

CSIR SHAREHOLDER'S COMPACT

Cycle commencing 1 April 2018



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

CSIR
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Acronyms

AISI	Aerospace Industry Support Initiative
ALC	African Laser Centre
ARC	Agricultural Research Council
ARDP	Accelerated Researcher Development Program
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 Lifecycle 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

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 appendices covering the following aspects:

- Strategic planning documents:
 - Strategic Plan (Appendix A);
 - Annual Performance Plan: 2018/19 (Appendix B);
- Documents setting out the governance structures and risk management strategies of the CSIR:
 - Governance Structure (Appendix C);
 - Risk Management Strategy (Plan) (Appendix D);
 - Fraud Prevention Plan (Appendix E);
 - Materiality/Significance Framework (Appendix F).
- Documents setting out our Financial Plan and our compliance with the applicable financial legislation
 - Financial Plan (Appendix G)

Shareholder's Compact



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Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

SHAREHOLDER'S COMPACT

FOR THE CYCLE COMMENCING 1 APRIL 2018

MADE AND ENTERED INTO BY AND BETWEEN:

THE MINISTER OF SCIENCE AND TECHNOLOGY

Mrs Naledi Pandor, 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 Majosi, 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 \(PFMA\)](#) furthermore requires the Accounting Authority of a Schedule 3B public entity to annually conclude a Shareholder's Compact with its Executive Authority; and

The CSIR Board is the organisation's Accounting Authority and the Minister of Science and Technology is its Executive Authority as a Cabinet member responsible for the CSIR;

The Parties have negotiated and reached 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 2018/19 financial year;
- Annexure [C](#) being the CSIR Governance Structure;
- Annexure [D](#) being the CSIR's Risk Management Strategy (Plan);
- Annexure [E](#) being the CSIR's 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 2018/19; the Group Three Year Financial Plan and the 3-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 No 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 No 55 of 1988;
- 1.8 **Effective Date** means the effective date of this Shareholder’s Compact, which shall be 1 April 2018;
- 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 No 66 of 1995;
- 1.12 **Materiality Framework** means the materiality framework as envisaged by Clauses 7.3 and 14. below and as recorded in Annexure F;
- 1.13 **Parties** means the Executive Authority and the Accounting Authority respectively;
- 1.14 **PFMA** means Acts No 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 No 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 Public Finance Management Act, 1999;

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 2018.



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 2019.

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 2018/19 planning cycle; the CSIR's Risk Management Strategy; the CSIR's Fraud Prevention Plan; the Materiality Framework; the Budget and Cashflow for 2018/19; the Group 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 Appendix A, matters relating to, amongst 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, 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, amongst others, the development of strategic plans, development of operational plans and budgets, appointment of staff, approval of salaries and acquisition and disposal of assets. 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 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 they are at all times 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 Build and Transform Human Capital.

The CSIR's research base contributions are only possible through the skills and capabilities of our research and support staff. The ongoing development, renewal and



transformation of our staff is therefore of critical importance for the organisation. In addition the CSIR is an important part of the national system of innovation, and through the development and training of our scientific base contributes to the national imperative to develop human capital and to the ongoing transformation of our society.

SO2 Conduct High-Quality Research to Foster Scientific Development.

The CSIR contributes to scientific development by identifying, and investing in, areas of research. The outputs of these interventions will include the production of a range of high-quality technical outputs (including peer-reviewed journal articles and patents) and the generation of contract Research and Development (R&D) income through the provision of research services.

SO3 Conduct Relevant Research to Foster Industrial Development.

A key component of our work is to support, through technological innovation, the short, medium and long-term development of the South African economy. We will accomplish this by collaborating with industrial partners, state-owned enterprises and other institutional stakeholders to identify opportunities to improve the efficiency and competitiveness of our existing industries, and to invest in the development of technologies that will underpin the industries of the future. To this end, Project Synapse was launched in August 2017 to define the CSIR's industrial development strategy.

SO4 Infrastructure Renewal and Development.

In order to support its scientific and industrial development mission the CSIR needs to develop, and maintain, a world-class research and built infrastructure. This will be accomplished through investment in our research facilities and the implementation of the Campus Master Plan.

SO5 Financial Sustainability and Governance

Without a financially sustainable and well-governed organisation our ability to, over the long-term, contribute to national development through our scientific and technological work would be severely compromised. The CSIR is therefore committed to maintaining our record of good governance and to continue to operate in a safe and sustainable manner.

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.

The KPIs (see Appendix A.5 for a detailed description of each KPI) are:



SO1: Build and Transform Human Capital

- **Total size of Science, Engineering and Technology (SET) base:**

The SET base is a measure of the CSIR's capacity to deliver on Research, Development and Innovation (RD&I) projects. SET staff consist of staff who work primarily on RD&I projects, and include researchers, engineers, technicians, project managers, and research managers. Bursars and vacation workers are not included.

- **Number and Percentage of SET base who are Black/Female:**

These indicators capture the level of demographic transformation within the RD&I capability of the organisation, and measure the number and proportion of Black and Female South African citizens in the SET base.

- **Total Number of Chief Researchers:**

Chief Researchers are internationally-recognised experts and are expected to conceptualise and lead large RD&I programmes. This indicator measures the size of the most senior research level of the CSIR.

- **Total Number of Principal Researchers:**

Principal Researchers are nationally-recognised specialists in their area of expertise and lead large RD&I programmes at the CSIR. This indicator measures the size of this group as pipeline to the Chief Researcher level.

- **Total Number and Percentage of Chief Researchers who are Black/Female:**

These indicators measure the level of demographic transformation at the most senior research leadership levels at the CSIR. These indicators refer to the number of Black and Female South Africans who are Chief Researchers.

- **Number and Percentage of Principal Researchers who are Black/Female:**

These indicators measure the level of demographic transformation of the second-most senior research leadership level at the CSIR. These indicators refer to the number of Black and Female South Africans who are Principal Researchers.

- **Number and Percentage of SET base with a PhD:** *These indicators provide a measure of the quality of our SET capacity. The indicators refer to the number of SET Staff with a doctoral level qualification, and the proportion of all SET staff with a doctoral level qualification.*

SO2: Conduct High-Quality Research to foster Scientific Development

- **Publication equivalents:**

Publication equivalents consists of peer-reviewed journal articles, peer-reviewed conference papers, peer-reviewed book chapters and books. The quantity and quality of peer-reviewed research publications is a measure of the CSIR's research quality, capabilities and outputs. The impact of research publications is a contribution to the knowledge base.



- **Journal articles published:**

Peer-reviewed research publications are a measure of the CSIR's research quality, capabilities and outputs. The impact of research publications is a contribution to the knowledge base.

- **New patents:**

Patents provide a lead indicator of impact through commercialisation, and serves to protect the valuable Intellectual Property (IP) created by CSIR researchers.

- **Contract R&D income:** *Contract R&D income is income earned and recognised on contracts with external parties. This measure indicates the value placed by stakeholders, customers and funding agencies on the research and development and services provided by the CSIR.*

SO3: Conduct Relevant Research to foster Industrial Development

- **New technology demonstrators:** *A technology demonstrator is an intermediate research output and is a critical step on the path to the deployment and transfer of the technology, either through licensing or the establishment of a spin-out company.*

- **Royalty and License income:** *Royalty and licence income is an indicator of successful technology transfer and commercialisation.*

The CSIR is developing additional indicators to measure the effect of our efforts to foster industrial development (see Section A.3.2 for further details). These may include some or all of the following:

- The number of new start-up companies established.
- The number of new licence agreements signed for CSIR-developed technologies.
- The number of companies (including SMMEs) supported to upgrade their manufacturing and production processes.
- The total number of new products and processes introduced to the private sector.
- Private sector income.
- Total value of private sector co-investment.
- The number of CSIR trainees or interns who are placed in the private sector.

SO4: Infrastructure Renewal and Development

- **Investment in Plant, Property and Equipment (PPE):**

This is the amount invested in CSIR property, plant and equipment for a financial year and measures our investment in developing and maintaining world-class R&D facilities and equipment.

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



measure the implementation of this initiative will be included in future versions of this Compact.

SO5: Financial Sustainability and Governance

- **Total income:**

Total income is the income earned for a financial year. It reflects the ability of the CSIR to ensure financial sustainability. Growth in total income is also a proxy indicator for growth in the outcomes and impact achieved by the CSIR.

- **Net profit:**

Profit for a financial year is calculated as total operating income, less total operating expenditure, plus net finance income. 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.

- **B-BBEE status:**

The CSIR B-BBEE policy seeks to support socio-economic transformation of society, within and outside the CSIR, by changing the demographic profile of meaningful and productive participation in the country's economic activity. The CSIR's assessment of its B-BBEE status is based on the Broad-Based Black Economic Empowerment Amendment Act, 2013 (Act No. 46 of 2013). All targets and definitions are derived from the Codes of Good Practice as published by the Department of Trade and Industry. The CSIR will aim to regain a level 2 qualification while continuing to monitor the effects of the changes in regulations that have taken effect in the 2016/17 financial year.

- **Disabling Injury Frequency Rate (DIFR):**

A disabling injury is defined as an injury, including occupational illnesses, arising out of and during the course of employment which results in the loss of one or more working days other than the date of accident. This indicator measures the quality of the health and safety management in the organization.

The target values for the set of KPIs is 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.



