, statistical and machine learning models) to apply predictive analytics and Artificial Intelligence services in the optimisation of business processes.	• Mining Technology - RTIMS phase 2 • Data Sciences for industrial development – Electricity Management
Human Language Technologies	
The development, deployment and servitisation of localised language technologies with the aim of supporting the application of artificial intelligence and machine learning to improve human-machine interfacing.	• Development of Industry 4.0 Digital Technology Blocks Augmented ebook system version Localised speech synthesis voices • Speech-to-speech (S2S) pipeline for egovernment service delivery
Smart IoT	
Show the benefits of the Industry 4.0 Digital Technology blocks to SMMEs. This is supported by the establishment of cyber-physical facilities that enables the experimentation with Digitalisation in multiple domains and sectors	• Cyber Physical Industrialisation Systems Lab Develop Industry 4.0 lab

B.4.1.4 Smart Logistics

Long-term Objective	2019/20 Objectives
Efficient transport networks	
Creation of solutions to improve the performance of transport network operations and associated management systems	• Build platform to model transport network performance at a national level for passenger and freight transport. • Collate necessary data to develop network behavioral models. • Develop road safety risk modelling framework. • Deepen international relationships in respect of sustainable freight transport. Comprehensive quantification of the public transport industry value chain.

Integrated logistics (Sustainable freight transport)	
Creation of solutions to improve the performance of transport network operations and associated management systems.	• Build platform to model transport network performance at a national level for passenger and freight transport. • Collate necessary data to develop network behavioral models. • Develop road safety risk modelling framework. • Deepen international relationships in respect of sustainable freight transport. • Comprehensive quantification of the public transport industry value chain.
High performance rural transport infrastructure	
Develop and facilitate implementation of methods and techniques for the delivery (i.e. planning, financing, design, construction, maintenance and management) of sustainable Access Road Infrastructure	• (Continuation of 2018/19 Activities) • Develop and facilitate implementation of methods and techniques for the delivery of sustainable Access Road Infrastructure. • Development and trialling of cost-effective road upgrading methodologies that rely less on non-renewable resources • Development of labour-intensive community-based approached for routine maintenance of low-volume access roads • Pilot implementation of cost-effective climate adaptation options in three African countries (Ethiopia, Ghana & Mozambique) • Development of a sustainability evaluation toolkit • Implementation of capacity building programmes • Establishment of Road Research Capacity in at least six African and Southeast Asian countries • Large-scale implementation of cost-effective road upgrading methodologies that rely less on non-renewable resources: uptake, embedment, monitoring and evaluation • Performance assessment of nano-modified emulsion stabilisers to enhance marginal materials

B.4.2 Emerging Initiatives

B.4.2.1 Water Resource Management

Long-term Objective	2019/20 Objectives
Water and Wastewater infrastructure	
New solutions for design, provision and operation of water infrastructure that will enhance water distribution, security and treatment of wastewater thus ensure sustainable service delivery and cost savings	• Smart Water Distribution Networks design, with improved operation and maintenance. • Fit for purpose water purification and supply infrastructure designs for off the grid areas • New Technologies for wastewater treatment and water purification. • New AMD treatment processes

Hydroscience	
Securing water resources for sustainable social and economic development, and improving water resilience.	• Develop Web application to predict water use on farms • Develop Web application to predict changes in water use from change in land use and climate; Guidelines and recommendations per Province

B.4.3 Ring-Fenced DST Initiatives

Long-term Objective	2019/20 Objectives
ICT RD&I Roadmap	
The investment is aligned with the ICT RD&I Roadmap and utilised to ensure CSIR contribution to RD&I that brings the country closer to the goals of the ICT RD&I Roadmap.	• See ICT Infrastructure in Section B.3.1 and Digital Opportunities, ICT for Industrialisation in Section B4.1 • Development of a biometric recognition system for minors. • Enable biometric authentication in smart cards. • Development of a secure biometric-enabled terminal. • Development of service delivery platforms (access control using tokens) for government. • Pilot test of service delivery platform at 2 local municipalities • Deployment of service delivery test bed in 1 national government department • Development of host based intrusion detection methods that uses pattern recognition and log files to learn future rules. • Development of an anomaly based intrusion detection technology, which involves the accurate and timely detection of intrusions as they occur. • Develop a benchmark network dataset generator – packaged as a software tool • Develop a network behavioural model

B.4.3.1 Fourth Industrial Revolution Centre

Long-term Objective	2019/20 Objectives
Fourth Industrial Revolution Centre	
Assist with the coordination of research, innovation and conformance standards testing to enable Africa to effectively tackle its socioeconomic challenges and consequently become competitive participants in the global economy.	• Finalise operating model and funding agreements • Establish centre as a World Economic Forum associate centre • Finalise agreement with International Telecommunication Union (Enabling Environment programme) • Establish Inclusive Development Platform (with HSRC and relevant partners) • Integrate Converging Technologies Platform • Establish governance model and structures • Initiate 2 national 4IR pilot studies (WEF collaboration) • Initiate 2 – 4 national technology development projects (CTP platform)

B.5 SO4: Build and transform human capital and infrastructure.

Limited capabilities exist to leverage the opportunity of new technologies impacting all industry sectors and society. This strategic objective seeks to build and transform the required human capital & infrastructure to drive industrialisation and the advancement of society. It emphasises the need for targeted capability development to leverage emerging technologies and capabilities

B.5.1 Human Capital Development

Our strategy for building a motivated, high-performing and diverse workforce is multi-faceted, encompassing improvements to the pipeline, a strong focus on leadership development, succession planning and performance management, innovative approaches towards sourcing, developing and retaining talent, and creating prospects for the long-term growth of our people.

To measure our success in building a motivated, high-performing and diverse workforce, we track our progress towards the desired culture, leadership competencies and engagement indices. The table below summarises (proposed) renewed human capital performance indicators and measures.

Long-term Objective	2019/20 Objectives
Capacity Development	
Attract, develop and retain a diverse and transformed workforce - Capacitate the business to support the new strategy	• Reposition employee value proposition to EPIC values so as to embed the new culture – revitalisation of existing staff and induction of new employees • Talent management framework • Revised pipeline development programmes • Revised learning and development programme • Increased investment and participation in training & development programmes • Targeted accelerated development programmes for critical staff • Improved workforce ecosystem • Improved employee growth
Leadership Development	
Create an enabling culture and leadership to drive strategy execution (Principal and Chief Researchers).	• Establish base line • Measure, develop and implement a culture improvement strategy • Leadership development programme
Human Capital Efficiency	
Increase HC operational efficiencies and effective: measure optimise business processes	• Align and optimise the organisational design to support strategy • Optimal business processes - performance, recruitment, data-analytics, induction and employee revitalisation tools

B.5.2 Infrastructure

Capital spending for the year is planned to be R95 million.

A significant portion of the CSIR's projected capital spend has been allocated to research infrastructure to support the new Strategy and the replacement and renewal of existing assets to maintain and sustain current operating levels as well as future growth opportunities.

A large portion of the project capital spending remains unfunded. The Campus Planning Development Office (CPDO) will focus on fundraising campaign in 2019/20 to build partnerships and seek investment opportunities.

The CPDO has been established to oversee the implementation of the Campus Master Plan. During 2019/20 financial year the CPDO will focus on the following interventions:

- Sourcing of funding for the initial priority projects (including the "Gateway to Science and Innovation Centre" and the Centralised, Shared Core Facility for Multidisciplinary Research (Shared Laboratory); and
- The preparation of detailed feasibility studies for the prioritised list of projects.

The Energy Autonomous Campus (EAC) Programme will continue with the first phase of the installation of rooftop photo-voltaic plants, as well as feasibility studies for the installation of the Biogas plant.

Long-term Objective	2019/20 Objectives
Campus Master Plan	
Implement the Scientia Campus Master Plan to provide the appropriate physical environment to support the CSIR vision and mission.	– Continued feasibility studies for the Gateway to Science and Innovation Centre and Bankable Business Case – Establish private and public sector partnerships to invest in the Gateway to Science and Innovation Centre – Secure funding for the development and operations of the Gateway to Science and Innovation Centre – Develop preliminary design for the Gateway to Science and Innovation Centre dependent on funding availability – Continued development of the feasibility studies for the centralised, shared core facility for multi-disciplinary research (Shared Laboratory) to achieve the CSIR vision and mission – Needs analysis and pre-feasibility studies for the rationalisation, consolidation and modernisation of office accommodation to accommodate the new – organisational structure – Needs analysis and pre-feasibility studies for the pilot plants and other infrastructure required to support the implementation of the new Strategy in line with the CMP. – Establish private and public sector partnerships to invest in the research infrastructure and the Campus Master Plan.

Capital Investment	
Implement the approved Annual Strategic Capital investment Plan to renew and develop infrastructure that supports scientific and development objectives in line with the CSIR Campus Master Plan.	– Invest R105 million in general facilities and infrastructure to ensure compliance to regulatory compliance and address Health and Safety, of which 60% of the capital investment to be invested in research infrastructure. – Efficient delivery of the approved capital investment projects
Energy Autonomous Campus (EAC) Programme	
– Installation of rooftop PV on the CSIR buildings with a high share of local content – Installation of a 1-3 MW Biogas power plant on the CSIR campus in Pretoria by year 2023. – Implement demand side management solutions to reduce demand by 20% and to implement demand shaping solutions – Develop an Integrated Energy Plan (IEP) for the CSIR campus	– Installation and commissioning of 0.9 MW of PV rooftop on select CSIR buildings – Achieve energy savings income of R 2.3 million for the EAC – Finalise the Environment Impact Assessment (EIA) Report for the Biogas Plant – Continued development of the detailed feasibility studies and Bankable business case for the Biogas Plant – Secure capex funding for the unfunded components of the programme

B.6 SO5: Diversify income, maintain financial sustainability and good governance.

The CSIR is forecasting a net loss of R49 million for the 2018/19 financial year. Certain areas within the CSIR have experienced ongoing financial sustainability challenges and poor performance due to operational inefficiencies and the inability to secure sales, which has negatively impacted the CSIR's financial performance as a whole. The CSIR received board approval in April 2018 to conduct an in-depth review to determine the viability of the areas in question, as well as actions required to improve financial performance and sustainability. The outcome of the review led to cost optimisation initiatives, as well as a targeted restructuring process. The forecast net loss is largely attributable to estimated costs of restructure that were not included in the 2018/19 budget.

Despite the forecast loss of 2018/19, the CSIR has budgeted net profit of R18 million for the 2019/20 financial year. This is based on the expected outcomes of the organisational repositioning and the implementation of Project Synapse. In addition to these strategic initiatives, the CSIR is actively driving cost containment and improved operational efficiencies.

Income diversification remains a key strategic objective and will reduce the financial risk associated with a significant reliance on public sector income. Income diversification is also expected to improve the CSIR's profitability as profit margins are currently between 1% and 2% on public sector income. The focus for 2019/20 will be on growing international income, whilst strengthening strategic alignment and partnership within the local private sector.

Conservative balance sheet practices, including working capital and cash flow management, are important to enable the CSIR to invest in the scientific equipment and infrastructure required to support strategic objectives.

All financial resources are invested in line with the CSIR's mandate.

B.6.1 Growth

The CSIR has budgeted for an increase of 5.7% in total operating revenue on 2018/19 forecast (see Table G.1). Contract income and baseline grant funding increase and decrease on a comparative basis by 8.6% and 0.3% respectively.

Income from the South African public sector and South African private sector is budgeted to increase by 6% and 2% respectively, based on secured contracts and current engagements with stakeholders and clients to secure contracts for proposals submitted.

International contract income is budgeted to increase by 33.5% as a result of repositioning the CSIR's value proposition within the International market as aligned to Project Synapse.

Included in contract income from the South African public sector is the Cyber Infrastructure ring-fenced allocation from the DST. These contracts have historically been reflected as such and are included as part of public sector income for comparative purposes.

It should be noted that the CSIR's Baseline Parliamentary Grant allocation for 2019/20 has been reduced by 0.5% from that of 2018/19 (R49 million). This will negatively impact the CSIR's ability to implement growth plans in terms of the new industrialisation strategy. In particular this impact will limit PPE investment and critical appointments required to increase capabilities aligned to the new industrialisation strategy. Certain PG initiatives will also no longer be possible, specifically uncommitted HCD initiatives.

The CSIR will implement the directive on wage freezing and budget cuts on goods and services in the 2019/20 financial year to address the reduction in baseline allocation. Organisational support requirements will be reviewed to ensure that efficiencies are obtained within support structures.

B.6.2 Expenditure

Total expenditure is budgeted to increase by 3.2% on 2018/19 forecast, with employee remuneration costs and depreciation budgeted to increase by 3.9% and 29.3% respectively. Operating expenses are expected to decrease by 0.2%.

The increase in employee related costs is determined by taking into consideration the expected savings from restructuring, human capital development costs, annual planned salary increase as well as the growth projections on contract income. All planned recruitment will be dependent on the securing of contracts, and resource planning of required skills within the CSIR.

The budget for operating expenses is determined by taking into account contract-specific expenses (directly associated with contract income) as well as operational overheads (inherent in running the business).

Based on the current economic climate and need to improve financial performance, strict cost containment measures have been implemented across the CSIR.

The increase in depreciation is based on affordability and the availability of cash flow. The budget

for 2019/20 includes fully funded grant assets. All planned investment in property, plant and equipment will be assessed to ensure alignment with strategy and operational requirements and will be prioritised based on affordability and return on investment. The investment for the campus master plan has not been included in the capital expenditure budget as this is dependent on the securing of external funding.

B.6.3 Royalty income and other income

Royalty income is budgeted at R 3.1 million and is based on current registered license agreements.

Royalty income is budgeted to increase slightly by R0.07 million (2.1%) from the 2018/19 forecast (R3.03 million). It is anticipated that sales volumes for royalties on non-commodity products will be very slow in the next financial year and hence the expected royalty stream will only increase slightly. The CSIR is targeting a number of new license agreements on which nominal returns are expected by the end of the 2019/20 financial year.

Included in the 2018/19 forecast is other income of R0.8 million. This relates mainly to the net effect of foreign exchange gains and losses. The CSIR takes a neutral view on the currency movements going forward and as such has not budgeted for a foreign exchange gain or loss.

B.6.4 Financial Sustainability

The 2019/20 budget indicates a positive net margin of R9 million against the 2018/19 forecast loss of R49 million. The R9 million increased net margin is due to predicted growth in total operating revenue and contract income of 5.7% and 8.1% respectively. The increase in contract income from the 2018/19 forecast is supported by the refocusing of CSIR contribution in the International market based on the new business model which targets international sales growth of 33.5% compared to 2018/19 forecast. The CSIR will continue to mitigate the risks relating to the negative climate that has an effect on contracts not being secured as planned, delays on large contracts, and stringent legislative requirements resulting in time consuming tender processes.

As a result, cost containment measures relating to all expenses are strictly managed, thus reducing operating expense by 0.2% on the 2018/19 forecast.

Investment income is expected to amount to R39.1 million.

Table B.1 provides the high-level CSIR statement of comprehensive income reflecting the forecast for 2018/19 and the budget for 2019/20. A statement of comprehensive income for the Medium Term Expenditure Framework (MTEF) period is provided in Table B.2.

Table B.1: Statement of Comprehensive Income

	Forecast 2018/2019 R'000	Budget 2019/2020 R'000
Total Operating Revenue	**2 705 059**	**2 859 326**
R & D Contract Income	**1 941 167**	**2 098 168**
Public - South Africa	1 476 096	1 571 049
Private - South Africa	211 620	215 814
International	167 322	223 316
Parliamentary Grant - Ringfenced	86 129	87 989
Parliamentary Grant	**760 092**	**758 068**
Royalty Income	**3 025**	**3 090**
Other Income	**775**	**0**
Total expenditure	**2 798 820**	**2 889 559**
Employees' Remuneration	1 640 011	1 703 908
Operating Expenses	1 058 385	1 055 872
Depreciation	100 424	129 779
Operating Profit before Investment Income	**(93 761)**	**(30 233)**
Investment Income	44 700	39 100
Net profit before non-guaranteed employees' remuneration (Performance bonus)	**(49 061)**	**8 867**
Non-guaranteed employees' remuneration (Performance bonus)		
NET PROFIT	**(49 061)**	**8 867**

*Included in contract R&D income from the South African Public sector is the Cyber Infrastructure ring fenced allocation for SANReN and the CHPC.