Indicator	Actual 2016/17	Target 2017/18	Projected 2017/18	Target 2018/19
SO1: Build and Transform Human Capital				
Total Size of SET Base	1,966	2,100	1,860	1,860
– Number of SET Base who are Black	1,190	1,280	1,160	1,160
– Percentage of SET Base who are Black	61%	61%	62%	62%
– Number of SET Base who are Female	702	785	687	687
– Percentage of SET Base who are Female	36%	37%	37%	37%
– Number of SET Base with a PhD	351	411	344	369
– Percentage of SET Base with a PhD	18%	20%	18%	20%
Total Chief Researchers	20	22	21	23
– Number of Chief Researchers who are Black	1	2	2	3
– Percentage of Chief Researchers who are Black	10%	9%	10%	13%
– Number of Chief Researchers who are Female	3	4	4	3
– Percentage of Chief Researchers who are Female	15%	18%	19%	13%
Total Principal Researchers	228	240	205	210
– Number of Principal Researchers who are Black	48	53	51	57
– Percentage of Principal Researchers who are Black	21%	22%	25%	27%
– Number of Principal Researchers who are Female	42	45	37	41
– Percentage of Principal Researchers who are Female	18%	19%	18%	20%
SO2: Conduct High-Quality Research to foster Scientific Development				
Publication Equivalents	491	500	500	480
Journal Articles	286	310	310	310
New Patents	15	15	15	15
Contract R&D Income (Rm)	R 1,952 m	R 2,128 m	R 1,868 m	R 1,970 m
SO3: Conduct Relevant Research to foster Industrial Development				
New Technology Demonstrators	56	≥35	40	≥50
Royalty and License Income (Rm)	R 5.4 m	R 5.2 m	R 4.1 m	R 4 m
SO4: Infrastructure Renewal and Development				
PPE Investment (Rm)	R 144 m	R 108 m	R 110 m	R 61 m
SO5: Financial Sustainability and Governance				
Total Income (Rm)	R 2,712 m	R 2,863 m	R 2,603 m	R 2,740 m
Net Profit (Rm)	R 95.5 m	R 64 m	R -32 m	R 0 m
B-BBEE Rating	Level 3	Level 2	Level 2	Level 2
DIFR	0	0.2	0.07	0.2

Table 2.1: CSIR Key Performance Indicators: 2018/19

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 2018/19 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,
- 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.

15.3 Should the dispute, despite such mediation, remain unresolved for a further period of 30 (thirty) 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 No. 13 of 2005).

Should the dispute remain unresolved for a period of 30 (thirty) 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.

- 15.4 Should the parties not be able 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) of the 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 1 (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 If applicable, previous unspecified ad-hoc work to be undertaken;

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;

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 Shareholders 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 Naledi Pandor approves of this approach and looks forward to the successful implementation of the undertakings embodied in this Shareholders Compact and its annexures. The Minister accepts that, although the detail of



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Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA



this Shareholders Compact may change due to variations and changes in the market and in society, the spirit thereof will remain unchanged.



THE CSIR SHAREHOLDER'S COMPACT

Agreed to and signed in CAPE TOWN on 23 FEB. 2018.

Prof. Thokozani Majazi

On behalf of the CSIR's Accounting Authority

Agreed to and signed in CAPE TOWN on 23 FEBRUARY 2018.

Mrs Naledi Pandor, Minister of Science and Technology

The Executive Authority

Strategic Plan

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A.1 Strategic Context

The strategic direction of the CSIR is influenced by a number of external and internal environmental factors. Our research programmes address national priorities, particularly those of addressing poverty, inequality and unemployment. As such our RD&I activities are developed in response national strategies such as the National Development Plan (NDP), the National 9-Point Plan and the derivatives of these through various government departments (including 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 this strategic direction.

A.1.1 External Context

South Africa is one of the most competitive countries in sub-Saharan Africa, but has suffered a dramatic decline in global competitiveness. The South African economy is experiencing slow growth, with Gross Domestic Product (GDP) Growth Rate averaging 2.83 percent from 1993 until 2017 and largely driven by agriculture, mining and manufacturing (StatsSA). Such a slow growth has contributed to an increasing high unemployment rate which is now at approximately 28%. The situation is even more desperate when including discouraged workers increasing the statistics to about 36.6%. Without any doubt slow growth in the economy negatively impact revenue collections, which has slowed down from the high of 17.8% recorded in 2007/08, to a low of 8.9% in 2016/17 (National Treasury and the South African Revenue Service, 2017). More worrying is the reality that South Africa now facing some challenges of funding government programmes due to constraints in revenue growth.

Our (CSIR) response to addressing challenges such slow economic growth may be hampered by the current economic climate. This combined with recent adjustments to the country's credit rating and various social priorities has meant that national budgets are severely constrained, particularly those related to R&D expenditure. South Africa's expenditure on R&D is at 0.7% of GDP, which is low in comparison to developed and developing nations (4th lowest amongst the BRICs countries). As the CSIR is reliant on public investment (90% of our income is from parliamentary grant and public sector contract R&D), this situation significantly affects our financial sustainability and crucially our ability to implement long term innovation projects. The public sector which include State Owned Entities/Agencies, and National/Provincial/Local government departments that are also equally affected, and thus it is increasingly becoming difficult to rely on them as additional source of income for the CSIR.

This poor economic climate extends to the private sector, who traditionally have had very low appetite for investment in R&D. While South Africa remains an innovative nation, the majority of that innovation within the private sector is implemented internally to the respective company and is generally through process and equipment innovation (productivity improvements) and not necessarily through investment in R&D outside of the company. For CSIR this means that until the economic climate shifts into one of sustainable growth and economic prosperity, it is unlikely that we will see significant increases in private sector income in the short term. However, the time is now to invest in capabilities that are relevant for the industry of tomorrow.

South Africa is further engulfed by socio-economic challenges where it is reported that wealth remains highly concentrated (i.e. 95 per cent of national wealth) in the hands of 10 per cent of the population, with the gap between the poor and the richer widening. Indeed some of the challenges are not unique to South Africa. As reported in the World Economic Forum, the global emphasis on economic growth in recent decades has led to substantial increases in wealth for large numbers of people across the globe, however, despite huge gains in global economic output, there is evidence that current social, political and economic systems are exacerbating inequalities, rather than reducing them globally. Institutions like the International Monetary Fund are already alluding to growing evidence that suggests that rising income inequality is the cause of economic and social ills, ranging from low consumption to social and political unrest, and is damaging to our future economic well-being.

More severely, South Africa has experienced a premature de-industrialisation over the past decade. Manufacturing investment as a share of GDP has remained trapped below 25%, much less than is required for sustained economic growth. This position is further exasperated 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; 112nd in higher education & training; 124th in technological readiness; 135th in innovation). It is clear therefore that addressing these key enablers is essential to reversing the deindustrialisation that South Africa is experiencing and in this, particularly with respect to innovation and technology readiness and partially in training, CSIR intends to play a significant role.

Changes within the South African environment (political landscape, economic climate including credit ratings, geopolitics and economics influencing foreign exchange etc.) have a direct effect (positive and negative) on the business of the CSIR and our ability to perform high impact research, development and innovation. As such we need to remain cognisant of (and responsive to) major changes that could hamper or provide opportunities for the CSIR.

From a technological point of view, 2 key developments have begun to shape the future strategic direction of research organisations like the CSIR. From a global perspective, we are now arguably in a fourth industrial revolution, which involves the fusion of technologies such as artificial intelligence, automation, biotechnology, and nanotechnology, that is blurring the lines between the physical, digital and biological spheres. Due to the intense pace of technology and particularly digital technological development, the fourth industrial revolution is broader and faster than any before it. The revolution will impact most, if not all economic

sectors. But it will also extend, due to the integrative nature of the revolution to business systems, technology developments and society in general. From a technology point of view we will see the integration of physical, digital and biological technologies. Business systems will change to more decentralised and globalised manufacturing and distribution accompanied with entirely new business models. Drivers of the fourth industrial revolution include Advanced Robotics, Additive Manufacturing, Augmented Reality, Simulation, Internet of Things, Big Data and Cyber Security.

As a multidisciplinary scientific and industrial research organisation, the Council for Scientific and Industrial Research (CSIR) is already actively involved in technological development in many of these drivers. Through Project Synapse we will be identifying key South African sectors to assist with transition into this new manufacturing paradigm. Equally, while South Africa is globally ranked poorly with respect to its innovation system, we are the continental leaders with respect to innovation. In this we have an opportunity to attract African as well as international contracting funding in support of African development programmes (such as the [Southern African Development Community \(SADC\)](#) industrialisation programme and [New Partnership for Africa's Development \(NEPAD\)](#) Science, Technology and Innovation (STI) initiatives).

The DST is developing a new white paper on STI. This white paper will direct the countries science, engineering and technology efforts over the next 12 to 15 years (Targeting 2030). Key to this new white paper is a renewed focus on developing and enhancing innovation structures within the country, from human capital development, through to technology development and the financing environment to ensure adoption of new technologies. As part of this renewed focus, the DST has set relevant targets with respect to job creation, small business support and revenue generation through STI interventions, along with the traditional indicators (scientific publications, patents, human capital development etc) that indicate the strength of the full research, development and innovation system. The CSIR aims to play a significant role in facilitating and contributing to the development of this innovation culture.

The CSIR as a Research and Technology organisation must be client-focused if the CSIR want to achieve the purposes for which it is created. The CSIR produce, integrate and transfer science and technology to help support Government, resolve the challenges of society, and support industrial competitiveness. The CSIR is vital to the innovation chain and is responsible for bridging the gap between basic research and practical application. This role in the national system of innovation requires the CSIR to develop partnerships with [Higher Education Institutions \(HEIs\)](#), [Research Technology Organisations \(RTOs\)](#), Government Departments and Industry. Equally, for the purposes of global competitiveness and relevance, and also to contribute to financial sustainability, it is critical that the CSIR grow and maintain productive international partnerships in both the public and private sector.

A.1.2 Internal Context

The CSIR operates within the South African National System of Innovation (NSI), directed by national imperatives, in a very complex legislative environment.

In fulfilling this mandate, the CSIR has configured its R&D activities into operating units and centres (Figure A.1) that generally provide individually or integrated capabilities required to support scientific and industrial development.

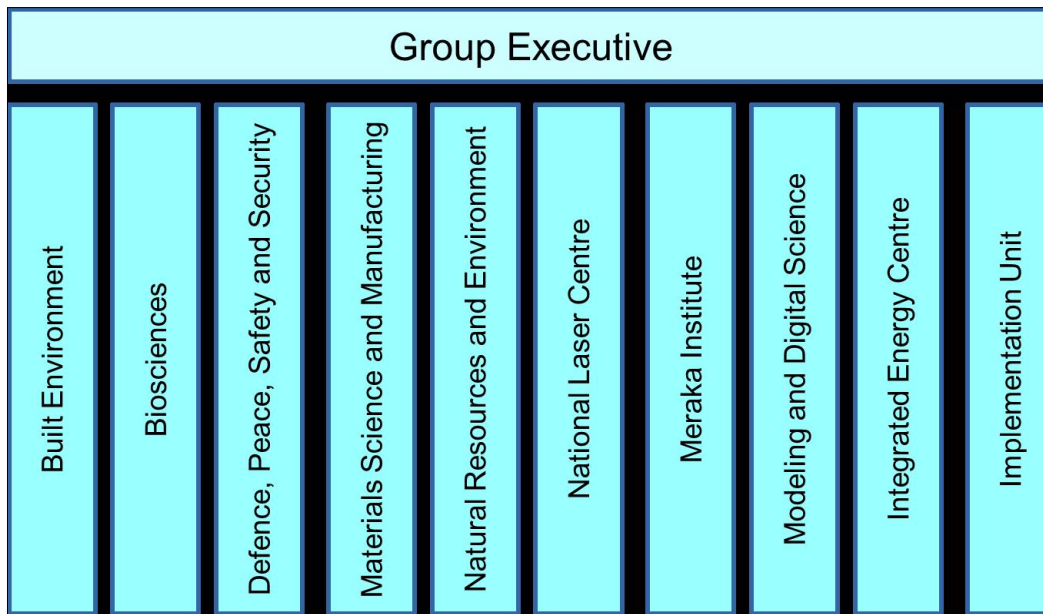


Figure A.1: CSIR Operating Units and Centres

The CSIR is classified by Treasury as a Schedule 3b entity in terms of the Public Finance Management Act, Act 1 of 1999 (PFMA). The implication is that CSIR generates its own income though it is also substantially government funded. The CSIR obtains approximately one-third of its operational budget from government in the form of a Parliamentary Grant, which is used to strengthen the Science, Engineering and Technology base at the CSIR. The remainder of our income is derived from contract income, while royalty income is currently negligible at less than 1%. Relatively low levels of private income from local and international sources and negligible royalty income are concerning, and this is largely attributable to the economic environment as described above, and the need to ensure that our innovation portfolio addresses the needs of the government.

In 2006 the CSIR embarked on a strategy to develop its scientific base. This was done very successfully with a steep increase in accredited publications and qualified science, engineering and technology (SET) staff. As a result we have developed capability across multiple disciplines for technology development and knowledge generation. Within the local context described above, it is critical now that we create capabilities to facilitate transfer of these technologies and the SET knowhow to the local economic sectors to enable growth at a national level, while still utilising the developed capabilities to assist government in addressing national priorities. Project Synapse aims to determine how best to configure the CSIR and prioritise RDI activities to achieve this. The result of this project, already well underway, will be a set of innovation

intervention priorities (targeting national priority sectors) for the short (3-5 years), medium (5-10 years) and long term (10-20 years). These identified interventions will be backed by new or renewed research and development focus to create relevant technology platforms and capabilities.

A key concern within the organisation is the declining financial sustainability. While this is in part due to the loss of traditionally lucrative long term contracts, we are also experiencing local challenges (which influence the majority of CSIR's funding). Internally, a number of CSIR cost models and overhead structures need to be reconsidered as working with external partners, particularly private sector, is becoming increasingly difficult. In the coming year this will initially be addressed through restructuring of the executive portfolios to streamline the organisations centralised overhead structures and improve operational efficiencies. This will be complimented, through Project Synapse, with a set of new business and cost models to ensure that CSIR becomes agile and has the ability to easily interact and contract with external public and private sector institutions. From the reverse perspective, an intervention is required to facilitate the contracting with national government institutions and state entities. This in particular has hampered progress over the past 2 years with lengthy and complicated contracting processes. Equally, the problems experienced by state-owned entities (particularly Transnet and Eskom) have had a significant impact on CSIR's financial sustainability.

Human Capital remains the corner stone of CSIR's success. The SET base growth rate has been declining over the past few years and is expected to remain static in the next year. This influences our ability to continue the good work in transforming our SET base and improving the overall qualification profile of the organisation. In the current environment (low financial growth and limited availability of qualified resources) it is difficult to attract and retain highly-qualified staff. It is essential therefore that internal programmes for career growth and transformation be strengthened to improve both the existing SET base and support staff. The CSIR will seek additional resources to support internal growth as well as supporting the growth of a relevant SET pipeline within the NSI.

Finally, the CSIR has not been significantly re-capitalised in the past 3 decades (some existing infrastructure was developed in the early 1980s, although major infrastructure development was as far back as the 1960s). Our campuses, particularly Scientia, have ageing and often outdated infrastructure. While annual investments in property, plant and equipment (PPE) address the most critical items, it is necessary for a more concerted effort to modernise the CSIR facilities. The Campus Master Plan sets out an operational plan to address this, which will require additional governmental support.

A.1.3 National Priorities

The design and implementation of the CSIR's strategic plan is guided by a range of policy documents, chief amongst 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 the 9-Point-Plan and the DST Strategic Plan: 2015-2020.

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:

1. **Economy and Employment.** The CSIR initiates RD&I programmes directly aligned to support key national economic sectors to enhance industrial competitiveness, contribute to GDP and create employment opportunities. Examples include Titanium Beneficiation, Additive Manufacturing, Technology Localisation, National Cleaner Production Centre and the Digital Economy.
2. **Building a Capable State.** Our interventions in this area focus on service delivery and its associated issues. In particular we aim to address a lack of organisational capacity (at municipal, provincial and national level) to support service development; the absence of integrated decision support capability; and the poor diffusion/uptake of potential technology-based service-delivery solutions.
3. **Economic and Social Infrastructure.** The CSIR is coordinating two of the national Strategic Infrastructure Programmes (SIPs) – 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.
4. **Transition to a Low-Carbon Economy.** The CSIR is working on improving both the measurement and management of our natural resources, therefore improving our ability to understand the long-term effects of climate change and hence assist government with the formulation of mitigation and adaptation strategies. The CSIR is also supporting the development of a green economy more generally (National Waste Roadmap implementation, support of the DST Bioeconomy Strategy)
5. **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.

6. **Improving Health.** The CSIR's work in support of health ranges from technical support to the National Health Insurance initiative, the development of interconnected and interoperable point-of-care devices and the development of new methods to understand, manage and diagnose disease at the cellular and molecular level.
7. **Building Safer Communities.** The CSIR interventions in this area focus on supporting the acquisition and integration of technology by our security forces, national police and the security sector. This includes research to define a holistic and integrated approach to national security as well as developing technology for integrated command and control capability within and between stakeholders within the security community.

A.1.3.2 National Nine-Point Plan

The national government has devised a Nine-Point plan aimed at boosting economic growth and creating employment, as outlined in the State President's 2015 State of the Nation Address.

The Nine-Point Plan is part of government's annual programme of action, and is linked to the NDP's priority outcomes in the medium to long term. The CSIR's R&D programme contributes to the Nine-Point Plan in various ways, and some examples are outlined below:

1. **Resolving the energy challenge.** Renewable energy and the development of technologies and processes to increase the share of renewable energies in South Africa's overall energy consumption. The CSIR support includes interventions around energy infrastructure and the development of technologies that support the maintenance of energy infrastructure.
2. **Revitalising agriculture and the agro-processing value chain.** Our interventions include support for the Bio-economy Strategy by increasing the conversion of bioscience R&D into commercialised products and technologies, including bio-processing technologies and processes.
3. **Advancing beneficiation or adding value to the mineral wealth.** Our interventions include activities around Titanium and Aluminum beneficiation and beneficiating polymer nanocomposites.
4. **More effective implementation of a higher 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).
5. **Encouraging private-sector investment.** The CSIR participates in the Industry Innovation Partnerships Programme (IIPF), in partnership with the DST, which seeks to attract private-sector investment in translating R&D outputs to commercial products by providing specialised prototyping, piloting and upscaling infrastructure to bridge the gap between the lab and the market. Examples include the Biomanufacturing Industry

Development Centre (BIDC), the Biorefinery Facility, National Nanotechnology Upscaling Facility, and the Photonics Prototyping Facility.

6. **Moderating workplace conflict.** The CSIR has no direct contribution to this item.
7. **Unlocking the potential of 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, with the creation of enterprises and with the transfer of technology.
8. **State reform and boosting the role of state-owned companies, information and communications technology infrastructure or broadband roll-out, water, sanitation and transport infrastructure.** Our interventions linked to the creation of digital opportunities, the development of Information and Communication Technology (ICT) infrastructure, water infrastructure, our partnerships with Transnet and Eskom all support this goal. CSIR will initiate an Integrated Water Research Centre to develop viable solutions for South Africa's water scarcity issues.
9. **Operation Phakisa which is aimed at growing the ocean economy and other sectors including Mining.** Our interventions include the development of processes that will address the current challenges facing the mining sector, the development and maintenance of our coastal infrastructure, the deployment of ecosystem services aimed at our oceans and coasts, and the development of a new generation of models, tools, maps and frameworks to improve the understanding and to enhance the design and management of multifunctional landscapes.

A.1.3.3 DST Strategic Plan: 2015-2020

The DST Strategic Plan 2015-20 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.

1. Phase one, 2014-2019: Use knowledge to increase economic efficiency;
2. Phase two, 2020-2025: Use knowledge to enhance industrialisation;
3. Phase three, 2025-2030: A knowledge-based economy.