Table B.2: Medium Term Expenditure Framework allocation to the CSIR (excl VAT)

Category	2019/20 R'000	2020/21 R'000	2021/22 R'000
Baseline Parliamentary Grant	**758 068**	**799 724**	**824 142**
Parliamentary Grant	727 174	767 131	789 789
National Laser Centre	30 894	32 593	34 353
Ring fenced allocation	**300 636**	**313 043**	**329 040**
Laser Loan Programme	9 070	9 569	10 085
African Laser Centre	4 955	5 227	5 510
Implementation: ICT R&D Strategy	67 754	71 480	75 340
Cyber Infrastructure (NICIS)	218 857	226 767	238 105
TOTAL	**1 058 704**	**1 112 767**	**1 153 182**

B.6.5 Statement of financial position

A CSIR statement of the financial position for the MTEF period is provided in Appendix G.2. Table B.3 provides a summary projected balance sheet.

Table B.3: Projected CSIR statement of financial position

	FORECAST March 2019 R'000	BUDGET March 2020 R'000
ASSETS		
Non-Current assets	**781 690**	**746 911**
Property, plant and equipment	767 911	733 132
Interest in Joint Ventures and Associates	9 068	9 068
Interest in Subsidiaries	4 712	4 712
Trade and other receivables	-	-
Current Assets	**690 477**	**726 807**
Trade and other receivables	243 254	257 339
Inventory and contracts in progress	(648 677)	(629 052)
Cash and cash equivalents	1 095 900	1 098 519
TOTAL ASSETS	**1 472 167**	**1 473 718**
EQUITY AND LIABILITIES		
Reserves	**942 823**	**951 690**
Retained earnings	942 823	951 690
Non-current liabilities	**11 072**	**11 183**
Post retirement medical benefits	11 072	11 183
Current Liabilities	**518 272**	**510 845**
Advances received	135 141	142 966
Trade and other payables	383 131	367 879
TOTAL EQUITY AND LIABILITIES	**1 472 167**	**1 473 718**

One needs to consider the budgeted cash balance of R1.1 billion in conjunction with the current liabilities of R518 million. The current ratio (current assets/current liabilities) is expected to remain at approximately 1.3.

B.6.6 Investment in property, plant and equipment

The budgeted investment in property, plant and equipment for the 2019/20 financial year is R 95 million.

Notwithstanding the fact that an item is included in the property, plant and equipment budget, the investment remains subject to approval as per the Approval Framework of the CSIR and additional considerations such as strategic alignment, return on investment and available cash flow.

B.6.7 CSIR Subsidiaries

Details of CSIR subsidiaries and associates are provided in Appendix G. The subsidiaries account for a marginal portion of the total Group's budget.

The CSIR and its subsidiaries do not pay dividends and accordingly have a zero dividend policy.

The five year borrowing plan is provided in Appendix G.3.

B.6.8 Governance

The CSIR will continue to sustain its role as a good corporate citizen through greater investments in implementing and effective B-BBEE programme and maintaining is environment, health and safety record.

To improve its B-BBEE Status, the CSIR will:

- Improve its performance on employment equity in line with its employment equity goals,
- Review it's B-BBEE strategy to ensure alignment with the new Codes of Practice,
- Develop an enterprise and supplier development framework, and
- Improve its preferential procurement spend.

Health and safety of CSIR employees and visitors will remain a priority in all CSIR operations and at all CSIR sites. The organisation will continue to focus on:

- Instilling a safety culture and improve staff behaviour and ownership at various levels in the organisation,
- Implementing an effective health and safety performance monitoring and evaluation system,
- Continually reviewing the organisation's health, safety and environmental management system

to ensure effectiveness and efficiency, and

- Continued compliance to relevant legislation and to international health, safety and environmental standards such as OHSAS 18001 and ISO 14001.

B.7 Annual and quarterly targets: 2019/20

Table B.4: CSIR Quarterly Targets: 2019/20

Indicator	Q1	Q2	Q3	Q4
SO 1: Conduct research, development and innovation, localise transformative technologies and accelerate their diffusion				
KPI 01 Publication Equivalents	90	194	314	420
KPI 02 New Priority Patent Applications Filed	0	0	0	5
KPI 03: New Patents Granted	0	3	6	13
KPI 04: New Technology Demonstrators	0	1	25	66
KPI 05: Number of technology licence agreements signed	0	5	12	24
KPI 06: Number of localised technologies	0	3	7	12
SO2: Collaboratively improve the competitiveness of high impact industries to support South Africa's re-industrialisation.				
KPI 07: Number of joint technology development agreements being implemented for industry	4	14	24	39
KPI 08: Number of SMMEs supported	16	50	67	92
SO3: Drive the socioeconomic transformation through RD&I which supports the development of a capable state				
KPI 09 Number of Reports Contributing to National Policy Development	2	5	13	24
KPI 10: Number of standards delivered or contributed in support of the state	1	5	10	16
KPI 11: Number of projects implemented to increase the capability of the state	15	27	39	54
SO 4: Build and transform human capital and infrastructure				
KPI 12: Total SET staff	1571	1587	1603	1619
KPI 13: – Percentage of SET staff who are Black	59	60	61	62
KPI 14: – Percentage of SET staff who are Female	34	35	35	36
KPI 15: – Percentage of SET staff with a PhD	19	20	21	22
KPI 16: Total Chief Researchers	14	14	15	15
KPI 17: – Percentage of Chief Researchers who are Black	7	7	13	13
KPI 18: – Percentage of Chief Researchers who are Female	13	13	13	13
KPI 19: Total Principal Researchers	189	195	202	209
KPI 20: – Percentage of Principal Researchers who are Black	29	29	30	31
KPI 21: – Percentage of Principal Researchers who are Female	17	17	17	18
KPI 22: Number of exchange programmes with industry	2	4	6	8
KPI 23: PPE Investment (Rm)*	14	41	68	95
SO 5: Diversify income, maintain financial sustainability and good governance				
KPI 24: Total Income (Rm)	625	1325	2013	2859
KPI 25: Net Profit (Rm)	-39	-19	-53	9.0
KPI 26: SA Public sector income (% Total Income)	52	52	53	55
KPI 27: SA Private sector income (% Total Income)	8	8	8	8
KPI 28: International contract income (% Total Income)	8	8	8	8
KPI 29: B-BBEE Rating*	3	3	3	3
KPI 30: Recordable incident rate*	2	2	2	2
KPI 31: Audit opinion	-	-	-	Unqualified audit opinion

Governance Structure

Contents

The Executive Authority of the CSIR is the Minister of Science and Technology. The Accounting Authority of the CSIR is the CSIR Board, duly appointed by the Minister. The Practice Note issued by National Treasury dealing with the Submission of Corporate Plans requires the inclusion of the following in the Corporate Plan:

- The composition of the Board of Directors and its subcommittees;
- The members of the Executive Management team.

C.1 CSIR Board

The members of the CSIR Board are:

- Prof Thokozani Majozi (Chairperson)
- Dr Thulani Dlamini (CEO)
- Ms Phindile Baleni
- Dr Amber-Robyn Childs
- Dr Ramatsemela Masango
- Mr Stafford Masie
- Ms Tiny Mokhabuki
- Dr Vuyo Mthethwa
- Mr Joel Netshitenzhe
- Dr Christine Render

- Mr Cassim Shariff

The Board has three sub-committees – Research, Development and Industrialisation; Audit and Risk; and Human Resources and Remuneration. The members of these committees are as follows:

Research, Development and Industrialisation Committee

- Dr Christine Render – Chairperson
- Dr Amber-Robyn Childs
- Dr Ramatsemela Masango
- Mr Stafford Masie
- Mr Joel Netshitenzhe
- Mr Cassim Shariff

Audit and Risk Committee

- Ms Tiny Mokhabuki – Chairperson
- Ms Phindile Baleni
- Mr Stafford Masie
- Dr Christine Render
- Dr Vuyo Mthethwa

Human Resources and Remuneration Committee

- Dr Vuyo Mthethwa - Chairperson
- Ms Phindile Baleni
- Dr Ramatsemela Masango
- Mr Cassim Shariff

Additional details on each board member are provided in Table C.1.

Table C.1: CSIR Board

Age	Sex	Race	Qualification	Years	Position on other Boards
Prof Thokozani Majozi (Chairperson)					
45	Male	Black	*University of Manchester Institute of Science and Technology* PhD (Process Integration) *University of Natal* MSc (Engineering) BSc (Chemical Engineering)	4	*Director* A1 Consulting Engineers CC Zyblue Pty Ltd
Dr. Thulani Dlamini (Chief Executive Officer)					
49	Male	Black	*University of the Witwatersrand* BSc Chemistry BSc (Hons) Chemistry PhD Chemistry, Catalysis *University of South Africa* Master of Business Leadership	2	*Council Member:* University of KwaZulu Natal Council *Council Member:* National Advisory Council on Innovation (NACI) *Director* Vumelana Trade 120 Kusile Invest 125 Mavela consulting Services
Dr Ramatsemela Masango					
43	Female	Black	*Pennsylvania State University* PhD (Nuclear Engineering) MSc (Nuclear Engineering) *Lyceum College* Diploma in Project Management *Cape Peninsula University of Technology* B.Tech Degree (Chemical Engineering)	4	*Executive Director* Mzansi Energy Solutions and Innovations (Pty) Ltd Mzesi Energy Mzesi Academy Mzesi Holdings *Non-Executive Director* ArioGenix Face to Face Foundation Redhorn Holdings Mzesi Water & Construction Yonga Energy Tingo Technologies Amanzi Technologies Africa Energy Wise Solutions Miyezi Investments Vito
Dr Amber-Robyn Childs					
39	Female	White	*Rhodes University* PhD (Ichthyology) MSc (Cum Laude) (Ichthyology) BSc (Hons) Ichthyology BSc Ichthyology, Zoology, Mathematical Studies	0	None
Dr Christine Render					
61	Female	White	*Leeds University (England)* PhD (Chemical Engineering) BSc Hons. (Chemical Engineering)	0	None

Age	Sex	Race	Qualification	Years	Position on other Boards
Dr Vuyo Mthethwa					
51	Female	Black	*University of KwaZulu Natal* PhD Higher Education governance	0	*Senior Director* Durban University of Technology
Ms Phindile Baleni					
51	Female	Black	*University of the Witwatersrand* B.Proc LLB	4	*Employee (Director General)* Gauteng Provincial Government *Council Member (Non-remunerative)* Wits University Council *Board Member (Non-remunerative)* IIASA NMO (RSA) *Trustee (Non-remunerative)* Rev LW Mbethe Trust Trust First Rand Black Directors BEE Scheme
Mr Cassim Shariff					
49	Male		*Leicester Business School, DeMontfort University* Master's in Business Administration	0	*Executive Director* Aquaworx Remediator & Infrastructure Solutions Lirazest Southern Cross Diamonds SDB Gas *Non-Executive Director* Silver Crown Trading *Shareholder* Opulent Energy
Mr Stafford Masie					
45	Male			0	*Non-Executive Director and Shares* Thumbzup South Africa Thumbzup Australia/AsiaPac Thumbzup International (London) Thumbzup USA *Shareholder/Funder* Green Moon Transact *Executive Director and Shareholder* GATTACA SnapTutor Razorlogix *Shareholder* LRXYM *Non-Executive Director and Board Member* Advtech

Age	Sex	Race	Qualification	Years	Position on other Boards
Ms Tiny Mokhabuki					
36	Female	Black	*SAICA* CA (SA) *CIMA* Adv Dip in MA Acma, CGMA *University of Kwa Zulu Natal* PGDA (with CTA) *University of the Witwatersrand* Bachelor of Commerce *Global Institute of Business Sciences* Aspen Management Programme	0	*Director* Business Entrepreneur Community (Dormant, Deregistration process) Equata World in a Bag Mokhabuki Building and Construction Sphimokha Digiten *Employee* Multichoice Support Services
Mr Joel Netshitenzhe					
62	Male	Black	*University of London* M.Sc (Financial Economics) Post-graduate Diploma (Economic Principles) *Institute of Social Sciences, Moscow* Diploma (Political Science)	4	*Executive Director* Mapungubwe Institute for Strategic Reflection *Director* Nedbank Group Nedbank Life Healthcare Group Lushote Trading (Fledgling) Topaz Sky Trading 316 (Fledgling) Betascape (Dormant) *Member* African National Congress NEC Camel Rock Trading 434 (Dormant)

C.2 Executive Management

A number of changes have been made to the CSIR executive portfolios in order to improve efficiency in the organisation. In particular these changes have been implemented in order to address:

1. Misalignment between strategy and operations, leading to mixed messages and confusion in the organisation;
2. The need to better align our strategic partnerships with our investment strategy, innovation strategy and operations; and
3. Streamlining our decision making and ensuring that there is single-point accountability.

To address these concerns and augment the impact of our key deliverables for organisational efficiency, the CSIR executive portfolios have been consolidated into the following portfolios:

- **Finance** – Chief Financial Officer, Ms Zanele Ngwepe
- **Business Excellence and Integration** – Divisional Group Executive: Vacant - Adv Esmé Kennedy (Acting)
- **Chemicals, Agriculture, Food & Health** – Divisional Group Executive: Vacant - Dr Rachel Chikwamba (Acting)
- **Mining, Manufacturing, Defence & Security** – Divisional Group Executive: Dr Motodi Maserumule
- **Natural Resources, Enabling Infrastructure, Public & Professional Services** – Divisional Group Executive: Vacant
- **Human Capital** – Divisional Group Executive: Ms Sithembile Bhengu
- **Legal, Compliance and Business Enablement** – Divisional Group Executive: Adv Esmé Kennedy

Additional information on each member of the Executive Management Team is given in Table C.2.

Table C.2: CSIR Executive Management

Age	Sex	Race	Qualification	Years	Position on other Boards
Ms Zanele Ngwepe, Chief Financial Officer					
40	Female	Black	CA (SA) University of KwaZulu-Natal BCom Hons University of the Witswatersrand BCom	1	*Finance Committee Member* Nelson Mandela Children's Hospital
Adv Esmé Kennedy Divisional Group Executive: Legal, Compliance and Business Enablement and Acting for Research, Development and Innovation					

Age	Sex	Race	Qualification	Years	Position on other Boards
41	Female	White	*University of Pretoria* B.Proc *Potchefstroom University* LLB LLM (Import and Export Law*)* *High Court of South Africa* Admitted as an Advocate *General Council Bar of South Africa* *Admitted as member of the Johannesburg Bar* *University of the North West – Potchefstroom Business School* MBA	0	*Trustee* CSIR Pension Fund
Ms Sithembile Bhengu, Divisional Group Executive: Human Capital					
40	Female	Black	*University of South Africa* ,*Human Resources Management* (PGD) B.A Social Science(Hons) *UNISA School of Business Leadership* Master of Business Leadership (MBL)	1	*Director* Expo for Young Scientists NOCs
Dr Motodi Maserumule, Divisional Group Executive: Mining, Manufacturing, Defence and Security					
51	Male	Black	*Rensselaer Polytechnic Institute (USA)* PhD Mathematics *Clark Atlanta University* MSc Mathematics. Applied Math *Morris Brown College* BSc Mathematics *IMD, Lausanne, Switzerland* Mastering Technology Enterprise *SA National Defence College* Executive National Security Programme	0	*Professional Membership* Institute of Directors S.A. Society of Industrial and Applied Mathematics
Dr Rachel Chikwamba, Divisional Group Executive (Acting): Chemicals, Agriculture, Food and Health					
48	Female	Black	*University of Queensland* M.Sc (Agricultural studies) *Iowa State University* PhD (Genetics) *Gordon Institute of Business Science* MBA	13	*Member* Academy of Science of South Africa Global Governing Board, ICRISAT South African Medical Research Council Board *Advisory Board* Institute for Science and Technology Education, UNISA Wits Health Consortium (Pty) Limited *Chair of Advisory Board* Applied Center for Climate & Earth System Science

D

Risk Management Plan

Contents

D.1 Introduction

D.1.1 Background

Every entity exists to provide value for its stakeholders. All entities face uncertainty and the challenge for management is to determine how much uncertainty to accept as it strives to grow stakeholder value. This is achieved through risk management.

Good risk management is fundamental to effective corporate governance and has become a focus area in all corporate governance frameworks**.**

National Treasury recognises that risk management is a corporate, as well as an individual responsibility. The establishment of effective systems of risk management is part of the framework of internal control. Anticipation of risks and their subsequent management increase the enterprise's ability to respond to them in a proactive manner.

A thorough understanding of risk accepted by the CSIR in the pursuance of its strategic objectives, together with those strategies employed to mitigate risks, is thus essential for a proper appreciation of the CSIR's affairs by the Executive Management Committee (ExCo) and the Board of Directors of the CSIR.

To this end, CSIR management is responsible for ensuring that all risks, both internal and external, faced by the CSIR are managed effectively. The approach to risk management utilised by the CSIR provides a mechanism to formalise responsibility and establish accountability for all risk management activities, i.e. a consolidated risk report culminating in a Risk Management Plan (RMP). The formalisation of risk management activities is achieved through the Audit and Risk Committee (ARC), which recommends approval of the RMP to the CSIR Board of Directors.

Risk Management is ultimately about proactively identifying and understanding the factors and events that may impact the achievement of strategic and operational objectives, then managing, monitoring and reporting these risks. Good risk management is not about eliminating or avoiding risks, but rather taking acceptable risks and managing them well.

The RMP assists the CSIR to improve and sustain performance by enhancing its system of risk management to protect against adverse outcomes and optimise opportunities.

This section sets out the CSIR's RMP through the adoption of Enterprise Risk Management (ERM).

D.1.2 Glossary of Terms and Abbreviations

Throughout this section, unless otherwise stated, the words/abbreviations in the first column below have the meanings assigned to them in the second column (and cognate expressions shall bear corresponding meanings):

Abbreviation/ Term		Meaning Ascribed
ARC	:	Audit and Risk Committee – a CSIR Board of Directors committee constituted to and tasked with reviewing the control, governance and risk management practices within the CSIR and to determine appropriate policies, controls and procedures to manage them, proportionate to the risk or opportunity involved
COSO	:	Committee of sponsoring organisations of the Treadway Commission (an international risk management standard)
DST	:	Department of Science and Technology South Africa
ERM	:	Enterprise Risk Management
ERMO	:	Enterprise Risk Management Office
ExCo	:	Executive Management Committee
Inherent risk	:	The exposure arising from risk factors in the absence of deliberate management intervention(s) to exercise control over such factors
Institutional Review Report		The report generated periodically in terms of section 3 of the 1997 White Paper on Science and Technology requiring periodic institutional reviews to be carried out on science, engineering and technology institutions by and independent panel
ISO 31000	:	A family of standards relating to risk management codified by the International Organisation for Standardisation that provides generic guidelines for the design, implementation and maintenance of risk management processes throughout an organisation
King IV	:	The King IV Report on Corporate Governance for South Africa, 2016
PFMA	:	Public Finance Management Act, 1999 (Act 1 of 1999) as amended by Act 29 of 1999).
Residual risk	:	The remaining risk exposure after management has put measures in to control the inherent risk
Risk	:	An unwanted outcome, actual or potential, to the CSIR's performance objective caused by the presence of risk factors (may also present as an upside potential available for exploitation)
Risk appetite	:	The amount of residual risk an organisation is willing to accept
Risk factor	:	Any threat or event which creates or has the potential to create risk
Risk management	:	A systematic and formalised process of identifying, assessing, managing and monitoring risks
Risk owner	:	The person accountable for managing a particular risk
Risk tolerance	:	The amount of risk an organisation is capable of bearing

D.1.3 Legislative Context

The CSIR RMP has been developed in terms of the prescripts of applicable legislation, including but not limited to:

- The Public Finance Management Act, 1999 (Act 1 of 1999);
- Treasury Regulations issued in terms of the PFMA;

- The Scientific Research Council Act,1988 (Act 46 of 1988);
- Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended by the Occupational Health and Safety Amendment Act, 1993 (Act 181 of 1993); and
- Labour Relations Act (LRA), 1995 (Act 66 of 1995).

The CSIR RMP also incorporates the requirements of the King IV Report on Corporate Governance for South Africa (King IV), in so far as it concerns risk management, as well as the principles of ISO 31000 and COSO.

D.2 CSIR Risk Management Plan

D.2.1 Risk Management Philosophy

The CSIR maintains a broad view of risk as any event, positive or negative, that could affect its ability to achieve its mandate, mission, vision, and strategic objectives.

The CSIR acknowledges that risk, in one form or another, is present in virtually all its endeavours, and that successful risk-taking will often be necessary to achieve strategic objectives. Therefore, we do not seek to eliminate all risk, but seek to be risk-aware as opposed to risk-averse, and to effectively manage the uncertainty inherent in our environment.

To this end, the CSIR seeks to identify, understand, assess, and respond to the risks and opportunities faced, taking into account their impact on the CSIR's resources, reputational standing, financial position, and performance. Furthermore, the CSIR seeks to pursue prudent risks or opportunities that we believe will generate sufficient and sustainable performance and value, avoid intolerable risks, manage residual risk within defined levels, and be prepared to respond to risks or appropriate opportunities when necessary.

CSIR Exco and the Board of Directors, acting through the ARC, will assess the CSIR risk philosophy on an annual basis, and report and implemented any recommended and approved changes.

To ensure that there is no uncertainty amongst employees and stakeholders about the policies and procedures that shape the CSIR's approach to risk management, it is the intent of the CSIR to develop and implement a dedicated Risk Management Policy and Risk Appetite and Tolerance Framework aligned with the RMP and the associated strategy.

D.2.2 Purpose of the RMP

The CSIR RMP is developed to support the successful implementation of the CSIR strategy, and to outline what risk management activities are necessary during the financial year. In addition, it aims to entrench a risk management culture throughout the CSIR, creating a corporate culture aligned with the CSIR's core organisational values, namely, excellence, people-centred, integrity and collaboration (EPIC).

These planned activities will form the basis for quarterly reporting to the Department of Science and Technology (DST) as required by the DST Governance Framework. The development of the Risk Management Plan for 2019 / 20 takes into account the CSIR strategic plan and the annual performance plan for the year.

The CSIR's approach to the identification and treatment of risks is informed by the King IV code of governance principles and applied in accordance with the principles and guidelines of ISO 31000. Risk management, as set out in King IV, addresses a much wider spectrum of risk than in the past, in addition, the corporate governance drivers behind risk management today require new ways of reporting and monitoring CSIR's risk exposures. Therefore, it is important to note that the RMP is, by necessity, an evolving risk management instrument. The contents of the plan reflect the current risk management requirements of the CSIR. The document is reviewed and updated annually by the ARC of the CSIR Board of Directors.

The concept of "Enterprise" is the undertaking of risk for reward; a thorough understanding of the risks accepted by an organisation in pursuance of its strategic objectives, together with those strategies employed to mitigate such risks, is therefore essential for a proper appreciation of an organisations ability to positively undertake enterprise. Risk management is the capability of proactively identifying and understanding the factors and events that may impact the achievement of strategic and operational objectives, then managing, monitoring and reporting these risks. Good risk management is not about eliminating or avoiding risks, but rather taking acceptable risks and managing them well. CSIR manages its risks through the adoption of the practice of ERM.

ERM is a process applied in strategy determination, and across all organisational operations, to identify potential events that may affect the entity, manage associated risk to be within acceptable levels and to provide reasonable assurance regarding the achievement of entity objectives in the face of uncertainty. Uncertainty presents both risk and opportunity, with the potential to erode or enhance value. ERM enables the organisation to deal with uncertainty and associated risk and opportunity effectively, enhancing the capacity to build value. Value is maximised when management sets objectives to achieve an optimal balance between growth and related risks, and effectively deploys resources in pursuit of the entity's objectives.

When ERM, is applied to all aspects of the organisation, it assists the CSIR in making informed choices which:

- Provide assurance that current significant risks are managed effectively;
- Improve business performance by assisting with enhancing decision-making and planning;
- Promote a more innovative, less risk averse culture in which the taking of calculated risks in pursuit of opportunities to benefit the organisation is encouraged; and
- Provide a sound basis for integrated risk management and internal control as components of good corporate governance.

The benefits accrued to the CSIR through the adoption of ERM include:

- Alignment of risk and strategy;
- Enhanced risk response decisions;
- Reduced operational surprises and losses;
- Identification and management of multiple cross-enterprise risks;
- Leveraged opportunities;
- Improved deployment of resources; and
- Increased probability of enterprise success.

D.2.3 Scope of Application

The RMP applies to all business activities of the CSIR.

D.3 Components of the CSIR RMP

The CSIR manages risk through a well-defined governance model. Each component of this governance model is defined through a number of supplementary guidelines, templates and implementation tools that provide clarity and enhancement for stakeholder use and ensure a single approach to enterprise wide risk management. The Governance model comprises the elements outlined below.

D.3.1 Risk Governance Model and Framework

The CSIR adheres to a three lines of defence model when approaching risk management as outlined in Figure D.1 below:

Figure D.1: CSIR Three Lines of Defence Model

As this model illustrates, the ownership and management of risk lies with those who undertake the operations within the organisation. Operational staff are also responsible for implementing corrective actions to address process and control deficiencies, for maintaining effective internal controls, and for

executing risk and control procedures on a day-to-day basis. They identify, assess and mitigate risks, guiding the development and implementation of internal policies and procedures and ensuring that activities are consistent with goals and objectives.

The ERMO coordinates the management of risk in support of the risk owners (ExCo), who in turn report to the Board of Directors. The latter retains ultimate accountability for the governance of risk. The Internal Audit function provides independent assurance directly to the Board of Directors on the effectiveness of risk management frameworks, systems and implementation.

Robust oversight by the Board of Directors and Exco, establishes the cornerstone of effective risk management. To give effect to their fiduciary responsibility, the Board is supported by the ARC. The ARC is an oversight body delegated with the responsibility of implementing an effective risk strategy, supported by an appropriate risk management framework that include adequate control mechanisms to ensure effective risk management. The ARC also reviews the overall effectiveness of risk management structures and response strategies.

D.3.2 Risk Management Framework Overview

The main elements of the CSIR's risk management framework, as per the ISO 31000 standard, are reflected in the Risk Management Process depicted in Figure D.2 below:

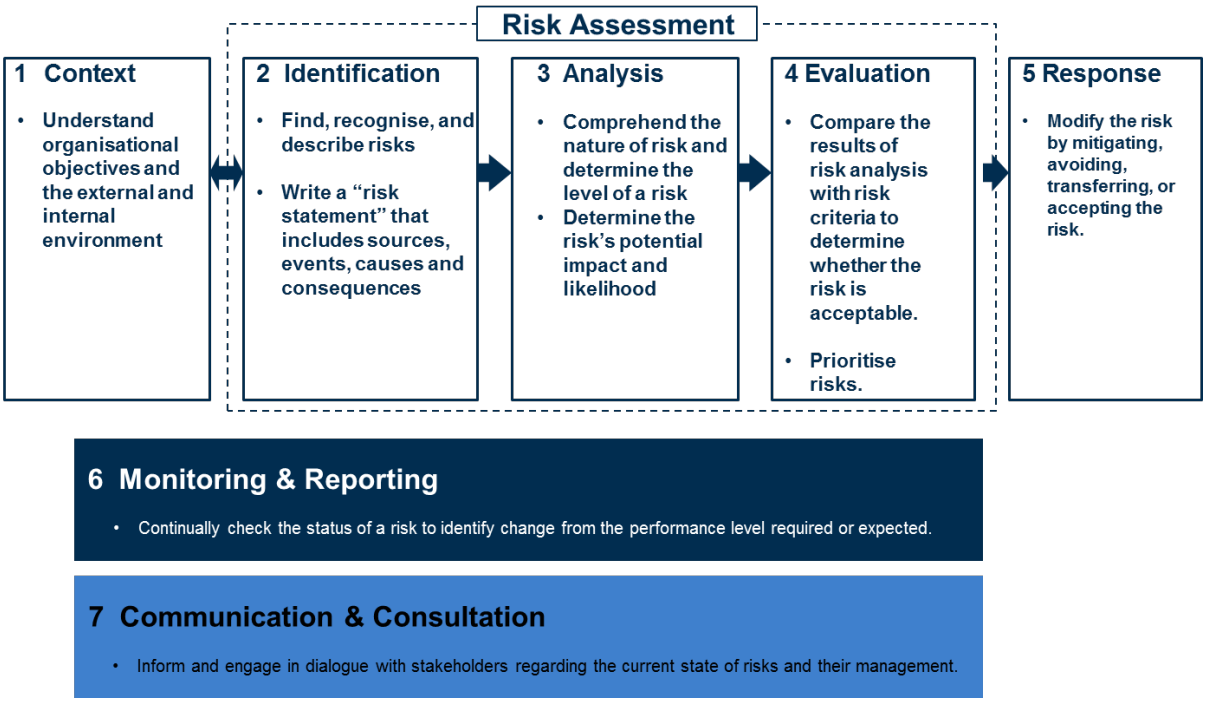

Figure D.2: Risk Management Process

A general description of each step of the process is given in the following sections.

D.3.3 Establishing the Risk Context

Establishing the risk context entails analysis of the CSIR's external and internal operating environment which is taken into account when managing risk as per the diagram below:

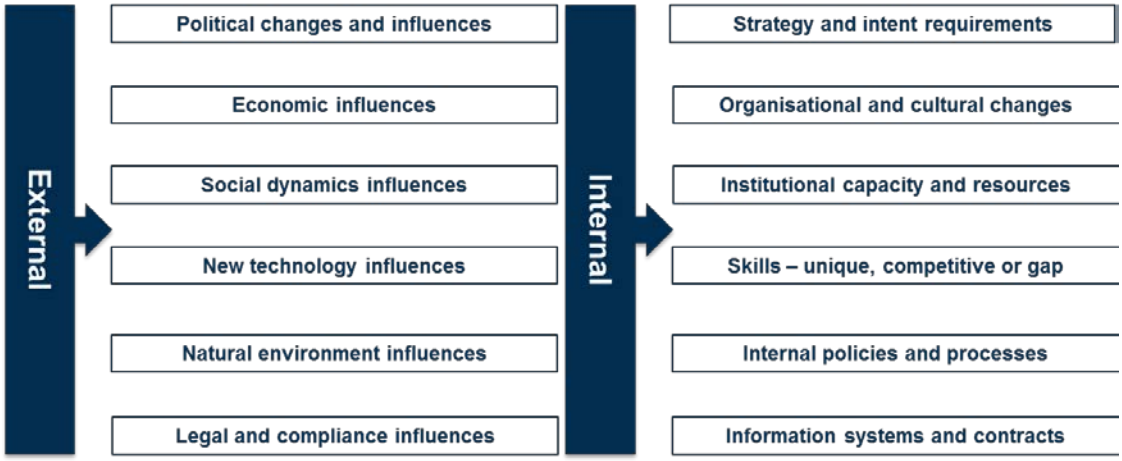

Figure D.3: Risk Context

In order to achieve the CSIR's strategic objectives, a thorough analysis of the overall risk environment is conducted periodically to establish a common understanding of the risk universe that needs to be addressed. As this environment remains in flux, the relevant risk universe is continuously reviewed, updated and agreed upon.

As the ownership and management of risk lies primarily with those who undertake operations within the organisation, CSIR operational and portfolio management is largely responsible to identify risk. ERMO consolidates the risk universe for further analysis and eventual agreement based on relevance and potential impact.