The DST has set interim proxy indicators to track the success of this strategic plan:

1. Additional revenue of R 500 million from businesses receiving support from DST-funded instruments;
2. Performance of 10,000 Small, Medium and Micro Enterprises (SMMEs) improved through technology interventions;

3. Improved standard of living for at least 500,000 people and/or 12 communities.
4. Decision-support that improves the service delivery of at least 10 government departments;

As a key implementation partner of the DST, the CSIR aims to contribute to the above targets through addressing the relevant objectives articulated in the DST Strategic Plan:

1. **New industrial development and economic diversification.**

Existing programmes include titanium beneficiation, support to the Bioeconomy Strategy and the IIPF. Project Synapse aims to identify further focal areas as well as models for improved support for industrial development

2. **Commercialisation of ideas.**

The CSIR supports commercialisation of ideas through creating and making available large scale and prototyping infrastructure in a variety of sectors. Additionally the CSIR supports emerging technology entrepreneurs through providing access to seasoned entrepreneurs from a variety of sectors through an Entrepreneur-in-Residence Programme.

3. **Improved SME competitiveness.**

The CSIR supports SMEs to adopt technologies to enhance competitiveness and/or develop products for market differentiation. CSIR further supports SMEs through facilitating supply chain development and technology localisation. Programmes include the IIP, the Technology Localisation Implementation Unit and Enterprise Creation for Development.

4. **Inclusive social development.**

The CSIR focusses on effective urban and spatial planning to ensure inclusive economic development. Concurrently the CSIR develops technology for effective service delivery.

5. **Expansion and transformation of research capacity through Human Capital Development and the provision of R&D infrastructure.**

The CSIR is an important part of the national system of innovation, and through the development and training of our research base contributes to the national imperative to develop human capital and to the ongoing transformation of our society.

6. **Deepening bilateral engagement with the rest of the African continent.**

The CSIR is actively involved in African development programmes in response to NEPAD's STI strategy and regional priorities. This includes programmes such as SANBio (promoting the uptake of biobased technologies and development of associated skills across the SADC region) and involvement in the NEPAD industrialisation strategy.

7. Building youth support, by itself through its agencies.

The CSIR actively develops the Youth through national bursary programmes and internally through Human Capital Development (HCD) programmes such as the Young Researcher Establishment Fund. The CSIR also strives to create (technology based) entrepreneurial opportunities through program such as the B IDC and the Digital Opportunities for the Youth.

8. Continuous engagement with the public.

The CSIR has continuous engagements with the private and public sectors to ensure alignment and effective responsiveness to the R&D needs of the country. Furthermore the CSIR maintains a close engagement with the HEIs as part of its intent to collaborate with various stakeholders towards the skills development requirements of the National System of Innovation (NSI).

The CSIR engages with the public through different outreach programmes, including visiting schools to promote science, participating at science festivals such as Scifest and Sasol TechnoX. The CSIR also organises CSIR open days in which different stakeholders are invited to the CSIR for technology demonstrations. The organisation supports science promotion activities organised by South African Agency for Science and Technology Advancement (SAASTA). The CSIR in its broader strategic programme, the Campus Master Plan, has a stated intent to build a state of the art visitors centre as a platform to further elevate the public engagement agenda.

A.1.4 The 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 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 Scientific Research Council 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.

Meeting this mandate requires that the CSIR responds to the major challenges facing South Africa – unemployment, inequality and poverty. The national government intends to address

these challenges through a broad range of programmes, guided by the NDP and further articulated through the 9-Point Plan and sector-specific initiatives.

R&D will play a critical role in supporting the short-, medium- and long-term growth of the economy. In the short-term we need to develop and deploy technologies that improve the efficiency, and hence competitiveness, of existing enterprises; in the medium to long-term we need to develop the industries and sectors (based for example on the use of new technologies or the beneficiation of local resources) that will grow the economy, as well as understanding and mitigating the risks to long-term growth due to climate change and the mismanagement of our natural resources. The CSIR has embarked on Project Synapse, a strategic initiative to amplify the organisation's focus on industrial development initiatives to enhance the performance of the South African economy.

While sustained economic growth will almost certainly address the issues of unemployment and poverty, dealing with the threat of inequality will require a strong and capable state. The CSIR sees its role as providing the scientific and technological innovations that will improve the ability of the state to efficiently deliver basic services (such as health, education, social security, access to energy and shelter) to all South Africans, hence combating both material inequality as well as inequality of access to basic services.

A.1.4.1 CSIR Strategic Framework

An overview of the **CSIR Strategic Framework** is provided in Figure A.2. The framework sets out the logical steps through which we take our inputs (people, processes and facilities) and undertake a set of activities (research and research management) to produce outputs (publications, reports and technologies). These outputs will then lead to a series of outcomes (scientific and technological development) that will ultimately result in an improved quality of life for all South Africans.

The key inputs are the skills (including scientific as well as managerial and support skills) of CSIR employees; the supporting environment consisting of research and other facilities; the financial resources provided by the State and other partners and clients; and the governance processes.

Each of these inputs has a particular role to play:

- Human capital is essential for delivering science and technology solutions, and for delivering the support process required by a large and complex organisation.
- Access to research facilities (including laboratories, libraries and communications facilities) essential for conducting scientific and technological research.
- Financial resources are required both to maintain our facilities, and to attract and retain the best research talent.
- A financially sustainable and well-governed organisation ensures that the focus can remain on the delivery of our scientific mission.

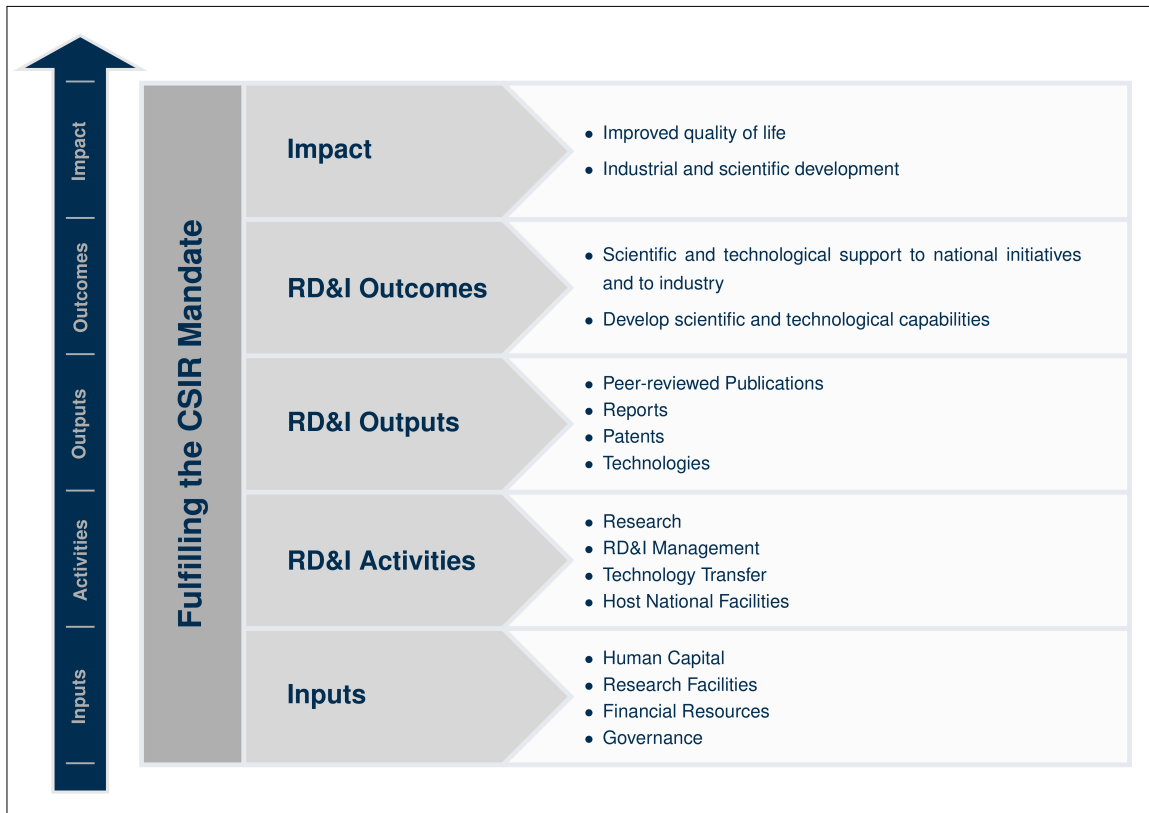


Figure A.2: CSIR Strategic Framework

The activities are, of course, related to the *technological research and innovation* specified in the CSIR mandate. These include the actual research, development and innovation activities, the management of the research process, the transfer of technological solutions to implementing partners, and the hosting of national facilities.

Our **RD&I outputs** (which form a significant component of our KPIs) include academic outputs such as peer-reviewed articles, conference papers and books; technical reports and solutions for our clients; the demonstration of technologies and patents on the technologies we develop.

The **RD&I outcomes** are scientific and technological support to both industry and the State, and the development of research and technological capabilities that will underpin our longer-term economic development.

Finally, the **impact** of our work should be visible both in the improved quality of life of all South Africans as well as the level of scientific and industrial development of South Africa.

A.2 Long-Term Strategic Objectives

A.2.1 Overview of Strategic Objectives

The CSIR has set the following five high-level strategic objectives in order to meet its mandate:

SO1 Build and Transform Human Capital.

The CSIR's research base contributions are only possible through the skills and capabilities

of our research and support staff. The ongoing development, renewal and transformation of our staff is therefore of critical importance for the organisation. In addition the CSIR is an important part of the national system of innovation, and through the development and training of our scientific base contributes to the national imperative to develop human capital and to the ongoing transformation of our society.

SO2 Conduct High-Quality Research to Foster Scientific Development.

The CSIR contributes to scientific development by identifying, and investing in, areas of research. The outputs of these interventions will include the production of a range of high-quality technical outputs (including peer-reviewed journal articles and patents) and the generation of contract R&D income through the provision of research services.

SO3 Conduct Relevant Research to Foster Industrial Development.

A key component of our work is to support, through technological innovation, the short, medium and long-term development of the South African economy. We will accomplish this by collaborating with industrial partners, state-owned enterprises and other institutional stakeholders to identify opportunities to improve the efficiency and competitiveness of our existing industries, and to invest in the development of technologies that will underpin the industries of the future. To this end, Project Synapse was launched in August 2017 to define the CSIR's industrial development strategy.

SO4 Infrastructure Renewal and Development.

In order to support its scientific and industrial development mission the CSIR needs to develop, and maintain, a world-class research and built infrastructure. This will be accomplished through investment in our research facilities and the implementation of the Campus Master Plan.

SO5 Financial sustainability and governance

Without a financially sustainable and well-governed organisation our ability to, over the long-term, contribute to national development through our scientific and technological work would be severely compromised. The CSIR is therefore committed to maintaining our record of good governance and to continue to operate in a safe and sustainable manner.

Our major long-term interventions in support of these strategic objectives are discussed below.

A.2.2 SO1: Building and Transforming Human Capital

A.2.2.1 Human Capital Development

The long term strategic objectives of the CSIR Human Capital function is to build, transform, develop and strengthen the CSIR's Human Capital capability to conduct relevant research, foster innovation and promote industrialisation in support of national priorities to impact and improve socio-economic conditions of the South African population. The Human Capital long term strategic objectives include the continuous development and implementation of the Human Capital strategy and operational plans to direct organisational growth, capacitate and develop the CSIR with the right mix of Human Capital skills and competencies, to provide related Human Capital expertise and services and to initiate Human Capital organisational change interventions required for the CSIR to fulfil its mandate.

The CSIR's Human Capital Development focus remains the development of a transformed and highly skilled cadre of researchers who make an important contribution to knowledge generation as well as development of technologies and applications for industrial development. These are critical to the global competitiveness of South Africa's economy as well to job creation and poverty alleviation. Although the CSIR has contributed to developing human capital over the years, the growth and development of researchers, especially among designated groups such as women, blacks, and the youth remains a challenge. It can only be effectively addressed through continued investment, responsive programmes and collaboration among all institutions in the national system of innovation. The CSIR, therefore, remains a committed partner in developing human capital and growing diverse skills for the benefit of the CSIR and the country.

In order to develop a world class base of researchers the CSIR broadly commits to achieve the following:

- Develop an appropriately qualified SET base to conduct research, development and technological innovation;
- Create a conducive and supporting environment for the advancement of designated groups into positions of leadership in science and leadership of science;
- Improve the qualification profile of its researchers consistent with other world-class research and technology organisations;
- Implement a set of interventions that help ensure development of a healthy pipeline of researchers; and
- Provide development opportunities for our enabling functions

The CSIR is currently reviewing its Human Capital Development Strategy in order to review progress made against targets set in the 2006 HCD Strategy and to redefine the future of human capital development. Such a future will include improving the qualification profile of

the CSIR staff, achieving a diverse and inclusive cadre of researchers and support staff and improving participation rates by designated groups across all levels. The revised strategy will, therefore, endeavor to meaningfully contribute to aspirations expressed in the National Development Plan and the DST's Human Capital Development Strategy.

These following are key human capital development priorities for the CSIR over the next three years:

- Placing a stronger focus on increasing the number of MSc and PhD graduates while continuing to support undergraduate studies in critical areas such as engineering disciplines to ensure a healthy pipeline of post graduate students in those disciplines.
- Supporting the creation of an enabling environment for meaningful career development for the research base in particular designated groups to grow from D1 (mid-career) to senior levels of the CSIR career ladders (Principal and Chief Researchers) over three years.
- Developing effective retention strategies that reduce turnover of Principal and Chief Researchers as well as black and female researchers, whilst acknowledging the competitive national context for scarce skills.
- Improving the percentage of CSIR staff with doctoral qualifications from 18% to 30% in five years in order to remain competitive among leading institutions in the South African R&D landscape and among international Research and Technology Organisations. Bold efforts to develop Masters and PhD graduates will be essential for the retention of the CSIR's status as a world-class research and technology organisation.
- Implement strong leadership development programmes to equip leaders in science (Project leaders, Researchers), leaders of science (Research Group Leaders, Competency Area Managers, Executive Directors) and leaders in support of science (Financial Managers, Intellectual Property Managers, ICT Managers) with the critical leadership and management competencies needed to deliver on CSIR's mandate and for succession planning.

To address these objectives in the short term, the CSIR will initiate the following programmes:

- *Accelerated Researcher Development Program*: to address the under-representation of black and female South African researchers in the higher levels of the career ladder
- *International Partnerships*: collaborate with international universities and institutions to leverage resources and ensure development, growth and exposure of our critical employees
- *Partnerships with local universities*: review partnerships with local universities to improve relations and leverage resources

These programmes are geared towards further supporting the growth of our researchers as well as addressing the shift towards higher levels of qualifications for pipeline development.

A.2.2.2 HCD programmes

The following programmes have been successfully contributing to human capital development and will be continued and, where relevant, improved in order to address strategic human capital development objectives.

a. Pipeline Development Programmes

The CSIR funds a number of programmes aimed at developing a large pool of appropriately qualified graduates, such as bursaries, studentships, internships and scholarships programmes. The bursary and studentship programmes have a direct and substantial impact on the CSIR. The CSIR uses these programmes as direct vehicles to support the transformation initiatives towards a demographically diverse and inclusive research base.

The CSIR absorbs a large proportion of graduates from these programmes either as post-graduate students for further study or as staff employed as researchers, engineers, and functional areas such as finance or ICT specialists. The bursary program is a feeder into the MSc level and entry level positions, particularly in the critical and scarce skills areas, with up to 95% of previously funded students taking up various opportunities within the CSIR in the last five years. The bursary program is largely targeted at supporting beneficiaries from quantile one (1) two (2) and three (3) schools as a direct support vehicle to the triple challenges that CSIR aims to address of unemployment, poverty and inequality. The studentship program is whereby students with Honors and Masters qualifications are appointed on fixed term contracts to pursue their Masters and Doctoral degrees respectively. This is to encourage the production of high level skills whilst providing the students with the much needed work readiness skills and experience to allow them to enter the job market. This program is geared towards growing intellectual capital ahead of strategic demand and has afforded the organisation an opportunity to have readily available high level skills. However, the program also contributes highly skilled human capital to the national system of innovation whenever opportunities arise.

b. Career Ladder Frameworks, Reviews and Evaluations

The CSIR introduced a Career Ladder system to guide the career development of research staff in line with the Beyond 60 strategy of 2006. Professional career ladders are used to place employees where there is a natural progression based upon the acquisition of increasing knowledge and skills within a professional area, e.g. researchers (i.e. scientists and engineers). These ladders allow for a dynamic and flexible approach to be followed in recognising and rewarding professionals where the type/level of work performed depends upon individual experience, qualifications, training and competence levels.

The business has conducted an ongoing review of the CSIR Career Ladders to cater for the changes in the strategic priorities of the business over time to ensure that they remain relevant

to encourage the right behaviour in the organisation that helps to achieve the organisation's objectives. The organisation embarked on a multi stakeholder engagement process to put forward the case for consideration, with specific reference to:

The scope of the review entailed the following:

- (a) the Career Ladder processes
- (b) the outputs of the career ladders – are these still valid and relevant, what should be changed and what should be added.
- (c) content of the ladders
- (d) administration of the career ladders
- (e) alignment to individual, CA, and Unit performance objectives
- (f) alignment with HR processes

This process resulted in a recommendation for consolidation of what was initially four career ladders, namely the research career ladder (primarily for research scientists) , the research application and development ladder (for research application and development engineers), the technical career ladder (for technicians), as well as the project management ladder (for project managers) , the outcome of which was the following:

1. The Research Career Ladder and the Research Application and Development Ladder be combined to form a single ladder, the Research Development Ladder, by taking the best input and output factors from each, as well as developing new factors.
2. The Project Management Ladder be migrated into a fixed job system.
3. The Technical Career Ladder be revised with key low-impact and high impact changes that would be phased in.

The factors/criteria for this ladder have been reviewed and re-designed. What is outstanding is consensus on the funding factor and the appropriate weighting of the various factors to ensure consistency. This will be followed by the piloting of the ladder in order to mitigate risk.

The CSIR Career Ladders were reviewed during the 2017/18 financial year, and the revised ladders will be implemented in the 2018/19 financial year. This will provide improved career development opportunities for researchers under the new Research and Development Career Ladder.

c. Accelerated Researcher Development Program (ARDP)

It has been identified that the organisation has a relatively low number of Chief (only 21) and Principal researchers (combined these only represent 7.6% of our SET base). These

levels of researchers are critical in leading our scientific activities (leadership in science). The transformation profile is particularly concerning when analysing the number of Black South Africans, and particularly females at these levels. In addition other factors such as high staff turnover (at senior levels), difficulty in attracting high-profile, high-level researchers and poaching by private sector and systems were identified as challenges. Systems for supporting, retaining and promoting or developing talent at senior and principal researcher levels were also found lacking. In an effort to address the above the ARDP has been developed and piloted.

The objective of the program is to provide targeted support and funding for the accelerated development of promising researchers (at the Senior or Principal Researcher level). The intent is to provide both systemic and resource based support to allow rapid development of their careers.

Dedicated funds will continue to be made available to identified researchers to support their specialisation in particular domains, to leverage additional external funding, to support exposure and collaboration with international researchers, and to procure infrastructure.

In addition the establishment of a formal mentorship program is essential. The focus of this program will include stakeholder engagement, attracting research funding, scientific leadership and domain specific mentorship.

d. Strategic Partnerships for human capital development

The CSIR has existing partnerships with a number of institutions in South Africa and abroad and through which it develops its staff and students. The CSIR is also exploring new partnerships in order to leverage additional capacity for student training abroad, especially in areas where South Africa has limited skills, such as cyber security. The following are CSIR's strategic human capital development partners:

DST: The CSIR is working closely with the DST to forge international partnerships with countries with which South Africa has bilateral agreements. The CSIR also runs a number of DST funded programmes with a strong human capital development mandate. The CSIR remains committed to joint design and development of new human capital development programmes to support the South African government in the development of high-level skills.