D.3.4 The Risk Assessment Process

In summary, the overall systematic approach taken by the CSIR for risk management is aligned to ISO 31000 and undertakes the following steps:

- Profiling the key aspects of the CSIR and the context in which the organisation operates in. This highlights dependencies and critical parts of the business and starts to pinpoint vulnerabilities. Identifying and understanding organisational objectives – the ultimate objectives of the CSIR guide the risk appetite within each operational area whilst adhering to the prescribed (by ARC) overall CSIR risk appetite. The profile of the individual operating environment objectives should take into consideration:
  - Revenue and expenditure targets;
  - Customer objectives and targets;
  - Socio economic targets; and
  - Other business objectives;

- Identifying and understanding operational activities;

- Identifying and categorising/prioritising risks – risk identification involves the identification of risk sources and events, their causes and potential consequences. This element consists of a detailed classification, analysis of the likely impact and likelihood of occurrence of a risk. A consequence/impact table is used in this process with clearly defined parameters that define the consequence/impact for each category of risk to determine the inherent risk, i.e., risk without controls. An assessment of the effectiveness of the controls is done to determine the residual risks and prioritisation of the risks including additional controls required to mitigate the risk further and escalation to the relevant levels.
- Determining a risk response strategy/identifying current controls/risk mitigation - putting in place controls to manage the risk. The three approaches to risk mitigation are tolerate, treat, transfer or to terminate the activities that give rise to the risk;
- Determining action plan, responsible person and the target date;
- Developing risk registers - in order to enable comparison and consolidation of the different risk registers in CSIR, a common risk register structure has been adopted;
- Monitoring and reviewing the risk and the response to it; and
- Reporting.

Risk Identification and Categorisation

Risk identification involves the identification of risk sources and events, their causes and potential consequences. Management meetings, strategy sessions, engagements with heads of Operating Divisions, Clusters, Research Centres and Portfolios are all part of the risk identification process.

The process to identify top risks also entails:

- Review of historical top risks and current relevance and threat assessment;
- Review of the CSIR's external operating environment through external macro-economic risk monitoring specialists;
- Consideration of the organisational strategy and risk implications;
- Review of CSIR strategy work stream reports;
- Review of the CSIR Institutional Review Report;
- Review of the CSIR operating model;
- Analysis of internal audit reports and reporting through a combined assurance model, highlighting weaknesses in the control environment; and
- Analysis of organisational incidents lessons learnt and current local and international incident trends.

Risk Analysis and Evaluation to Determine Prioritisation

The outcomes of the risk identification and classification processes are compiled into risk registers within each operational area of the organisation. An escalation process is utilised, as outlined in Figure 14 below, wherein each level of the organisation identifies, evaluates and then prioritises the risks it faces, and reports the major risks to the next level in the organisation.

Risks are thus identified for each operational Cluster or Portfolio in CSIR, with major risks reported to the next level, ultimately culminating in the formulation of the CSIR's top risks. This escalation process involves executive-level, in-depth analysis of risks that might not be identified at the level below, but which often represent the most critical risks for the organisation as a whole. All operational

areas are required to compile a risk register and maintain continuously through risk assessment workshops coordinated by ERMO.

Risk registers are reviewed and updated on a quarterly basis through meetings with risk and action plan owners coordinated by ERMO. After any strategic, policy, mandate or structural change, a risk assessment workshop is conducted to review and update the applicable risk register.

Risks in CSIR have been classified into the following three broad categories:

- Systemic risks - originate from macro-economic and national challenges affecting the National System of Innovation and National Government Business Enterprise space in which the CSIR operates;
- Strategic risks – risks that directly impact on the ability of the CSIR to deliver on its strategic objectives and statutory mandate; and
- Operational risks - include financial, legal and compliance risks and are those risks affecting the systems, people and processes through which the CSIR operates.

Assessing and prioritising the total identified risk universe consists of a detailed classification and analysis of the likely impact and likelihood of occurrence of a risk. A consequence/impact table is used in this process with clearly defined parameters that express the consequence/impact for each category of risk in order to determine the inherent risk, i.e., risk without controls. An assessment of the effectiveness of the controls is done to determine the residual risks and prioritisation of the risks, including additional controls required to mitigate the risk further and escalation to the relevant levels.

In order to enable comparison and consolidation of the different risk registers in the CSIR, a common risk register structure has been adopted. Annexure A to this document identifies the top organisational risks that have been identified through the bottom-up risk evaluation process. The process is based on the following:

- Risks are identified from the bottom up and require analysis by each level of the specific risks pertaining to that level, culminating in a top down evaluation to determine organisational relevance and the top organisational risks; and
- Risk management is integrated into existing management processes such as planning, budgeting and performance management and evaluation;

The risk register as well as the management of risk events is built and managed through an escalation from project level, to Operating Division/Cluster/Portfolio level as illustrated by the following diagram:

Figure D.4: Risk Escalation

Risk Mitigation

Risk mitigation entails implementing controls to manage the risk. This involves the below options:

- Tolerate – accepting the risk by keeping activities unchanged. This option is applied when exposure is tolerable, control is impossible or the cost of control exceeds potential benefit. The question of whether or not a particular risk can be tolerated is a key management decision;
- Treat – adjusting (adding or revising) relevant activities;
- Transfer – sharing the risk by involving relevant stakeholders. This works well for financial risks, risks to assets and includes securing conventional insurance or sourcing a third party to manage or undertake the risk; and
- Terminate – avoiding or cancelling the activities that give rise to the risk after considering the cost/benefit analysis.

Mitigation strategies are translated into mitigation activities with defined implementation timelines. For those areas and items for which the risk owner recommends the option “treat”, i.e. mitigate the risk, actions are taken to reduce the probability of the risk occurring or to reduce the impact of the risk. Mitigation measures are also linked to the best use of resources.

Mitigation strategies consider the results / reports of the combined assurance efforts and ensure that appropriate action is taken to address identified areas for improvement.

D.3.5 Monitoring and Reporting

After the establishment of detailed risk register and associated mitigation strategies, each risk is monitored by the ERMO to verify implementation of the proposed mitigation strategies. ERMO also facilitates the review of the risks taking into consideration:

- Changes in the assessment of the risk;

- Changes to risks as forced by the macro environment;
- Suggested changes to the risk mitigation strategy; and
- Progress made against the detailed action plans.

Internal audits and ad hoc risk assessments, either in accordance with the combined assurance plan or due to a perceived risk, will be conducted to monitor and evaluate the extent of compliance with policies, procedures and proposed controls. The role of the Internal Audit function is to actively monitor the internal and external environment and, if identified risks are not responded to appropriately, to be the catalyst for ensuring that the risk universe is continually updated.

Furthermore, the CSIR will establish a Risk Management, Compliance and Audit Steering Committee to steer and take responsibility for the CSIR RMP and to ensure the effective implementation thereof in support of combined assurance, and ensuring that key risks are being managed appropriately.

The objectives of the Risk Management, Compliance and Audit Steering Committee will mainly be to:

- Identify and specify the sources of assurance over the CSIR's risks;
- Provide the Audit and Risk Committee, the Accounting Officer and Executive Management with a framework of the various assurance parties;
- Link risk management activities with assurance activities;
- Assist the Accounting Officer to review the effectiveness of the risk management system; and
- Provide a basis for identifying any areas of potential assurance gaps.

In compliance with King IV, the CSIR Board of Directors will receive assurance regarding the effectiveness of the RMP through the following principles:

- On a monthly basis and once established, the Risk Management, Compliance and Audit Steering Committee will provide Exco with progress updates against the combined assurance plan and progress against the implementation of the RMP.
- On a quarterly basis, management will provide assurance to ExCo that the RMP is integrated into the daily activities of the CSIR. The CSIR CEO, as part of his quarterly report to the Board of Directors, will provide assurance to the Board of Directors via the ARC on the effectiveness of the risk management system;
- On a quarterly basis, the Chief Risk Officer will provide assurance to the Board of Directors that the planned risk management activities are being implemented according to this RMP. This assurance shall be communicated to the Board of Directors via the ARC;
- On an annual basis, the Internal Audit function will provide a written assessment of the effectiveness of the system of internal controls and risk management to the Board of Directors via the ARC;
- In order for the Board of Directors to discharge their duty of ensuring effective and continual monitoring of risk management takes place, risk monitoring is an integral part of the CSIR RMP, to give assurance that measures remain effective.

D.4 Conclusion

The CSIR consequently proposes a proactive approach towards risk management and will continue to take the necessary measures to improve is ERM practices. The top risks identified for the CSIR for the 2019/20 financial year are depicted in Annexure A hereto.

Annexure A

Systemic risks:

These are risks that originate from macro-economic and national challenges affecting the National System of Innovation and National Government Business Enterprise space in which the CSIR operates.

Risk No. 1 – Fraud, corruption, poor governance and maladministration. CSIR Strategic Objectives SO1 & SO2 impacted							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
Fraud, corruption, poor governance and maladministration in the national system (public and private) sectors has introduced onerous bureaucracy and adherence to rules and formality requirements. **Source** • 2018 South Africa Risk Report; • CSIR Portfolio Risk Identification Workshops.	External	• Corruption in the national procurement system. • National Treasury introduced more/strict procurement regulations/practices in an attempt to control fraudulent and corrupt activities. • State capture of State Owned Entities (SOEs), law enforcement agencies, and assurance providers. • Abuse of power (complemented by incompetence and disregard for good corporate governance) by those entrusted with governance, e.g. boards of directors and executives of the State Owned Enterprises. • Lack of the principles of independence, integrity and objectivity by auditors, law enforcement agencies, assurance providers and management consultants. • Lack of effective consequence management for transgressors.	• The wide spread corruption, fraud, maladministration and poor corporate governance hampers CSIR's ability to meaningfully contribute to building a capable state. • Failure to operate a financially sustainable business.	• The CSIR is to ensure that it consistently develops and/or improves its Fraud Prevention Policy and Fraud Prevention Plan aligned with the principles of best practice corporate governance as per the King IV code of good corporate governance. • The CSIR is to effectively embed the internal Ethics Management System. • Deployment of relevant resources, and implementation of suitable governance structures, to ensure the creation of awareness, enforcement and investigation of incidents or suspected incidents of fraud and corruption. • The CSIR is to adhere to all relevant recommendations highlighted by the annual statutory audits by the Auditor General (AG) alternative external audits and internal audit and risk assessment outcomes.	ARC	CSIR Executive Committee	Ongoing
Risk No. 2 – Macro-economic environment All CSIR Strategic Objectives impacted							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation status & date**
The South African economy is dictated by global markets which in turn influence research work being done at CSIR.	External	• Global protectionist economic trends in almost all geographies.	• Failure to operate a financially sustainable business.	• Build capacity that ensures continued monitoring and interpretation of macro-economic events, allowing improved responsiveness.	CSIR Board of Directors	CSIR Executive Committee	Ongoing

The CSIR pursues foreign investment. Instability could potentially affect the levels of contract income from the international clients as well as increase the cost of importing equipment. The current environment also results in added cost pressures due to inflation, overheads and maintenance related costs. **Source** • 2018 South Africa Risk Report. • CSIR Portfolio Risk Identification Workshops. • CSIR Divisional Risk Identification Workshops. •			• Hampers CSIR's ability to meaningfully contribute to building a capable state. • Deferred/delayed realisation of Project Synapse strategic objectives.	• Dedicated pursuit of income diversification strategy, especially growth and diversification of international income sources.			
Risk No. 3 – Inhibitors to delivery of CSIR mandate. **CSIR Strategic Objectives SO5 impacted**							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation status & date**
Although the CSIR is mandated by an Act to undertake directed, multidisciplinary research and technological innovation that contribute to the improved quality of the life of South Africans, it faces major bureaucratic hurdles in doing so. The organisation exists to, amongst others, work to support government departments, SOEs and key stakeholders in their	External	• Lack of clarity in National Treasury regulations. • Agile private sector competitors.	• Failure to deliver on mandate • Failure to operate a financially sustainable business.	• Engage National Treasury to help them understand the CSIR mandate and operating model. • Document the process followed for consortiums or partnerships and present to NT. • Develop a strategy for the entire South African system of research innovation and associated parties to engage with NT to define rules and regulations that may ensure good governance, whilst not inhibiting R&D and innovation to find solutions where well intended legislation strangles	ARC	CSIR Executive Committee	30 September 2019

research needs. However, collaborative initiatives with partners are treated by National Treasury (NT) as standard procurement thus enforcing competitive tender processes which are lengthy and cumbersome and inhibit and prevent the CSIR from delivering on its mandate due to lack of agility and competitiveness in trying to do business with those stakeholders **Source** • 2018 CSIR Institutional Review Report. • Project Synapse Operating Environment Work stream • CSIR Divisional Risk Identification Workshops.				the ability of the innovation chain to function			

Strategic risks:

These are risks that directly impact on the ability of the CSIR to deliver on its mandate.

Risk No. 4 – Securing contract income target **CSIR Strategic Objective SO5 impacted**							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation status & date**
Inability to achieve/meet contract income target. **Source** • 2018 CSIR Institutional Review Report. • CSIR Portfolio Risk Identification Workshops.	Internal	• Current Income sources/contract income is largely from the public sector collaboration contracts. • Protracted procurement processes within the CSIR, as well as the bureaucracy experienced by government departments when procuring services from the CSIR (National Treasury procurement and tendering regulations and compliance requirements).	• Failure to operate a financially sustainable and profitable business. • Limits CSIR's ability to meaningfully contribute to	• Develop and implement a strategy to diversify sources of income in the private and public sectors. • Develop and implement a focused collaboration strategy with the private sector. • Equitable allocation, distribution and utilisation of the Parliamentary Grant (PG).	CSIR Board of Directors CSIR Executive Committee	Divisional Group Executives	31 March 2019

• CSIR Divisional Risk Identification Workshops.		• Inadequate and ineffective business model. • Inadequate and ineffective operating model. • Year on year adjustment/reduction of the parliamentary grant (PG) to the CSIR. •	building a capable state.	• Negotiate a CSIR exemption from National Treasury tendering process for the work defined in the CSIR's legal mandate/act. • Develop and implement the Marketing and Communication Strategy to improve the profiling of the organisation's value proposition. • Securing long-term relationships with new strategic clients. • Introduce efficient trend analysis, strategic foresight and opportunity identification as parts of business planning processes.			
Risk No. 5 – Strategy implementation Threatens CSIR Strategic ObjectivesSO1 & SO2							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
Stakeholder resistance / lack of buy-in into CSIR strategy. **<u>Source</u>** • Project Synapse Risk Register. • 2018 CSIR Institutional Review Report. • CSIR Portfolio Risk Identification Workshops. • CSIR Divisional Risk Identification Workshops.	Internal and External	• Poor understanding of and lack of buy-in into the CSIR strategy and operating model by the stakeholders. • Delayed realisation of strategic objectives. • Macro-economic environment not conducive to a growth strategy. • Political instability in South Africa and the world - timing of policy implementation not favourable. • Project Synapse being implemented in face of a tight fiscus and strategic restructuring of non-feasible operating areas. • Strategy aligned capacity and capability availability within the CSIR and the local market.	• Failure to operate a financially sustainable business. • Hampers CSIR's ability to meaningfully contribute to building a capable state. • Deferred/delayed realisation of Project Synapse strategic objectives.	• Drive execution of strategy implementation plan. • Establish effective and strategic collaborations and partnerships with the public sector and industry. • Deploy adequate dedicated resources to address the strategy implementation plan and change management process associated with the strategy. • Partner with key stakeholders (Public and Industry) to implement project Synapse e.g. DST, the dti, etc. • Actively recruit and capacitate resources aligned with the Operating Model. • Develop a Human Capital Strategy.	• CSIR Board of Directors • CSIR Executive Committee	Group Executive: Strategy Implementation	30 June 2019

Operational risks:

These include financial, legal and compliance risks and are those risks that affect the systems, people and processes through which the CSIR operates.

Risk No.6– Lack of a suitable skills base aligned with strategic requirements Threatens CSIR Strategic Objective SO4							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
• Unavailability of the required skills and capability of the available skills to implement the new strategy • Inability to attract and retain critical SET base and support skills. **Source** • Project Synapse Risk Register. • 2018 CSIR Institutional Review Report. • CSIR Portfolio Risk Identification Workshops. • CSIR Divisional Risk Identification Workshops.	Internal	• Loss of key SET-base skills to the market and competitors. • Inadequate and low supply of the SET-base skills by the labour market (skills demand exceeds the supply) • Human capital (HC) value proposition inadequate and not market competitive e.g. staff recognition, promotions, career ladder, slow pace of transformation. • Positions becoming redundant as a result of changes in the business, stakeholder needs, industry, technology, government policy •	Lack of adequate human capital capacity to deliver on the CSIR strategic objectives and to respond to market needs/requirements.	• Develop and implement a robust and comprehensive HC value proposition that will position the CSIR as an employer of choice. • Develop and effectively implement sound succession planning policy/strategy. • Improve and implement bursary programmes, internship/mentoring programmes and pipe-line development aligned with the CSIR strategic needs.	Human Capital Committee	Group Executive : Human Resources	Ongoing and by 30 September 2019 for the development of the Human Capital Strategy
Risk No. 7- Intellectual Property Management Strategy not aligned with strategic business needs. Threatens CSIR Strategic Objective SO1							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
• Intellectual property (IP) investments that do no align with industry needs and pressure points. • Investment in IP that has become obsolete/dated. • IP not adequately protected against	Internal	• Sabotage of CSIR IP by competitors or cyber criminals/syndicates. • Theft of IP by employees, contractors, and collaborators. • Loss of IP through poor data management. • Loss of IP through poor device management.	Loss of valuable IP.	• Assessment and audit of complete CSIR IP asset base. • Implement a holistic IP Management strategy aligned with strategic business needs. • Awareness and education on IP management and protection to all employees. • Align CSIR Information Security Policy and ICT Policy with the IP management strategy –	• ARC • CSIR Executive Committee	Divisional Group Executives **Supported by** • Chief Information Securi	Ongoing with targeted completion during FY2019/2020

theft, loss and sabotage. **Source** • Project Synapse Risk Register; • 2018 CSIR Institutional Review Report; • CSIR Portfolio Risk Identification Workshops; • CSIR Divisional Risk Identification Workshops.				proactive security against loss and third party access. • Develop and implement an IP defence strategy.		ty Officer • Group Manager: Security Services • General Manager: Licensing and Ventures	
Risk No. 8 – Lack of Business continuity strategy Threatens CSIR Strategic Objective SO1							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
• Inability to service internal business operational, systems and infrastructure requirements. • Inability to continue the offering of products and services to the customer/clients at the pre-defined and required service level(s) during a negative event/incident. **Source** Business Impact Analysis undertaken by the ERMO and external service provider.	Internal and external	• Ineffective and poorly embedded CSIR Business Continuity Management Plan (BCMP). • Inadequate Disaster Recovery Plan (DRP) (Current scope limited to the ERP environment) • Lack of Crisis Management Plan (CMP).	• Additional operational costs to run temporary skeleton infrastructure. • Loss of business opportunity and day to day business income. • Reputational damage. • Internal and external stakeholder disgruntlement and frustration. • Negative insure premium impacts. • Contractual and related liabilities due to non-performance. • Increased, safety, health, environmental	• Review and implement BCM strategy and plan. • Review current BCM arrangements e.g. CMP, ERP and DRP.	• ARC • CSIR Executive Committee	Group Executive: Legal, Compliance and Business Enablement **Supported by** Chief Risk Officer	30 June 20019

			and security risks.				
Risk No. 9 – Non-compliance to statutory and regulatory requirements Threatens CSIR Strategic Objective SO3							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
The CSIR as a SOE Schedule 3B operates in a heavily regulated environment. The risk of non-compliance to statutory and regulatory requirements are pronounced and aggravated by regulatory volatility and increasing scope. **Source** • 2018 South Africa Risk Report. • 2018 CSIR Institutional Review Report. • ERMO assessment. • CSIR Portfolio Risk Identification Workshops.	Internal	• Non- compliance to PFMA (irregular expenditure). • Lack of compliance to National Treasury procurement framework (policies and standards). • Lack of an established and fully resourced compliance function. • Inadequate CSIR compliance framework and related compliance universe. • Lack of regular internal compliance audits. • Deficiencies in education and awareness of compliance requirements, policies and procedures.	• Reputational damage to the CSIR brand, audit findings, fines, imprisonment and perception of poor corporate governance and weak internal control environment.	• Strict implementation of CSIR Fraud Prevention Plan (FPP). • CSIR to develop and implement a dedicated Fraud Prevention Policy aligned with the FPP and the associated fraud prevention strategy. • Establishment of a Compliance Function • A Whistle Blowing Policy that facilitates a culture of disclosure of information by employees in a responsible manner; • Creation of compliance, fraud and corruption awareness amongst employees and relevant stakeholders through communication and education. • Establishment of a Risk Management, Compliance and Audit Steering Committee to steer and take responsibility for regulatory compliance and compliance control instruments.	• ARC • CSIR Executive Committee	Group Executive: Legal, Compliance and Business Enablement **Supported by** Chief Compliance Officer	30 June 2019
Risk No. 10 – Ineffective and inefficient internal control environment. Threatens CSIR Strategic Objective SO1							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
CSIR's internal control environment is over-controlled and risk averse.	Internal	• Current approval and routing systems bureaucratic, cumbersome and not conducive to optimal productivity.	• Lack of agility and responsiveness to industry/client needs. • Frustration and inefficiency for internal	• Conduct systems health and needs assessment. • Develop and plan short-medium and long term systems improvement and	• ARC • CSIR Executive	Chief Financial Officer **Supported by**	

The internal control environment is not agile and ineffective to respond to the client/industry needs. **Source** • Project Synapse Operating Environment Work stream. • CSIR Portfolio Risk Identification Workshops. • CSIR Divisional Risk Identification Workshops. • ERMO assessment.		• Systems integrations lacking and silo based. • Lack of systems to absorb manual processing activities.	and external stakeholders.	implementation form a holistic and strategic perspective with the following objectives: • Negotiate CSIR's exemption from the National Treasury tendering framework/process based on CSIR's legal mandate. • Review of the CSIR approval framework. • Review of the CSIR contracting and contract routing processes. • Integration of business systems to achieve agility, data integrity and seamless reporting.	Comm ittee	Chief Information Officer	
Risk No. 11 – Poor Health and Safety(H&S) culture Threatens CSIR Strategic Objective SO1							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governanc e Oversight**	**Action Plan owner**	**Implementatio n date**
A poor H&S culture increases the probability of injuries and death to CSIR employees and stakeholders which could result in fines and penalties and reputational damage to the CSIR brand. **Source** • CSIR Executive Committee. • Health & safety incident investigation reports and risk assessments. • Health & Safety audit report.	Internal	• CSIR operates pockets of high risk research facilities (e.g. advanced 3D printer for metal components) and pilot plants (e.g. Titanium Pilot Plant) on its premises which pose greater environmental, health and safety risks. The risk exposure is not only to CSIR employees but also to the communities CSIR is doing business with and around. • Immature/low compliance to SHEQ requirements. • Outdated equipment's (lack of proper maintenance of equipment). • Culture of SHEQ not embedded and employees ignorant on SHEQ best practices in the work environment. • SHEQ incident response strategies and plans inadequate and poorly embedded.	• Health hazards • Injuries • Loss of human life • Environmental impacts • Loss of valuable assets • Fines and penalties • Reputational damage	• Implementation of the SHEQ strategy, policy and action plans. • Increased education and awareness on SHEQ best practices aligned with operating environment. • Campus Master Plan to incorporate SHEQ requirements. • Continuous organisational awareness and training on SHEQ best practice. • Conduct regular and periodic SHEQ audits.	• ARC • CSIR Execut ive Comm ittee	Group Executive: Legal, Compliance and Business Enablement **Supported by** • Group Manager: SHEQ • Chief Risk Officer	Ongoing
Risk No. 12 – Unauthorised access to CSIR data, infrastructure and systems. Threatens CSIR Strategic Objectives SO1							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governanc e Oversight**	**Action Plan owner**	**Implementatio n date**

Compromise of the CSIR mission critical infrastructure, systems and data through cyber security attacks and targeted cyber terrorist attacks by syndicates. **Source** • 2018 South Africa Risk Report. • Penetration Test Reports. • CSIR Information Security Office • Incident reports.	Internal and External	• Increasing trend of general cyber-attacks on business across industries. Business are constantly attacked by general Information security threats e.g. Malware. Phishing, Denial of Service attacks (DoS), Ransomware, Spam, Hacking, Insider attacks, Whaling, SQL injection, Brute- Force etc. • Changing trend in technology dependency by businesses increase the risk of cyber-security threats and losses; New technologies include, but are not limited to: o Bring Your Own Device (BYOD) o Mobility; o Cloud Computing, o Internet of Things (IoT), o Digitisation • Hosting of external databases. • Co-dependent governance and oversight structures.	• Breach of CSIR systems and unauthorised access to sensitive data and information • Legal liability for personal information/data breach. • Contractual liability and losses. • Business interruption and loss. • Penalties and fines. • Fraud.	• Establish a sound and effective information security controls system in the ICT infrastructure, systems and data protection measures. • Review of governance structures to ensure independence of oversight and responsibility structures. • Regular implementation of control testing such as system penetration testing and associated security effectiveness reviews.	• ARC • CSIR Executive Committee	Chief Financial Officer **Supported by** Chief Information Security Office	Ongoing testing in evaluation for new security threats.
Risk No. 13 – Outdated and obsolete infrastructure and equipment Threatens CSIR Strategic Objectives SO1 & SO2							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
CSIR has had significant infrastructure and property investment over the past number of years. There remains a shortfall in funding to address all the equipment and infrastructure needs across the CSIR. This results in CSIR having obsolete and outdated infrastructure, systems and equipment. **Source** • 2018 CSIR Institutional Review Report.	Internal	• Lack of funding • Aged infrastructure • Legacy maintenance and renewal issues	• Poor quality of R&D outputs. • Increased risk of projects not being delivered on brief and on time. • Increased SHEQ risks. • Damage to CSIR brand. • Increased insurance liability. • Marketability of rental space compromised.	• Explore private public partnerships. • Implement the Campus Master Plan. • Continue to investigate collaborative and shared models with HEIs, Science Councils and the private sector.	• RDIC • CSIR Executive Committee	Campus Master Plan Executive **Supported by** • Capital Projects • Facilities Management	Ongoing against CMP timeline and funding resources.

• Building Condition Assessment Report. • CSIR Portfolio Risk Identification Workshops. • CSIR Divisional Risk Identification Workshops.							
Risk No. 14 – Poor quality of Research, Development & Innovation (RDI) outcomes Threatens all CSIR Strategic Objectives							
Detailed risk Description	**Risk Context**	**Risk contributing factors (Risk Root Causes)**	**Risk Impact**	**Recommended remedial action plans**	**Governance Oversight**	**Action Plan owner**	**Implementation date**
Production of inferior research, development and innovation outcomes that lack a positive impact on the social-economic transformation/prosperity in South Africa **Source** • 2018 CSIR Institutional Review Report. • CSIR Portfolio Risk Identification Workshops. • CSIR Divisional Risk Identification Workshops.	Internal	• RDI in areas that lack a meaningful contribution to the improvement of the quality of life in society. • Lack of government and industry investment/funding of significant projects. • Use of outdated and obsolete research infrastructure and equipment. • Lack of robust client analysis to understand the industry needs/requirements. • Technology evolution/changes that could disrupt business model, operating model, systems, processes etc.	• Lost opportunity to meaningfully contribute and positively impact the national system and to building a capable state. • Reputational damage to the CSIR brand that could make the organisation less attractive to industry.	• Ensure the effectiveness of the following functions: • Research Ethics Committee • Strategic Research Panels • Strategic Research Managers Forum • Business Development and Commercialisation dedicated personnel to ensure that client analysis is done to understand industry needs/requirements • Research policies that guide the research agenda • Pre and post review of research work done • Ongoing assessment of controls and promotion of scientific excellence and rigour. • Invest in RD&I infrastructure and equipment for the current and future needs of the CSIR (Implement a Campus Master Plan Programme). • Build collaboration partnerships with public and private sector industry to invest on RD&I infrastructure and equipment needs for the industry.	• RDIC • CSIR Executive Committee	Divisional Group Executives	Ongoing

Fraud Prevention Plan

Contents

E.1 Introduction

E.1.1 Background

The Council for Scientific and Industrial Research (CSIR) Fraud Prevention Plan (FPP) has been developed in compliance with section 3.2.1 of the Treasury Regulations of the Public Finance Management Act, 1999 (Act 1 of 1999). The CSIR subscribes to the principles of good corporate governance, which require business to be conducted in an honest, ethical and transparent manner. Consequently, the CSIR is committed to eradicating fraudulent behaviour at all levels within the organisation.

This FPP is premised on the CSIR's core ethical values driving the business of the CSIR, the development of its systems, policies and procedures, interactions with upstream and downstream stakeholders in its value chain and overall value proposition, including public and private sector customers, members of the public at large, suppliers and service providers, employees and its shareholder.

In alignment with the CSIR's core organisational values of excellence, people-centred, integrity and collaboration (EPIC), this FPP is the cornerstone in promoting ethical conduct and determining how incidents or suspected incidents of fraud and corruption will be prevented, detected and investigated.

The FPP is a dynamic plan and will continuously evolve as the CSIR strives to further promote ethics and prevent fraud.

E.1.2 Glossary of Terms and Abbreviations

Throughout this FPP, unless otherwise stated, the words/abbreviations in the first column below have the meanings assigned to them in the second column (and cognate expressions shall bear corresponding meanings):

Abbreviation/Term		Meaning ascribed
Accounting Officer	:	A person as defined in terms of section 36 of the PFMA
Approval Framework	:	The CSIR Approval Framework is the CSIR policy document specifying the decision matrix and levels of maximum approval authority for different role players within the CSIR, as approved by the Board of Directors of the CSIR and as amended from time to time
ARC	:	The Audit and Risk Committee is constituted in terms of the requirements as prescribed by the Treasury Regulations of the PFMA and sound corporate governance practices. The Audit and Risk Committee is established to assist the Board in discharging its duties, relating to the safeguarding of assets, the operation of adequate systems, control processes and the preparation of accurate financial reporting and statements in compliance with all applicable legal requirements and accounting standards
Code	:	The CSIR Code of Conduct/Ethics

Conditions of Service	:	The CSIR Conditions of Service as approved by the Board of Directors of the CSIR in terms of section 12 of the Scientific Research Council Act, 1988 (Act 46 of 1988) and as amended from time to time
CSIR	:	Council for Scientific and Industrial Research
Disciplinary Code and Procedure	:	The CSIR Disciplinary Code and Procedure provides guidance when dealing with misconduct and poor work performance. It promotes regulated fairness, certainty and consistency in the application of discipline, establishes standards, principles and procedures when addressing misconduct, and encourages all employees to adhere to the appropriate standards of conduct by providing for progressive and corrective action, as approved by the Board of Directors of the CSIR and as amended from time to time
ERMO	:	Enterprise Risk Management Office
Ethics Hotline Procedure	:	The CSIR Ethics Hotline provides employees with an independent mechanism to bring any unethical business practices to the attention of management via telephone, e-mail, web-based tip-off facility, facsimile or post.
Fixed Asset Policy	:	The CSIR Fixed Asset Policy governs the controls associated with the recognition, de-recognition, financing and transfer of assets as approved by the Board of Directors of the CSIR and as amended from time to time
FPP	:	Fraud Prevention Plan
Information Communication Technology (ICT) Policy	:	The CSIR ICT Policy provides the framework within which the CSIR's computing facilities and assets that are provided to employees and CSIR representatives for the purpose of conducting CSIR business, are administered and managed, as approved by the Board of Directors of the CSIR and as amended from time to time
Information Security (IS) Policy	:	The CSIR IS Policy expresses the CSIR's position and intent to implement, maintain and improve its information security measures as approved by the Board of Directors of the CSIR and as amended from time to time
PFMA	:	The Public Finance Management Act,1999 (Act 1 of 1999)
Treasury Regulations	:	Means the regulations issued by National Treasury in support of the PFMA

E.1.3 Purpose of the Fraud Prevention Plan

The purpose of the CSIR FPP is to establish an approach in dealing with fraud risk, and recognises basic fraud prevention initiatives within the CSIR, as well as identifying the custodians responsible for the creation of awareness, enforcement and investigation of incidents or suspected incidents of fraud and corruption.