South African Universities: The CSIR has existing partnerships with a number of higher education institutions in South Africa and through these, contributes to developing its staff and CSIR sponsored students who form part of its pipeline of researchers. Currently, the CSIR has formal relationships with at least seven South African universities funding over 40 post graduate students in joint 50:50 scholarship programmes with those institutions. In addition to these students, the CSIR funds more than 500 undergraduate and post graduate students who are registered with various SA universities.

International Universities and Research and Technology Organisations: The CSIR is also exploring new international partnerships in order to leverage additional capacity

for student training abroad. The CSIR is developing a number of agreements with international universities to support South African citizens who wish to pursue post graduate studies abroad in areas where South Africa has limited skills and/or supervisory capacity. South Africa's bilateral agreements for science and technology benefit human capital development. The CSIR is also seeking to be part of a network of institutes on the African continent focusing on collaborative initiatives and human capital development.

Sector Education Training Authorities (SETAs): The CSIR runs a number of bursary and internship programmes for various SETAs, helping to give interns work experience in various pilot manufacturing plants and operating units. The growing partnerships with the SETAs are critical to skills development and addressing youth unemployment in the country. A very good example of this is the partnership between the CSIR and the **Media, Information and Communication Technologies (MICT) SETA**, which supports training of 50 CSIR based interns and 50 bursaries annually.

The human capital development plan seeks to help the CSIR address challenges and respond to a changing national landscape for researchers and those in roles in support of SET endeavors. If a need to develop new programmes is identified in the review of the HCD Strategy, such programmes will be implemented subject to availability or reallocation of resources.

A.2.3 SO2: Conduct High-Quality Research to foster Scientific Development

The CSIR conducts directed multi-disciplinary research that contributes to scientific knowledge development which is the key step for innovation and basic component of the economy. As the evidence, the organisation continues to reach targets for key performance indicators relating to scientific development (publications, patents, conference presentations). This is attributable to the SET base's commitment to continuously producing high quality and relevant research outputs. For instance, the CSIR in the past three years has produced 875 publications, and 860 conference papers.

The CSIR has structured its research activities into six **Research Impact Areas (RIA)**, Industry (including manufacturing and mining), Built Environment, Natural Environment, Energy, Health and Safety and Security. There are significant overlaps between some of these interventions (particularly those under the Industry RIA) and SO3: Conduct relevant research to foster industrial development, as the CSIR often prioritises fundamental and applied research activities which aim to solve industrial problems, introduce new technologies and products or improve efficiencies.

Research, Development and Innovation activities within the RIAs are coordinated through the R&D offices and implemented by various operating Units and Centres. In addition the CSIR implements a number of cross-organisational strategic programmes to foster scientific development and will, in the coming year, implement a number of new strategic initiatives.

A.2.3.1 Research Impact Areas

A.2.3.1.1 Industry Research Impact Area

South Africa has recently experienced a decline in industrial activity, and the manufacturing sector has been particularly hard-hit. At a time when manufacturing should be driving development in South Africa, the sector is in a perilous state, with its contribution to GDP dropping from 24% in the early 1980s to less than 13% today.

The IPAP lists the challenges facing the domestic manufacturing sector as increasing global competition, weak demand in key external markets, substantial cost pressures, the unstable supply and high cost of electricity, exchange rate volatility, skills constraints, high administered prices (especially rail freight and port charges for value added products) and industrial action.

IPAP also highlights that South Africa remains mainly a producer and exporter of primary commodities and an importer of value-added manufactured products. South Africa's export sector came under increased pressure during the course of 2014, caused mainly by falling commodity prices, labour unrest and reduced global demand. To the limited extent that domestic value-added exports exist, they are highly concentrated in a few sectors.

Advanced manufacturing (Industry 4.0) has been globally recognised as critically important to reverse de-industrialisation and to create decent, well-paying jobs. Competitive advantage is increasingly dependent on combining new knowledge and improved technologies (the so-called specialised and advanced factors of production) rather than the traditional factors of production like labour, materials and energy.

In this context the CSIR is well-positioned to play a key role in the national effort at reindustrialisation through a range of key capabilities that are aligned to national priorities, ranging from the beneficiation of key strategic minerals of abundance, through to the aerospace and defense sectors.

Selected key interventions at the research and development level are described below:

Mechatronics and Manufacturing

There is limited local development of new products and manufacturing technologies which improve industry competitiveness, particularly in the areas of manufacturing productivity and quality, and mining productivity and safety. Our aim is to develop a suite of advanced mechatronics machines for manufacturing and mining applications, as part of an industrial automation platform. The recent focus has been developing capability in automation technologies related to the fourth industrial revolution and [Product Lifecycle Management \(PLM\)](#).

Mining

The strategic R&D activities within Mining and Mineral Resources area are aligned to the Mining R&D strategy developed by the Mining Phakisa (South African Mining, Extraction, Research, Development and Innovation). Our aim is to contribute to the development of 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. We have co-developed (together with the Chamber of Mines, relevant academia and government departments) a coherent R&D strategy and funding plan for extraction-related research in the mining sector. This has resulted in the (re)establishment of the mining research hub in Johannesburg (The Mining Precinct) and number of research programmes. We will now initiate projects in advanced mineral extraction (including mechanization and narrow seam extraction), mine safety and digital integration. This will be further supported by the development of geophysical tools to assist in delineating the rockmass and reserves ahead of current mining operations.

Research Support for the National Bioeconomy Strategy

The South African Bioeconomy is significantly under developed in comparison to established European and American markets and is increasingly lagging behind development in the similar economies such as the fellow BRICS nations. It is crucial that this sector be developed considering the access to biological resources and biodiversity in South Africa. Along with platforms for SME support and development the CSIR has developed research programmes in synthetic biology, biological production platforms and natural compound chemistry to support technology development. The CSIR provides low-cost and tailored protein expression, protein characterisation and pilot manufacturing services in human and animal health for therapeutic proteins, vaccines and adjuvants. We will also develop cutting edge knowledge based science in gene engineering, cellular biology and pharmaceuticals chemistry that supports the development of innovative products by multinational pharmaceutical companies.

A.2.3.1.2 Built Environment Research Impact Area

Our interventions in this area will focus on service delivery and its associated issues. There are a number of initiatives that deal with the development of policy, but these will be dealt with under the specific intervention areas involved.

The main problems we are attempting to address are:

1. A lack of organisational capacity to support service delivery. This lack of capacity may take various forms, including the absence of co-ordinating or implementing agencies, or the shortage of specific technical or program management skills.
2. The absence of an integrated decision support capability at all levels of government responsible for service delivery. This absence may lead to poor decisions with respect to the planning in service delivery interventions.
3. The poor diffusion/uptake of potential technology-based service-delivery solutions. There are instances where potentially appropriate and effective technical solutions to service delivery problems have been developed but are not being implemented.

There is also a clear need to maintain and upgrade South Africa's existing infrastructure, and to develop the technologies that will form the basis for the infrastructure of the future. South Africa's economic growth and its ability to provide basic services to its people will be fatally undermined if there is no concerted effort to maintain and re-build our transport, water, energy and ICT infrastructure. The CSIR is coordinating two of the SIPs (Higher Education Infrastructure and Expanding access to Communication Technology) and is providing specialist support (including, for example, in the form of environmental impact assessments) to a number of other SIPs.

Our interventions in support of economic and social infrastructure takes are in the form of evidence-based support for the development of national policies and the design of technological solutions. Selected interventions in response to these problems are as follows:

Incubation of national capabilities to support service delivery

By working with national institutions such as [Cooperative Governance and Traditional Affairs \(COGTA\)](#) and MISA, and building on our existing expertise in immovable asset management and our work with specific municipalities, we intend to incubate service delivery capabilities in two domains. Potential intervention areas include health, education and water treatment facilities.

An integrated and multi-sectoral decision support centre

This centre will, in collaboration with universities and developmental agencies, provide decision support services to amongst others government departments, local government, and state-owned companies. The centre will have capabilities that deal with the collection, transmission, collation, storage, and analysis of applicable data sets, as well as the decision support frameworks that transform this data into useful inputs for decision makers. Such a centre will enable a range of actors to make more coherent and better-informed decisions within their domains. This focus area will include work on decision support in environmental systems (the capability for port data analysis and systems dynamics modelling as well as the capability to detect land-usage change) and data science (machine learning research for anomaly detection, predictive policing and social media mining).

The development of Earth observation technologies

In order to protect our natural resources and to ensure environmental sustainability we need to develop the ability to continuously predict, monitor and assess risks to economic infrastructure and resources that are spread over very large areas. We have developed advanced spatial data infrastructure technologies that incorporate open geospatial standards, and with this capability develop integrated large-area information and awareness systems based on processing of diverse satellite and in-situ data. The focus of systems will be in the areas of disaster management, oceans and coastal monitoring, land surface deformation and terrestrial dynamics.

ICT Infrastructure

The national priority with respect to broadband infrastructure is that a seamless information and communications infrastructure will be universally available and accessible at a cost and quality that is at least equal to South Africa's main peers and competitors. There are a number of key national challenges (including the capacity and cost of our networks) that need to be addressed in order to reach the stated objectives of the NDP with regard to communication infrastructure. Our aim is to address the lack of quality data, analysis and tools on South African broadband network infrastructures and spectrum, and to inform the policy, decision-making, design and coordination of broadband development and spectrum usage. In particular we have developed dynamic spectrum assignment and management tools to enable automated spectrum assignment and for increasing the efficient utilisation and management of networks. Next year will see the initial implementation of this technology together with the Department of Telecommunications and Postal Services. Concurrently we are developing advanced networks and services models, including Software Defined Networking and Network Functions Virtualisation solutions to enable low cost implementation and efficient management of shared broadband infrastructure. Finally we are developing tools to collect, store, process, design and analyse data on broadband network infrastructure to enable better planning and monitoring of the extensions of the broadband infrastructure, as well as to lower the cost of provisioning of broadband services.