The primary objectives of the CSIR FPP are to:

- Provide guidelines in preventing, detecting and reporting fraudulent activities within the CSIR;
- Create and encourage a culture within the CSIR where all employees and stakeholders continuously behave ethically in their dealings with, or on behalf of, the CSIR;
- Improve the application of applicable systems and compliance with applicable policies,

procedures and regulations;
- Encourage all employees and stakeholders to strive towards the prevention and detection of fraud impacting, or having the potential to impact on the CSIR;
- Encourage all employees and stakeholders to report suspicions of fraudulent activity without fear of reprisals or recriminations; and
- Provide a governance framework within which the initiatives that support the creation of awareness, enforcement and investigation of incidents, or suspected incidents of fraud and corruption, are implemented and overseen.

E.1.4 Legislative Context

The FPP was developed with the aim of giving effect to the requirements and stipulations of the following legislations, among others, as amended from time to time:

- The Constitution of the Republic of South Africa;
- The PFMA
- Treasury Regulations issued in terms of the PFMA;
- The Scientific Research Council Act, 1988 (Act 46 of 1988);
- Protected Disclosures Act, 2000 (Act 26 of 2000);
- Prevention of Organised Crime Act, 1998 (Act 121 of 1998);
- The Prevention and Combatting of Corrupt Activities Act, 2004 (Act 12 of 2004); and
- All mandatory policies adopted by the Board of Directors of the CSIR contextualising legislative and related compliance requirements.

E.1.5 Scope of Application

The FPP applies to all corruption, fraud, theft, financial misconduct and maladministration or suspected irregularities of such nature involving the following persons or entities:
- All members of the CSIR Board of Directors;
- All employees of the CSIR;
- Consultants, suppliers, contractors and other providers of goods or services to the CSIR; and
- All parties representing the CSIR and its business activities in an official capacity.

E.1.6 Policy Stance

The policy of the CSIR is one of zero tolerance to fraud and corruption. All alleged cases of fraud and corruption will be investigated and followed up by the application of all remedies available, within the full extent of the law, and the implementation of appropriate prevention and detection measures. These measures include existing financial and related controls and verification mechanisms as prescribed in the systems, policies and procedures of the CSIR.
The CSIR wishes to facilitate a culture of disclosure of information relating to suspected fraud and related misconduct by employees in a responsible manner. Employees and stakeholders are encouraged to report suspicions of fraudulent activity without fear of reprisals or recriminations.

The efficient application of instructions contained in the regulations, policies and procedures of the CSIR is one of the most important duties of every employee in the execution of his/her daily tasks.

The CSIR's policy stance is currently encapsulated in various CSIR policies and procedures including but not limited to, the CSIR Code of Conduct/Ethics (Code), the CSIR Conditions of Service, CSIR Disciplinary Code and Procedure, CSIR ICT Policy, the IS Policy and the CSIR Ethics Hotline Procedure.

To ensure that there is no uncertainty among employees and stakeholders about the policies and procedures that shape the CSIR's approach to fraud, it is the intent of the CSIR to develop and implement a dedicated Fraud Prevention Policy aligned with the FPP and the associated fraud prevention strategy.

E.2 Components of the FPP

E.2.1 Guiding Principles

The main principles upon which the FPP of the CSIR is based, are the following:

- Creating a corporate culture that is ethical, fair and intolerant to fraud and thereby aligned with the CSIR's core organisational values of excellence, people-centred, integrity and collaboration (EPIC);
- Deterrence of fraud and corruption;
- Reporting of suspicious fraudulent activity without fear of reprisals or recriminations;
- Detecting of fraud;
- Investigating any detected fraud;
- Taking appropriate action in the event of fraud, e.g. disciplinary action, recovery of losses and prosecution; and
- Applying sanctions, such as blacklisting of suppliers/service providers guilty of corrupt practices.

This plan applies to all allegations, attempts and incidents of fraud impacting or with the potential to impact the CSIR.

All CSIR employees and management must comply with the spirit and content of the plan.

A person who holds a position of authority as stipulated in section 34 of the Prevention and Combatting of Corrupt Activities Act, should report any suspected corrupt activity and/or an offence of theft/ fraud to the police.

E.2.2 Components

The CSIR's FPP encompasses controls that have three strategic objectives:

- Prevent instances of fraud and corruption from occurring;
- Detect instances of fraud and corruption when they do occur; and
- Respond appropriately and take corrective action when fraud and corruption happens.

The FPP provides the CSIR with tools to manage fraud and corruption risk and has four phases:

- Assessment of organisational needs, based upon the nature of fraud and corruption risks and existing control environment;
- Design of programmes and controls in a manner that is consistent with legal and regulatory requirements, as well as best practices;
- Implementation of programmes and controls through the assignment of roles, building of internal competencies, training and deployment of resources; and
- Evaluation of programme and control design, implementation and operational effectiveness.

Fraud prevention is a business imperative, and a shared responsibility between management and employees. The fraud prevention plan forms part of the Shareholders Compact that is approved by the CSIR Board of Directors annually.
The components of the FPP are the following:

- The CSIR's core organisational values: - excellence, people-centred, integrity and collaboration (EPIC);
- A CSIR Code of Conduct/Ethics;
- CSIR systems, policies, procedures, rules and regulations;
- The CSIR Disciplinary Code and Procedure;
- Internal controls to prevent and detect fraud;
- Physical and information security management;
- Internal Audit function;
- Ongoing risk assessments;
- Reporting and monitoring of fraud allegations;
- A Fraud Policy and fraud response plan that clarify the policy stance of the CSIR and the steps for the reporting and resolution of allegations and incidents of fraud (under development);
- A Whistle Blowing Policy that facilitates a culture of disclosure of information by employees in a responsible manner (under development);
- Creation of fraud and corruption awareness amongst employees and relevant stakeholders through communication and education;
- Establishment of a Risk Management, Compliance and Audit Steering Committee to steer and take responsibility for the FPP and ensuring the effective implementation thereof in support of combined assurance that key fraud risks are being managed appropriately in the CSIR; and
- Ongoing maintenance and review of the FPP.

The key deliverables of the FPP are to raise awareness about potential fraud and corruption, and to put fraud prevention and response strategies in place.

In addition to the generic risks and mitigation strategies identified herein below, the CSIR has also developed and maintains a CSIR Fraud Risk Register as a sub-set of the overall organisational Risk Register. The Fraud Risk Register is a key outcome of the risk identification and assessment

process and includes all key risks that require a mitigating response as they fall outside of the CSIR's risk tolerance levels and pose a significant potential impact on the ability of the CSIR to achieve the primary objectives of the FPP.

E.3 Approach to Fraud

E.3.1 Preventing Fraud

Fraud prevention strategies are the first line of defence and provide the most cost-effective method of controlling fraud within the CSIR. To be effective, fraud prevention requires a number of contributory elements, including an ethical organisational culture, a strong awareness of fraud among employees, suppliers, service providers and clients, and an effective internal control framework.

I. Code of Conduct/Ethics

The Code of Conduct/Ethics establishes clear guidelines for employees and representatives of the CSIR regarding the standard of conduct required in their internal and external dealings for and on behalf of the CSIR.

The generic risks identified by the CSIR in application of the Code, are the following:

- Lack of buy-in, or compliance with the requirements of the Code by management and employees or official CSIR representatives;
- Lack of awareness and/or inadequate communication and training strategy relating to the Code;
- Employees with low integrity and/or standards of professional conduct seeking to enhance personal benefit; and
- Lack of control over the acceptance of gifts and/or benefits by employees.

Strict compliance with the Code by employees and CSIR representatives, both in its spirit and content, addresses the aforementioned risks. However, recognising that striving to achieve such a status and culture of compliance in totality, is idealistic, the CSIR will pursue the following tactics to improve the professional ethics and conduct of its employees and representatives:

- A copy of the Code will be circulated to all employees and CSIR representatives and will be included in induction packs for new employees/representatives;
- All employees will be required to sign a declaration annually, serving as an indication of their understanding of, commitment to and compliance with the Code; and
- Relevant aspects of the Code will be included in awareness presentations, training sessions and communication programmes to create awareness thereof amongst employees and relevant stakeholders. Further objectives of this training will include the following:

    o Assisting employees to understand the meaning of fraudulent and corrupt behaviour;

- Presenting case studies to assist employees in developing behaviour to articulate and encourage attitudes and values that support ethical behaviour in all conduct; and
- Communicating the implications of unethical behaviour and its impact for individuals, the workplace, professional relationships, the CSIR as a whole, external stakeholders and the public.

To this end, the CSIR is establishing a compliance function under the custodianship of a Chief Compliance Officer to review and revive the relevance and implementation of the Code, its communication and supportive education.

II. Systems, Policies, Procedures, Rules and Regulations

The CSIR has a number of systems, policies, procedures, rules and regulations designed to ensure compliance with prevailing legislation, and to limit the risk of fraud. Fundamentally all CSIR employees and representatives should be fully conversant and compliant with these. In addition, several operational measures have been designed to control business activities.

The generic risks identified by the CSIR in terms of systems, policies, procedures, rules and regulations, are the following:

- Lack of knowledge and understanding of prevailing policies and procedures among employees;
- Lack of structured awareness and training programmes for employees in applicable policies, procedures, rules and regulations;
- Non-adherence with policies and procedures as a result of weaknesses in systems and tools;
- Lack of proper delegation; and
- Non-compliance due to an absence of a culture of compliance and shared value system.

The aforementioned risks suggest that controls should be continuously reviewed to secure tolerable levels of compliance.

The CSIR recognises that its employees are often best placed to identify shortcomings or weaknesses in systems and procedures. Therefore it is committed to harnessing this knowledge through the development of a structured programme aimed at encouraging employee commitment and effort in reporting such weaknesses.
In addition, the CSIR will undertake the following actions to mitigate the risks identified:

- The existing CSIR policies and procedures and any updates or amendments thereto will be communicated and made accessible to all CSIR employees and representatives for them to be informed of all the applicable policies and procedures;
- Provisions for all employees to acknowledge, in writing, that they have read the policies and procedures applicable to their duties, have undergone relevant training and/or are aware of these policies and procedures;
- Keeping of adequate records serving as proof that employees have been made aware of the policies and procedures applicable to the CSIR and relevant to their duties;
- Internal audits and ad-hoc risk assessments, either in accordance with a combined assurance plan or due to a perceived risk, will be undertaken to monitor and evaluate the extent of compliance with policies and procedures;
- In instances where breaches occur, swift and appropriate disciplinary action will be undertaken to set an example to other potential wrongdoers; and

- A specific effort will be made to ensure that measures are put in place, for the censure of suppliers and/or other providers of goods and/or services who are found guilty of unethical conduct or other irregularities. Any employee found to be colluding with suppliers will be subjected to immediate disciplinary action with a possible sanction of dismissal and/or personal liability for losses suffered.

III. Disciplinary Code and Procedure

The CSIR Disciplinary Code and Procedure prescribes appropriate steps to be taken to resolve disciplinary matters. The identified risks of fraud with regard to discipline and the application thereof, are the following:

- In some instances, the disciplinary process is too lengthy;
- Inadequate training of investigating officers presenting the case and parties chairing or adjudicating the charges raised;
- Inadequate maintenance and security of source documents to be used at disciplinary, criminal and civil proceedings; and
- Inconsistent application of disciplinary actions and outcomes.

The CSIR recognises that the consistent and efficient application of disciplinary measures are an integral component in making the FPP a success. The CSIR will continue to pursue the following steps to ensure the consistent, efficient and speedy application of disciplinary measures:

- Ensure that all managers are aware of the content of the Disciplinary Code and Procedure, their responsibility for maintaining discipline, the standards of discipline expected, the procedure for the application of disciplinary measures and the disciplinary process, through communication and awareness exercises;
- Ongoing training of managers and investigating officers with regard to the content of the Disciplinary Code and Procedures, the application of disciplinary measures and the disciplinary process, and sustaining this training in conjunction with the Compliance Function and Human Resources Department;
- Developing a system to facilitate the consistent application of disciplinary measures, e.g. a monitoring system that includes proper record keeping of all disciplinary actions taken; and
- Developing a system where managers are held accountable for the management and addressing of misconduct and fraud within their areas of oversight.

IV. Internal Controls

This section of the FPP relates to basic internal controls to prevent and detect fraud. The systems, policies, procedures, rules and regulations of the CSIR prescribe various controls, which, if effectively implemented, would limit fraud within the CSIR. These controls may be categorised as follows, it being recognised that the categories contain overlapping elements:

- Prevention controls: These are divided into two sub-categories, namely;
  - Authorisation; and
  - Physical;
- Detection controls: These are divided into four categories, namely:
  - Arithmetic and Accounting;
  - Physical;

  - Supervision; and
  - Management Information; and
- Segregation of Duties.

Prevention Controls

- Authorisation:
  All transactions require authorisation or approval by a responsible person with appropriate authority limits. The authority limits are specified in the CSIR Approval Framework.

- Physical:
  These controls are concerned mainly with the custody of assets and involve procedures and security measures designed to ensure that access to assets is limited to personnel, who have been duly authorised, in writing. The CSIR Fixed Asset Policy governs the controls associated with the recognition, de-recognition, financing and transfer of assets.

Detection Controls

- Arithmetic and accounting:
  These are basic controls within the recording function that check that transactions to be recorded and processed have been authorised and that they are completely and correctly recorded and accurately processed. Such controls include checking the arithmetical accuracy of the records, the maintenance and checking of totals, reconciliation and accounting for documents.

- Physical:
  These controls relate to the security of records. They therefore underpin arithmetic and accounting controls. Their similarity to preventive controls lies in the fact that these controls are also designed to limit access to unauthorised persons.

- Supervision:
  This control relates to managers' supervision of day-to-day transactions and the recording thereof.

- Management Information:
  This relates to the review of management accounts and budgetary control. These controls are normally exercised by management outside the day-to-day routine of the system.

Segregation of Duties

The lack of segregation of duties, or the overriding of existing internal controls, is a generic risk that exposes the CSIR to the inherent risk of fraud and manipulation of data. One of the primary means of control is the separation of those responsibilities or duties, which, if combined, enable one individual to record and process a complete transaction, thereby providing him/her with the opportunity to manipulate the transaction irregularly and commit fraud.

Segregation of duties reduces the risk of intentional manipulation or error and increases the element of verification.

Functions that should be separated include those of recording, checking, authorisation, approval, custody, execution and, in the case of computer-based accounting systems, system controller functions and daily operations.

In the context of fraud, segregation of duties lies in separating either the authorisation or the custodial function from the verification function.

To ensure that these internal controls are effectively and consistently applied, deficiencies and non-compliance identified by internal audit will be addressed as follows:

- The CSIR will continue to regularly re-emphasise to all managers that consistent compliance by employees with internal control is in itself one of the fundamental controls in place to prevent fraud. Managers will be encouraged to recognise that internal control shortcomings identified during the course of audits are, in many instances, purely symptoms and that they should strive to identify and address the causes of these internal control weaknesses; and

- The CSIR will ensure that the performance appraisal of senior managers will take into account the number of audit queries raised and the level of seriousness of the consequent risk to the CSIR, as a result of the internal control deficiency identified. This is intended to raise the level of accountability for internal control by the Accounting Officer and Managers. Where managers do not comply with basic internal controls, e.g. non-adherence to the limits of the CSIR Approval Framework, firm disciplinary action will be considered.

V. Physical and Information Security

- Physical Security:
  Recognising that effective physical security is one of the "front line" defences against fraud, the CSIR will take regular steps to improve physical security and access control at its sites of operation in order to limit the risk of theft of assets. The CSIR will also conduct a regular review of the physical security arrangements at its offices and facilities, and improve on weaknesses identified.

- Information Security:
  The CSIR will ensure that employees are sensitised to the risks of fraud associated with poor management of information security on a regular basis, in order to enhance their understanding thereof and the risks to the CSIR associated with poor control over confidential information.

  Regular reviews of information and computer security will also be considered. Weaknesses identified during these reviews will be addressed with the respective managers. The CSIR Information Security (IS) Policy expresses the CSIR's position and intent to implement, maintain and improve its information security measures.

E.3.2 Detecting, Reporting and Investigating Fraud

Detection controls are designed to discover any fraud or corruption as soon as possible after it has occurred. In spite of best practice prevention activities, fraud and corruption may occur. The next line of defence is a robust suite of detection strategies to discover any incident of fraud and

corruption as soon as possible to minimise any detrimental impacts. The CSIR's detection controls include:

- Maintaining an effective system of internal controls;
- Review and approval of financial transactions;
- Review and approval of management reports;
- Internal and external audits;
- Monitoring and evaluation;
- Data analysis; and
- A CSIR Ethics Hotline Procedure to report allegations of fraud, corruption and unethical conduct.

I. Response

CSIR response strategies that ensure appropriate mechanisms are in place to:

- Take corrective actions;
- Minimise the impact of fraud and corruption risks;
- Improve prevention and detection strategies; and
- Report any occurrences to the relevant stakeholders.

All identified occurrences of fraud and corruption will be investigated in accordance with the principles enshrined in the Protected Disclosure Act, 2000 (Act 26 of 2000), the CSIR Ethics Hotline Procedure and this FPP. The principles include confidentiality, protection from victimisation and the application of justice.
CSIR key response strategies include:

- Investigation of all allegations of fraud and corruption;
- Central registry of all fraud and corruption allegations maintained, reported and monitored;
- Disciplinary procedure;
- Review of internal controls post incident;
- Implementation of corrective and preventative actions and recommendations;
- Recovery of losses; and
- Fidelity and employee dishonesty insurance.

II. Fraud Policy and Fraud Response Plan

The CSIR's policy stance is currently encapsulated in various CSIR policies and procedures including but not limited to, the CSIR Code of Conduct/Ethics, the CSIR Conditions of Service, CSIR Disciplinary Code and Procedure, CSIR ICT Policy, the IS Policy and the CSIR Ethics Hotline Procedure. To ensure that there is no uncertainty amongst employees and stakeholders about the policies and procedures that shape the CSIR's approach to fraud, it is the intent of the CSIR to develop and implement a dedicated Fraud Prevention Policy aligned with the FPP and the associated strategy.

III. Whistle Blowing Policy

In order to limit the risk of employees being victimised for whistle blowing, in contravention of the Protected Disclosures Act, the CSIR is undertaking the development of a Whistle Blowing Policy. The Whistle Blowing Policy is based on the Protected Disclosures Act, which guarantees protection to

employees against victimisation following disclosure of fraudulent activity by employees, and is intended to encourage and enable employees to raise serious concerns without fear of victimisation.

E.3.3 Further Implementation and Maintenance

I. Creating Awareness

This component of the plan comprises two approaches, namely education and communication. The strategic weaknesses identified in this area are the following:

- Lack of a formalised strategy to create awareness amongst employees of the manifestations of fraud and the risks of fraud facing the CSIR; and
- Lack of knowledge of approaches to prevent and detect fraud in specific processes and transactions.

CSIR key response strategies include:

- Education:
  The CSIR will ensure that regular presentations and formal training are carried out for employees to enhance their understanding of the manifestations of fraud, prevention and detection techniques and the components of the FPP.

- Communication:
  Communication is crucial in creating awareness of the FPP amongst employees and other stakeholders. This is intended to facilitate a culture where all stakeholders strive to make the FPP a success and to sustain a positive, ethical culture within the CSIR. This will increase the prospect of fraud being reported and improve the CSIR's prevention and detection ability.

  The CSIR will consider various means of communicating its fraud prevention initiatives, including the following:

- Conducting workshops and creating awareness of the FPP;
- Developing a poster campaign aimed at all stakeholders to advertise the CSIR stance to fraud and its expectations with regard to the ethics and integrity of all stakeholders;
- Circulating appropriate sections of the Code to other stakeholders, e.g. consultants and contractors;
- Publicising "lessons learned" following investigations into allegations of fraud amongst employees;
- Circulating successes related to the FPP and fraud modus operandi;
- Placing notices or other communiqués related to the FPP on notice boards and other areas to which employees and the public have access;
- Giving copies of the Code to suppliers of goods and services;
- Developing a fraud prevention suggestion box where all employees can make suggestions on how to prevent fraud and corruption and further improve the FPP;
- Developing promotional items communicating the FPP or components thereof; and

- Using the intranet to communicate issues relating to the prevention and detection of fraud, including matters reported and action taken.

II. Risk Management, Compliance and Audit Steering Committee

The CSIR will establish an operationally-based Risk Management, Compliance and Audit Steering Committee to steer and take responsibility for the FPP and to ensure the effective implementation thereof, in support of combined assurance and ensuring that key fraud risks are being managed appropriately in the CSIR.

The objectives of the Risk Management, Compliance and Audit Steering Committee are mainly to:

- Identify and specify the sources of assurance over the CSIR's risks;
- Provide the Audit and Risk Committee, the Accounting Officer and Executive Management with a framework of the various assurance parties;
- Establish a combined assurance strategy and plan;
- Link risk management activities with assurance activities;
- Assist the Accounting Officer with reviewing the effectiveness of the risk management system; and
- Provide a basis for identifying any areas of potential assurance gaps.

The Committee, once established, will be responsible for the ongoing maintenance and review of the FPP. This will include:

- Evaluating reports of fraud and highlighting areas of risk within the CSIR;
- Considering fraud threats to the CSIR and addressing them;
- Monitoring action taken to implement recommendations relating to incidents of fraud;
- Steering and taking responsibility for the FPP;
- Reviewing and making appropriate amendments to the FPP; and
- Ensuring that ongoing implementation strategies are developed and carried out.

III. Control Environment

The CSIR's Audit and Risk Committee significantly influences the fraud control environment, particularly by overseeing the tone at the top. This is done in the discharge of its duties in terms of the PFMA and Treasury Regulations.
The Audit and Risk Committee systematically oversees, and periodically reviews the internal controls established by the management of CSIR. Oversight extends to:

- Enterprise risk and fraud risk management;
- The potential for management to override controls or exercise other inappropriate influence over the financial reporting process;
- Mechanisms for employees to report concerns;
- Receipt and review of periodic reports describing the nature, status and eventual resolution of alleged or suspected fraud;
- An internal audit plan that addresses fraud risk, and a mechanism to ensure that internal audit can express any concerns about management's commitment to appropriate internal controls, or to report suspicions or allegations of fraud;

- Involvement of other experts, such as legal and human resources, as needed to investigate any alleged or suspected wrongdoing;
- Review of accounting principles, policies and reasonableness of significant estimates used by the CSIR;
- Review of significant non-routine transactions (if any) entered into by management and employees; and
- Functional reporting by internal and external auditors to the Audit and Risk Committee.

E.4 Conclusion

The CSIR proposes a proactive approach towards managing fraud risk in the organisation. It has adopted a zero tolerance approach towards fraud, theft and corruption and will continue to take the necessary measures to ensure that the risks are managed effectively.

F

Materiality/Significance Framework

Executive Summary

In terms of Treasury Regulations for government departments, trading entities, constitutional institutions and public entities, issued in terms of the PFMA, 1999, the CSIR must have a materiality framework of acceptable levels of materiality and significance within the organisation.

The CSIR's reputation, built over more than half a century, depends on the nature of every business transaction, conducted by every employee, on a daily basis. It is built on an implicit set of values, which inspires our employees to maintain the highest ethical standards in all their dealings with our clients and stakeholders, as well as their relationships within the CSIR.

The CSIR is committed to a policy of fair dealing and integrity in conducting its business. This commitment is based on a fundamental belief in honest, fair and legal conduct in all business activities. We expect all our employees to share this commitment to high morals, ethics and legal standards.

Ethics involve the ability to distinguish right from wrong and a commitment to do what is right. Values are core beliefs that create individual attitudes. Although individual values may differ, this does not imply a choice about behaving ethically in the business environment of the CSIR. Our Code of Conduct, as well as the Constitution of the Republic of South Africa and the national laws and regulations, prescribe the legal conduct that embodies values based on ethical principles, while respecting cultural diversity.

F.1 Treasury Regulation 28.1.5

"For purposes of "material" [sections 50(1), 55(2) and 66(1) of the Act] and "significant" [section 54(2) of the Act], the Accounting Authority must develop and agree on a framework of acceptable levels of materiality and significance with the relevant Executive Authority in consultation with the external auditors."

(HOWEVER, THE CSIR HAS BEEN EXEMPTED FROM SECTION 54 (2) AND THIS SCHEDULE DOES NOT INCLUDE THIS SUBSECTION.)

		Material
Section 50 (1)	(1) The Accounting Authority for a public entity must –	
	(a) exercise the duty of utmost care to ensure reasonable protection of the assets and records of the public entity;	Significant audit findings that could negatively impact on the CSIR's operations and the attainment of strategic goals.
	(b) act with fidelity, honesty, integrity and in the best interest of the public entity in managing the financial affairs of the public entity;	The CSIR sets high standards on fidelity, honesty and integrity. The best interest of the public entity is always relevant in fulfilling its mandate and in the execution of the Shareholder's Compact. Any acts of dishonesty, infidelity and others that are not in the best interests (from a research, financial and reputation perspective) of the CSIR are viewed in a serious manner.
	(c) on request, disclose to the Executive Authority responsible for that public entity or the legislature to which the public entity is accountable, all material facts, including those reasonably discoverable, which in any way influence the decision or actions of the Executive Authority or that legislature; and	The CSIR is committed to disclosing any relevant information to its stakeholders. Materiality can only be determined if the nature of the information is known.
	(d) seek within the sphere of influence of that Accounting Authority, to prevent any prejudice to the financial interests of the state.	The CSIR employs an ongoing Enterprise Risk Management System, as well as controls that are aimed at the prevention/mitigation of any prejudice to the financial interest of the entity. Lack of the required governance processes, lack of due diligence in conducting business, and fruitless and wasteful expenditure are inherently regarded as material.

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		Material
Section 55 (2)	(2) The annual report and financial statements referred to by PFMA Subsection 55 (1)(d) must –	
	(a) fairly present the state of affairs of the public entity, its business, its financial results, its performance against pre-determined objectives and its financial position as at the end of the financial year concerned;	As per guidelines issued by National Treasury: Significance/materiality is calculated as 0.75% of revenue, which amounts to R202950 00.
	(b) include particulars of –	
	(i) any material losses through criminal conduct and any irregular expenditure and fruitless and wasteful expenditure that occurred during the financial year;	R1 000 000. All cases are unique and will thus be treated as such. These will be subject to internal audit reviews.
	(ii) any criminal or disciplinary steps taken as a consequence of such losses or irregular expenditure or fruitless and wasteful expenditure;	R1 000 000. All cases are unique and will thus be treated as such. Issues that inform steps to be taken are: • The level of responsibility and position of the person involved; • The affected core business/support/operational; and • The impact on other areas of operation of the CSIR. • These will be subject to internal audit reviews.
	(iii) any losses recovered or written off;	R1000 000 (excluding losses incurred through normal operating activities)
	(iv) any financial assistance received from the state and commitments made by the state on its behalf; and	Will disclose as prescribed.

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		Material
	(c) include the financial statements of any subsidiaries	All subsidiaries are consolidated.
Section 66 (1)	(1) An institution to which this Act applies may not borrow money or issue a guarantee, indemnity or security, or enter into any other transaction that binds or may bind that institution or the Revenue Fund to any future financial commitment, unless such borrowing, guarantee, indemnity, security or other transaction – (a) is authorised by this Act; and (b) in the case of public entities, is also authorised by other legislation not in conflict with this Act; and (c) in the case of loans by a province or a provincial government business enterprise under the ownership control of a provincial executive, is within the limits as set in terms of the Borrowing Powers of Provincial Governments Act, 1996 (Act No 48 of 1996).	The CSIR complies with this requirement.

G

Financial Plan

Contents

G.1 CSIR Budget and Parliamentary Grant Cash flow 2019/20

G.1.1 CSIR Statements of Comprehensive Income over the MTEF period

Table G.1: Statement of Comprehensive Income – MTEF Period

	Forecast 2018/2019 R'000	Budget 2019/2020 R'000	Budget 2020/2021 R'000	Budget 2021/2022 R'000
Total Operating Revenue	**2 705 059**	**2 859 326**	**3 074 759**	**3 321 382**
R & D Contract Income	**1 941 167**	**2 098 168**	**2 270 400**	**2 490 287**
Public - South Africa	1 476 096	1 571 049	1 694 087	1 840 330
Private - South Africa	211 620	215 814	248 186	297 823
International	167 322	223 316	241 851	261 199
Parliamentary Grant - Ringfenced	86 129	87 989	86 276	90 935
Parliamentary Grant	**760 092**	**758 068**	**799 724**	**824 142**
Royalty Income	**3 025**	**3 090**	**4 635**	**6 953**
Other Income	**775**	**0**	**0**	**0**
Total expenditure	**2 798 820**	**2 889 559**	**3 054 819**	**3 272 744**
Employees' Remuneration	1 640 011	1 703 908	1 799 327	1 925 280
Operating Expenses	1 058 385	1 055 872	1 119 224	1 197 570
Depreciation	100 424	129 779	136 268	149 895
Operating Profit before Investment Income	**(93 761)**	**(30 233)**	**19 940**	**48 637**
Investment Income	44 700	39 100	39 882	40 680
Net profit before non-guaranteed employees' remuneration (Performance bonus)	**(49 061)**	**8 867**	**59 822**	**89 317**
Non-guaranteed employees' remuneration (Performance bonus)				15 036
NET PROFIT	**(49 061)**	**8 867**	**59 822**	**74 281**

G.1.2 CSIR Statements of Financial Position over the MTEF period

Table G.2: Statement of Financial Position over the MTEF Period

	FORECAST March 2019 R'000	BUDGET March 2020 R'000	BUDGET March 2021 R'000	BUDGET March 2022 R'000
ASSETS				
Non-Current assets	**781 690**	**746 911**	**730 643**	**730 748**
Property, plant and equipment	767 911	733 132	716 864	716 969
Interest in Joint Ventures and Associates	9 068	9 068	9 068	9 068
Interest in Subsidiaries	4 712	4 712	4 712	4 712
Trade and other receivables	-	-	-	-
Current Assets	**690 477**	**726 807**	**804 901**	**883 123**
Trade and other receivables	243 254	257 339	245 981	232 497
Inventory and contracts in progress	(648 677)	(629 052)	(676 447)	(730 704)
Cash and cash equivalents	1 095 900	1 098 519	1 235 367	1 381 330
TOTAL ASSETS	**1 472 167**	**1 473 718**	**1 535 544**	**1 613 871**
EQUITY AND LIABILITIES				
Reserves	**942 823**	**951 690**	**1 011 512**	**1 085 793**
Retained earnings	942 823	951 690	1 011 512	1 085 793
Non-current liabilities	**11 072**	**11 183**	**11 295**	**11 408**
Post retirement medical benefits	11 072	11 183	11 295	11 408
Current Liabilities	**518 272**	**510 845**	**512 737**	**516 671**
Advances received	135 141	142 966	122 990	99 641
Trade and other payables	383 131	367 879	389 747	417 029
TOTAL EQUITY AND LIABILITIES	**1 472 167**	**1 473 718**	**1 535 544**	**1 613 871**

One needs to consider the budgeted cash balance of R1.1 billion in conjunction with the current liabilities of R518 million. The current ratio (current assets/current liabilities) is expected to remain at approximately 1.3.