Urban Modelling

Increasing urbanisation places strain on service provision (e.g. waste, sanitation, healthcare, education, food and safety), infrastructure (e.g. transport and housing) and management of resources. We have developed (and continue to refine and apply) decision and planning support, on city and regional development futures, through advanced spatial analysis and modelling. We are enabling smarter decision making, with a particular focus on Urbanisation. This includes development of a Smart Campus that provides context and situational awareness assistance to decision makers allowing for improved and more informed decisions across organisations; provides automatic control and optimisation of infrastructure and resources, enabling more efficient and optimal usage; and utilise enabling systems that allow decisions to be made quickly while minimising risks and resources. We are further developing integrated end-to-end-logistics architectures and platforms covering multiple sensor modalities, goods, entities, equipment across entire logistical value chains allowing for real time monitoring, timeous interactive management, improved decision making and novel services involving multiple stakeholders. We will demonstrate and test these capabilities on the Scientia campus, using the knowledge generated to enable municipalities and regions to implement smart city technologies.

A.2.3.1.3 Energy Research Impact Area

The global energy markets are currently facing a massive restructuring, a global energy

transition. The two underlying drivers are the finiteness of all fossil resources, which creates price and policy pressure, and the need to reduce greenhouse gas emissions, which creates policy pressure. These drivers lead to two megatrends: energy-efficiency and renewable energies.

The South African energy system today is almost completely self-sufficient. Oil as feedstock to refine liquid fuels and a small amount of gas and liquid fuels is imported, but all other energy is supplied from domestic sources (mainly coal). It is unique to South Africa that large parts of the liquid fuel demand are supplied from coal-to-liquid and gas-to-liquid processes, based on domestic coal, as well as domestic and imported gas as feedstock. The South African energy system is hence not very diversified, with gas and renewables in larger volumes being the missing links in the portfolio.

South Africa today cannot supply sufficient electricity, which is an impediment to social and economic goals. At the same time, the country is one of the largest emitters of greenhouse gases, which is contrary to environmental goals. South Africa thus needs a rapid expansion and transition in the energy sector as a catalyst for economic growth; in a reliable, affordable, sustainable and cleaner manner.

Energy Infrastructure

Our aim is to develop technologies that support the maintenance of our energy infrastructure and to support the development of energy storage systems. These include:

1. A Sulfur Hexafluoride¹ gas leak detection system for use by the power industry in SA.
2. The development of a fully integrated radiometric infra-red and ultra-violet, high definition multi-spectral inspection system with associated image processing and analytics capability.
3. The development of new materials-based technologies for energy storage and conversion systems, and demonstrating and proving such technologies at pilot scale to enable new industrial activity. Specific areas of focus will be fuel cells; metal organic frameworks and scaling up cathode material production.
4. Natural gas – Energy technologies, processes and policies centred on natural gas as an energy source, including gas markets, gas storage and gas-to-power generation.

Renewable Energy

South Africa is one of the least efficient countries worldwide when it comes to converting energy input (primary energy) into economic output (GDP). This is the result of two factors – South Africa's economy was historically built around relatively energy-intensive industries (such as mining or the production of iron and steel), and low electricity and energy prices as

¹Sulfur Hexafluoride (SF6) is a gaseous dielectric for high voltage power applications and has been used extensively in high voltage circuit breakers and other switch gear employed by the power industry.

a result of excess and very cheap primary energy in the form of easy-to-mine coal reserves. This poses a significant threat to the South African economy, as any change in energy prices affects an energy intensive economy much more than an energy efficient one. Our work in this area will focus on demand assessment in end-use sectors; demand-side technologies and demand forecasting (short-term, long-term and spatially).

A.2.3.1.4 Natural Resources Research Impact Area

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 hence to assist government with the formulation of mitigation and adaptation strategies. The CSIR is also supporting the development of a green economy more generally.

Selected key interventions are described below:

Climate Change

In order to mitigate and adapt to climate change we need to predict climate futures at various temporal and spatial scales. We also need to develop applications which define the impact of climate and climate change in selected sectors. We have, since initiating this research area, developed the Variable Resolution Earth System Model for projecting climate futures, developed application models in the fields of agriculture, human health, air quality, and stream-flow / dam-levels and continue to develop the observation platform and basic research to enhance domain expertise in the ocean-atmosphere-terrestrial environments. The high quality outputs generated through this area are being included into global climate monitoring and modelling collaborations. The team will continue to refine the current models to achieve greater levels of resolution to generate more relevant, real time data.

Green Economy Solutions

There is a shortage of effective tools for embedding sustainability into development planning and a need for new knowledge and technologies to unlock the green economy development opportunities evident in the biomass and waste sectors. Our intent is to generate knowledge and create tools to effectively integrate sustainability into development policy, assessment, planning and management for SA's transition to a Green Economy. We have provided new scientific evidence and decision support tools for unlocking green economy growth from the solid waste sector (SASCOST model) which will be formally introduced and rolled out to a number of municipalities in the coming year. We have also developed a forest and waste biomass biorefinery R&D platform developing technologies and directed chemical engineering, chemistry, and biology capabilities enabling green economy development. This will be formally launched in the coming year although technical solutions have already been developed and currently being adopted by industry role players. Work in this area will focus on creation of sustainable SMMEs in Niche biorefinery areas in the short term. We will also continue implementation of the National Waste RDI Roadmap.

Ecosystem Services

The high-level national challenge for South Africa is to protect our natural resources to ensure environmental sustainability and to develop the ability to continuously predict, monitor and assess risks to economic infrastructure and resources that are spread over very large areas. Our aim is to improve the national capability to monitor, evaluate, report and predict over the very wide land and sea surfaces that make up the South African territory. To this end we have and will continue to develop advanced spatial data infrastructure technologies and open geospatial standards to enable integrated large area information and awareness systems based on processing of diverse satellite and in-situ data. These include landcover classification and change detection tools, enhanced disaster management decision making tools, the integrated Oceans and Coasts information and awareness system and an automated land surface deformation monitoring system.

A.2.3.1.5 Safety and Security Research Impact Area

The CSIR interventions in this area focus on supporting the acquisition and integration of technology by our security forces, the development of systems for the effective sharing of information across different components of the security forces, the continuous improvement of South African Air Force air capability, the protection of air and naval assets against guided weapons, the support of specialised, highly-mobile combat ready forces, the development of national surveillance capabilities, and protection against cyber-security threats.

The most significant impact on the CSIR mission in this domain is its changing role in the South African Defence Safety and Security Industry. The CSIR's primary partner has traditionally been the Department of Defence (DoD), but there has been a growth in partnerships with South African Police Service (SAPS) in recent years. Strategic level partnership agreements are in place with the DoD, SAPS, and Department of Telecommunication and Postal Services (DTPS) that provides a strategic framework for engagement and also provides a strong platform ensuring long term sustainability of a relevant technology capability, but a mixture of both R&D and growing operational requirements are emerging. The relationship with Armscor, although not formalised, is continuously being managed with a close working relationship existing with a number of senior managers.

The Defence Review of the Military Strategy of the SANDF emphasises the necessity for a Defence Research and Development capability. The Defence Review, as the core of the National Defence Policy, places important responsibilities and expectations on the CSIR which is considered to be strategically essential for the protection of national interests. These responsibilities also bring with them new opportunities for the CSIR to carry out its broader mandate.

The CSIR is singled out as being the primary provider of SET support in the area of electronics (including radar, electronic warfare, information warfare, command and control), aeronautics, landwards capabilities and special operations.

Selected key interventions are described below:

Holistic and integrated approach to national security

There is a lack of an integrated national level operating concept across different government departments and other stakeholders and role players, for addressing cross-functional and multidisciplinary issues. Our aim is to address safety and security risks by means of a new holistic integrated approach taking into account how economic and social factors influence safety and security. This will create a shared understanding and analysis of the safety and security problem, and develop an integrated national level operating concept across different government departments. We have used a “Whole-of-Society” approach for dealing with complexity which includes the creation of a shared understanding and analysis of the safety and security problem using models, stakeholder engagement and integrating multiple disciplines and organisations.

Security sector capability development

National institutions in the safety and security sector lack full set of capabilities for delivering on their strategic objectives. There are insufficient methodologies for safety and security operational concept definition, capability definition, experimentation, capability development and implementation. There are insufficient methodologies, architecture principles, and architecture frameworks for developing the technology, information and process elements underpinning the organisational capabilities required. Many of these capabilities require complex technology support for establishment and sustainability. We assist national institutions in the safety and security sector with technology and engineering systems support in order to deliver on their strategic objectives

Multi-agency command, coordination, and control

There is a lack of all-inclusive command, coordination and control solutions for multi-agency operations such as border safeguarding, combating rhino poaching, disaster response, major event security and others. This includes interoperability of systems and data, business processes and systems for joint planning, creating shared situational awareness amongst agencies, and multi-agency tasking and control.

We support the development of an all-inclusive command, co-ordination and control solution for multi-agency operations, including the interoperability of systems and data, business processes and systems (such as those developed for the National Parks to combat poaching and those that we will be integrating into SAPS through the next financial year). We develop, design and implement architectures, systems, applications, processes and infrastructures to meet multi-agency Command and Control requirements in partnership with relevant elements in the NSI and the private sector (existing technology suppliers). This includes the development of new technologies (including CMore, Smart operational personal equipment) and the evaluation of existing solutions to solve problems in the domain of inter-departmental and multi-national operations.