G.1.3 CSIR Cash Flow Statement

Table G.3: CSIR Cash-Flow Statement

	MARCH 2020 R'000
Cashflow from operating activities	
Cash receipts from external customers	2 059 722
Parliamentary Grant income	758 068
Cash paid to suppliers and employees	(2 759 855)
Cash generated from operating activities	**57 935**
Net finance income	39 100
Net cash from operating activities	**97 035**
Cashflow from investing activities	
Increase in interest in joint ventures and associates	-
Decrease in long term receivables	584
Acquisition of property, plant and equipment	(95 000)
Net cash utilised in investing activities	**(94 416)**
Cashflow from financing activities	
Increase in non current liabilities	-
Net cash generated from financing activities	**-**
Net decrease in cash and cash equivalents	**2 619**
Cash and cash equivalents at beginning of the year	1 095 900
Cash and cash equivalents at end of the year	**1 098 519**

G.1.4 Twelve Month Cash Flow Projection for Parliamentary Grant: 2019/20 (including VAT)

Table G.4: Cash-Flow for Parliamentary Grant

R'000	Total	April	July	October	January
	1 217 509	304 377	304 377	304 377	304 376
Baseline	836 250				
National Laser Centre	35 528				
Laser Loan Programme	10 430				
African Laser Centre	5 698				
Implementation: ICT R&D Roadmap	77 917				
Cyber Infrastructure (NICIS)	251 686				

G.1.5 PPE Budget Summary

Table G.5: PPE Budget Summary

Category	2019/20 R'000
Buildings	4 750
Equipment	30 875
ICT equipment	56 525
Furniture and fittings	1 710
Vehicles	1 140
TOTAL	**95 000**

The budgeted investment in property, plant and equipment for the 2019/20 financial year is R95 million, which includes fully funded grant assets.

Notwithstanding the fact that an item is included in the property, plant and equipment budget, the investment remains subject to approval as per the Approval Framework of the CSIR and additional considerations such as strategic alignment, return on investment and available cash flow.

G.1.6 Alignment of Parliamentary Grant Budget and Strategic Objectives

Table G.6: Link between Parliamentary Grant and CSIR Strategic Objectives

PG ALLOCATION DESCRIPTION	2019/20 Allocation R'000	Strategic Objectives
Total Baseline Allocation	**R 871 778**	
Baseline Allocation to Clusters (previously Business Units)	R 389 752	SO1,SO2 & SO3
Portfolios and Support Functions	R 210 712	
Leadership Team	R 39 572	SO5
Campus Master Plan Office	R 5 750	SO4
Internal Audit	R 10 207	SO5
Research and Development Office	21 133	SO1,SO2 & SO3
Licensing and Ventures Office	R 9 509	SO1,SO2 & SO3
Planning and Reporting	R 5 290	SO1,SO2 & SO3
Information and Knowledge Management	R 17 054	SO1,SO2 & SO3
Strategic Partnerships	R 10 580	SO1,SO2 & SO3
Strategic Communications and Stakeholder Relations	R 10 118	SO5
Legal	R 8 516	SO5
POPI	R 796	SO5
Enterprise Risk Office	R 9 066	SO5
Knowledge Commons	R 3 481	SO5
Finance	R 16 683	SO5
Information and Communication Technology	R 20 231	SO5
Human Resources	R 12 408	SO4
Human Capital development	R 10 319	SO4
Strategic Programmes	R 83 950	
Emerging Research Areas	R 51 750	SO1,SO2 & SO3
Thematic Programme	R 18 400	SO1,SO2 & SO3
Young Researcher Empowerment Fund	R 13 800	S04
Non-Discretionary Special Initiatives	R 50 187	
Strategic Research Panel	R 541	SO1,SO2 & SO3
Research Ethics Training	R 484	SO1, SO2 & SO3
Research Ethics Committee	R 690	SO1,SO2 & SO3
CSIR Board and sub committees	R 2 584	SO5
Communications Projects	R 6 360	SO5
Bursary program	R 17 104	SO4
Health & Wellbeing	R 1 150	SO4
CSIR Conference / Excellence awards	R 2 300	SO4
SEED Fund: L&V office	R 5 750	SO1,SO2 & SO3
Legal	R 1 725	SO5
Senior Researcher Acceleration Programme	R 11 500	S04
Discretionary Allocations (To be invested upon receipt of motivations)	R 137 177	
Project Synapse: New Indstrial Development strategy Implementation	R 137 177	SO1, SO2, SO3
Ring-Fenced Allocations	**R 345 731**	
Implementation: ICT R&D Roadmap	R 77 917	SO2 & SO3
African Laser Centre (NLC)	R 5 698	SO2 & SO3
Laser Loan Program (NLC)	R 10 430	SO2 & SO3
Cyber Infrastructure	R 251 686	SO2 & SO3
Total	**1 217 509**	

Table G.7: Summary of PG Investment by Strategic Objectives

PROGRAMS	Strategic Objectives	Investment	%
Program1: Administration: Financial Sustainability and Good Governance	SO5	R 129 337	11%
Program2: Research, Development and Innovation	SO1,SO2 & SO3	R 1 013 842	83%
Program3: Human capital and infrastructure development	SO4	R 74 330	6%
Total		**R 1 217 509**	**100%**

G.2 CSIR Group 3 Year Financial Plan

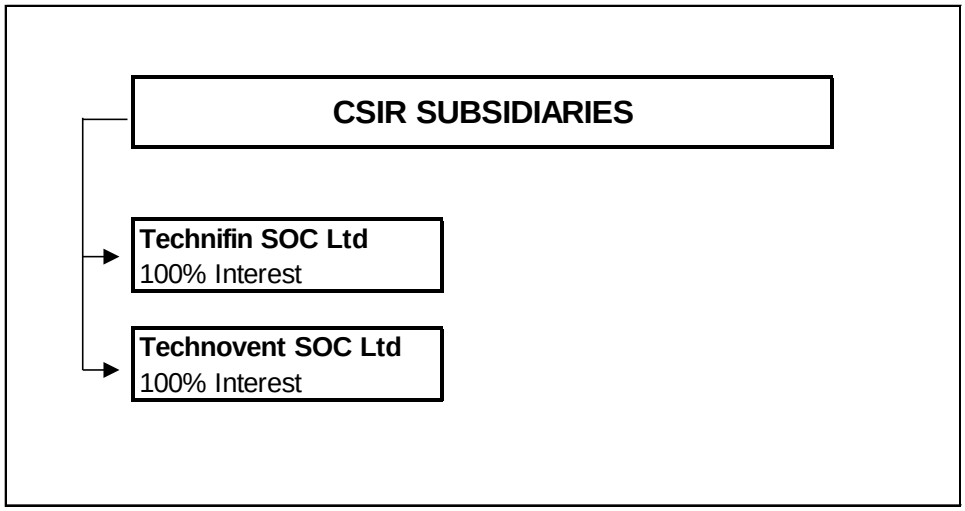
G.2.1 Subsidiaries and Associate Companies

Table G.8: CSIR Subsidiaries and Associated Companies: Income and Expenditure 2019/20

	Total	Technifin SOC Ltd	Technovent SOC Ltd	SERA (Pty) Ltd	Ellipsoid Technology (Pty) Ltd	Persomics AB
Incorporated		South Africa	South Africa	South Africa	South Africa	Sweden
% Holding		100	100	50	50	37,89
	Annual budget - R'000					
Total Income	**432**	**432**	**-**	**-**	**-**	**-**
Contract income	-	-	-	-	-	-
Royalty income	-	-	-	-	-	-
Finance income	401	401	-	-	-	-
Other income	31	31	-	-	-	-
Expenses	**2 579**	**52**	**-**	**-**	**-**	**2 527**
Operating expenses	52	52	-	-	-	-
Employees' remuneration	-	-	-	-	-	-
Depreciation/amortisation	-	-	-	-	-	-
Share of (loss)/profit of joint ventures and associates	2 527	-	-	-	-	2 527
Net profit	**(2 147)**	**380**	**-**	**-**	**-**	**(2 527)**

The CSIR subsidiary companies have duly appointed Boards. The subsidiary companies are audited by the Auditor-General.

The subsidiary companies have a zero dividend policy. CSIR Subsidiary Companies



CSIR Group Statements of Comprehensive Income

Table G.9: Group Statement of Comprehensive Income – MTEF Period

	Forecast 2018/2019 R'000	Budget 2019/2020 R'000	Budget 2020/2021 R'000	Budget 2021/2022 R'000
Total Operating Revenue	**2 705 090**	**2 859 326**	**3 074 759**	**3 321 382**
Contract R&D Income	**1 941 167**	**2 098 168**	**2 270 400**	**2 490 287**
Public - South Africa	1 476 096	1 571 049	1 694 087	1 840 330
Private - South Africa	211 620	215 814	248 186	297 823
International	167 322	223 316	241 851	261 199
Parliamentary Grant - Ring fenced	86 129	87 989	86 276	90 935
Parliamentary Grant	**760 092**	**758 068**	**799 724**	**824 142**
Royalty Income	3 025	3 090	4 635	6 953
Other Income	806	31	-	-
Total Expenditure	**2 798 872**	**2 889 590**	**3 054 850**	**3 272 776**
Employees' Remuneration	1 640 011	1 703 908	1 799 327	1 925 280
Operating Expenses	1 058 437	1 055 903	1 119 256	1 197 601
Depreciation	100 424	129 779	136 268	149 895
Operating Profit before Investment Income	**(93 782)**	**(30 233)**	**19 909**	**48 606**
Investment Income	45 101	39 400	40 197	41 010
Share of (losse)/profit of joint ventures and associ	(2 527)	(2 527)	(2 786)	(2 926)
Net profit before non-guaranteed employees' remuneration (Performance bonus)	**(51 208)**	**6 640**	**57 320**	**86 691**
Non-guaranteed employees' remuneration (Performance bonus)	-	-	-	15 036
Net Profit	**(51 208)**	**6 640**	**57 320**	**71 655**

G.2.2 CSIR Group Statements of Financial Position

Table G.10: Group Statement of Financial Position over the MTEF Period

	FORECAST March 2019 R'000	BUDGET March 2020 R'000	BUDGET March 2021 R'000	BUDGET March 2022 R'000
ASSETS				
Non-Current assets	**776 978**	**742 199**	**725 931**	**726 037**
Property, plant and equipment	767 911	733 132	716 864	716 969
Interest in Joint Ventures and Associates	9 068	9 068	9 068	9 068
Interest in Subsidiaries	-	-	-	-
Trade and other receivables	-	-	-	-
Current Assets	**697 577**	**731 679**	**807 271**	**882 867**
Trade and other receivables	243 254	257 339	245 981	232 497
Inventory and contracts in progress	(648 677)	(629 052)	(676 447)	(730 704)
Cash and cash equivalents	1 103 000	1 103 392	1 237 738	1 381 074
TOTAL ASSETS	**1 474 555**	**1 473 879**	**1 533 203**	**1 608 904**
EQUITY AND LIABILITIES				
Reserves	**945 211**	**951 850**	**1 009 170**	**1 080 825**
Retained earnings	945 211	951 850	1 009 170	1 080 825
Non-current liabilities	**11 072**	**11 183**	**11 295**	**11 408**
Post retirement medical benefits	11 072	11 183	11 295	11 408
Current Liabilities	**518 272**	**510 845**	**512 737**	**516 671**
Advances received	135 141	142 966	122 990	99 641
Trade and other payables	383 131	367 879	389 747	417 029
TOTAL EQUITY AND LIABILITIES	**1 474 555**	**1 473 879**	**1 533 203**	**1 608 904**

G.3 CSIR Group Cash Flow

Table G.11: CSIR Group Cash-Flow Statement

	MARCH 2020 R'000
Cashflow from operating activities	
Cash receipts from external customers	2 059 808
Parliamentary Grant income	758 068
Cash paid to suppliers and employees	(2 761 995)
Cash generated from operating activities	55 881
Net finance income	39 400
Net cash from operating activities	**95 281**
Cashflow from investing activities	
Decrease in interest in joint ventures and associates	-
Decrease in non-current trade and other receivables	-
Acquisition of property, plant and equipment	(95 000)
Net cash utilised in investing activities	**(95 000)**
Cashflow from financing activities	
Increase in non-current liabilities	111
Net cash generated from financing activities	**111**
Net increase in cash and cash equivalents	**392**
Cash and cash equivalents at beginning of the year	**1 103 000**
Cash and cash equivalents at end of the year	**1 103 392**

G.4 5 Year Borrowing Plan

Table G.12: CSIR 5 Year Borrowing Plan

Financial year ending	Performance bonds	Bid bond	Payment guarantee	Advance payment guarantee	Total annual limit
			R'000		
31 March 2019	25 000	4 000	15 000	45 000	89 000
31 March 2020	25 000	5 000	20 000	50 000	100 000
31 March 2021	35 000	5 000	20 000	50 000	110 000
31 March 2022	45 000	5 000	20 000	50 000	120 000
31 March 2023	50 000	5 000	25 000	50 000	130 000

DST Letter

MINISTER
SCIENCE AND TECHNOLOGY
REPUBLIC OF SOUTH AFRICA

Private Bag X727, Pretoria, 0001, South Africa. Tel: +27 12 843 6717 / Private Bag X9156, Cape Town, 8000, South Africa. Tel: +27 21 469 5000

Prof. Thokozani Majozi
Chairperson
Council for Scientific and Industrial Research Board
P O Box 395
PRETORIA
0001

Dear Prof. Majozi

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH MEDIUM TERM EXPENDITURE FRAMEWORK ALLOCATION: 2019/20 TO 2021/22

The 2019 Medium Term Expenditure Framework (MTEF) process has been completed. I would like to present you with the details of the funding allocated to the Council for Scientific and Industrial Research (CSIR) over the 2019 MTEF period.

Changes to the 2018 MTEF allocation are reflected in the table below. **It should be noted that the 2019 MTEF allocation indicated below is VAT inclusive.**

Council for Scientific and Industrial Research (CSIR)	**2019/20 R'000**	**2020/21 R'000**	**2021/22 R'000**
Baseline	**885,341**	**934,036**	**963,428**
Baseline reduction (1. Wage freeze for executives and senior management, 2. Goods and services reduction)	(49,091)	(51,835)	(55,171)
Ring fenced allocations (Programme Level)	**381,259**	**397,481**	**417,902**
National Laser Centre	35,528	37,482	39,506
Laser Loan Programme	10,430	11,004	11,598
African Laser Centre	5,698	6,011	6,336
Implementation: ICT R&D Roadmap	77,917	82,202	86,641
National Integrated Cyberinfrastructure System (NICIS)	251,686	260,782	273,821
TOTAL 2019 MTEF ALLOCATION	**1,217,509**	**1,279,682**	**1,326,159**

Included in the baseline is an allocation for the Improvement in Service Condition (ISC). The CSIR should decide on the appropriate percentage to be earmarked specifically for the ISC of its employees. These include salary increases and other aspects of remuneration such as pay progression, housing allowance and other improvements in conditions of service that may apply. Also included in the baseline is a wage freeze for executives and senior management, and goods and services reduction imposed by the National Treasury (see annexure for National Treasury guidelines). The CSIR is advised to implement the reductions in accordance with the attached National Treasury formula.
The DST was provided with a three-year allocation of R190 million to support the development of a Mining R&D Hub. The CSIR will be allocated a portion of this funding and is expected to partner with other R&D institutions. The planned deployment of the funding need to be finalised between the DST and CSIR before 31 March 2019. The management of the allocation will be done via the standard contract process.

The MTEF allocation includes ring-fenced amounts for specific initiatives of the Department that are being managed by the CSIR. These initiatives build on past investments and efforts. The CSIR is, therefore, required to work closely with the DST to finalise detailed work programmes, inclusive of performance indicators, and reporting arrangements for the ring-fenced funding.

According to the National Treasury line-funding's categorisation, all ring-fenced allocations indicated above are earmarked and may not be used for purposes other than those specified. As indicated in previous allocation letters, the interest earned on ring-fenced allocations should be utilised for Human Capital Development projects and must be disclosed in all quarterly reports submitted to the DST.

Allocations for the two outer years of the 2019 MTEF (2020/21 and 2021/22) are not final and are subject to review, however, they can be reliably used for planning purposes. In terms of section 52 of the Public Finance Management Act (PFMA), the CSIR is expected to present its 2019/20 Corporate Plan to the Minister of Science and Technology based on this allocation before the end of the 2018/19 financial year.

Lastly, please note that information relating to your institution and the Science and Technology budget is formally published in the "2019 Estimates of National Expenditure", and until then the above information is provisional.

Yours sincerely

MS MT KUBAYI-NGUBANE
MINISTER OF SCIENCE AND TECHNOLOGY
DATE: 13/02/2019

Cc CEO: Dr Thulani Dlamini; CFO: Ms Zanele Ngwepe