National Surveillance and Situational Awareness

There are major deficiencies in the national surveillance capability, and in some cases no existing technology solutions to support the increased ability to detect, track, classify, and identify objects of interest at a distance in different environments. Some of the required capabilities are Maritime Environment Surveillance (Anti-piracy); Environmental Asset Protection (poachers, illegal fishers); Peace support operations (personnel, vehicles, weapons); Border safeguarding and combating crime. With regards Border protection we are at an advanced stage of discussion regarding hosting of the Border Management Agency Centre of Excellence to develop and integrate technologies for efficient border protection and cross-institution cooperation. We also aim to develop improved optical surveillance and radar networks (for border protection, defence, and crime prevention applications).

National Cyber Security Capability

Cyber vulnerabilities exist on a national, institutional, and personal level, while cyber threats are growing in sophistication. These threats must be countered now and in the future, through a range of measures including hardening of critical infrastructure, supporting institutions in hardening their systems and developing mitigation capabilities, and developing a national capability to respond to large scale cyber security incidents. This must facilitate continued operational effectiveness on national and organisational level while under severe cyber-attack. Our work focuses on implementation of the National Cyber Security Policy Framework. Through this we have established a Cyber Security Centre of Innovation to support the exchange of threat information, establishment of cybersecurity skills and the development of innovative cybersecurity solutions. We will also develop the SANDF cyber defence capability that can defend against current and future cyber threats and non-nation threats. We will further develop National Cybercrime Combatting Capability which will include the creation of capabilities for Cybercrime intelligence, the development of tools that can assist with the identification of organised Crime social structures, the development of tools for internet and darknet evidence gathering (surveillance, indexing and big data analysis), development of tools for combatting of child trafficking and pornography, and development and support for the SAPS Cybercrime Centre.

A.2.3.1.6 Health Research Impact Area

The CSIR's work in support of health ranges from technical support to the National Health Insurance initiative (particularly with respect to the security, use and transfer of health-related data), the development of interconnected and inter-operable point-of-care devices (such as Cellnostics or Umbiflow), the use of technology in support of diagnostic functions, the development of vaccines using bio-therapeutic manufacturing methods, and the development of new methods to understand, manage and diagnose disease mechanisms at the cellular and molecular level.

Selected interventions are described below:

E-Health

The development of a standards framework for interoperability of eHealth systems, and the establishment of a national regime for implementation of interoperability standards. This included the establishment of the foundational national infrastructure required for interoperability of eHealth systems (e.g. national patient registration and identification system, national clinical repositories, security and audit services, health information orchestration and exchange). This has, in part, resulted in a seamless, secure and trustworthy integration and exchange of health information/data across devices, systems, components and business processes. We will continue to roll out, maintain, upgrade and enhance the systems implemented in this regard.

Point-of-Care Medical Devices

Develop a portfolio of medical devices, sensors and information systems to provide **Point-of-Care (PoC)** assistance, comprising screening technologies for foetal health and cardiovascular diseases; biosensors; PoC blood screening; medical visualisation and analytical tools, and national medical databases. A special focus will be to implement the Cellnostics business model and investigate the creation of a medical device and diagnostic incubator for industry.

A.2.3.2 Strategic Programmes

A.2.3.2.1 Emerging Research Areas

Emerging Research Areas (ERAs) were defined as new areas of science that the CSIR wishes to pursue. Such areas could be unique to the local circumstances or could be an investment in an area that is notably successful internationally and needs to be established for local competitiveness. The CSIR is currently reviewing the ERA program with respect to the classification of these programmes as “emerging” with the intent to reposition the platforms towards application of the developed capabilities. This could see the platforms exiting the ERA program in favour of stand-alone centres or competency areas within relevant operating Units. With the potential exit of the current platforms (from the ERA program), we will start exploring the potential for a new ERA within the next financial year. This could include an ERA, for example, for developing capabilities technology development related to the Fourth Industrial Revolution.

The CSIR currently has three Emerging Research areas:

1. **National Centre for Nanostructured Materials** – cutting edge research in nanotechnology, human capacity development and infrastructure development to enable nanotechnology research in the country. The ERA has been successful in all these aspects and gone on to further develop capability for increasing local industry competitiveness both through development of local intellectual property in the field and infrastructure to prove concepts at industrial scale.

2. **Synthetic Biology** – the ERA aimed to develop infrastructure, produce high impact outputs (publications, patents), train high level students (PhD, MSc) and build national and international networks in the synthetic biology field. The ERA has produced a number of publications, graduates and 2 spin-off companies (Persomics, Resyn). Components of the ERA have now either been absorbed into the Biosciences Unit, spun out as a start-up company or evolved into follow on research initiative (BTRI).
3. **Mobile and Intelligent Autonomous Systems (MIAS)** – The MIAS ERA was established to build capability in robotics. It arose from recognition of the need to establish critical mass in this emerging research area. MIAS has focused on field robotics – robotics systems for relatively unconstrained environment, with the aim of developing capability and systems which can be employed in “real-world” environments. The ERA can thereby contribute to improving quality of life and to achieving economic imperatives such as improved industrial competitiveness and productivity.

A.2.3.2.2 Thematic Program The principal goals of the thematic program are to:

1. Support the development of new areas of science, engineering and technology (SET) and enhance existing SET platforms
2. Respond to emerging (and potentially higher-risk) SET trends
3. Develop and consolidate areas of set excellence within the CSIR that will support the research activities of the whole organisation
4. Encourage trans-, inter and multidisciplinary research projects, with preference given to proposals that show clear mechanisms for the integration of disciplines and work between various units and centres at the CSIR
5. Attract new knowledge experts into our structures
6. Support the research output of the CSIR and the transfer of technologies to clients and partners

The program focuses on two general types of research activities:

Focussed Thematic Projects support the development of integrated CSIR responses to cross cutting questions, to contribute to the incubation of ideas that will potentially become longer-term interventions, or to complete an intervention that does not require investment over a longer period. Projects supported under this area are expected to last for approximately 12 months. In the past support from this fund has included the following projects:

- Road mapping the R&D space in Smart Infrastructure;
- Developing an integrated CSIR Health Strategy;

- Developing a strategy for strengthening and integrating the advanced manufacturing capabilities in the CSIR;
- User-driven frameworks for remote sensing applications in water resources management;
- A Cyber Security Roadmap;
- A study into approaches for improving industry product development capabilities; and
- A Novel Spectral Camera for Fire Detection from a NanoSat.

Longer Term Investigations are generally sector specific and are completed over a period of three years. These projects have clear technical outputs (publications, conference presentations, technology demonstrators, patents, students, etc). The investigation should also have a sense of what the long term impact will be, and what immediate actions will be necessary to support that impact. The thematic projects currently supported include:

- Development of the first African-based Earth System Model and its projections of change over Africa and the Southern Ocean;
- Remote sensing based spatial decision-support solutions.
- Dealing with the rising complexity of security problems: Holistic and integrated approaches;
- Printed power sources and smart electrochemical sensors;
- Settlement design guidelines for climate change adaptation in South Africa;
- Development of high resolution predictive and observational capabilities for South African marine domains;
- Development of novel formulations platform for veterinary biopharmaceuticals;
- Development of Miniaturised Compound Microarray Technology for Therapeutic and Diagnostic Screening Applications.

A.2.3.3 Emerging Strategic Initiatives

A.2.3.3.1 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 Institute for Civil Engineers leading to major losses and water quality problems. The CSIR aims to develop an Integrated Water Research Centre with the aim to (non-exhaustive list, still to be fully conceptualized):

- Develop coherent water resource decision-support frameworks, and address gaps in assessments, technologies, tools and techniques. These include integrated hydro-geological decision-support tools and water risk assessment measures to promote and improve the health of freshwater ecosystems.
- Develop a portfolio of technology solutions, for industry and the public sector, 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.

A.2.3.4 Ring-Fenced DST Initiatives

A.2.3.4.1 Implementing the national ICT Roadmap

Ringfenced Parliamentary Grant is used across our key focus areas and ICT RDI interventions. The investment is aligned with the ICT RDI Roadmap and utilised to ensure CSIR contribution to RDI that brings the country closer to the goals of the ICT RDI Roadmap. Thus we have major initiatives in (all link to the Roadmap Clusters and progression paths):

1) **Digitilisation for Government.** CSIR will pursue three key strategic activities: e-Government will focus on ICT solutions for (i) citizen identification and authentication, (ii) backend integration of Government systems to improve coordination and synchronisation across Government Departments, and (iii) improved citizen engagement and accessible service delivery; eHealth which will focus on addressing the problem of fragmentation of health information systems by implementing (in partnership with the Department of Health) a national regime for standards-based health systems interoperability; and Oceans and Coasts Monitoring, which is an Advanced Spatial Data Information system, which integrates seven diverse but interoperable sSmart Spatial Decision Support Tools (DeSTs).

2) **Digitalisation of Industry.** Development of technology building blocks and proof of concepts of end-to-end solutions in a few specific industrial sectors. The proof of concepts will show the benefits of modernised industrial processes. The outcomes will yield 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). Examples include Real time information Management system for mines and Cyberphysical Inofrmation of Things (IoT) systems in manufacturing

3) **ICT Sector Growth and Transformation.** Information communication infrastructure is not evenly distributed across the country, cost of access to information communications services

is too high for majority of citizens and there is low availability of local online multimedia content and low economic benefits from such, especially by the youth. A fundamental challenge that has to be resolved in order to unlock competition and innovation and thus enable new business models is to enable flexible management of and access to radio frequency spectrum. A related challenge is the available of low cost and flexible network and radio equipment and associated infrastructure deployment models to support emerging business models. The CSIR is addressing this through broadband modelling for SA, implementing dynamic spectrum access for terrestrial mobile broadband and developing advance sensor networks, etc.

4) **Information Security.** The field of information security is one of the areas that experience a discontinuity between local academic research and adopted solutions in industry. Currently, local and international companies serve as a distribution channel for imported solutions that in some instances are not tailored to local conditions. These imported technologies, processes and skills are however not always applicable to local challenges in South Africa and often cannot be locally supported. (e.g. failure of fingerprint access control in the mining and construction sectors due to the non-legibility of chapped fingerprints caused by manual labour). The CSIR addresses the need for tailored solutions to local conditions by developing fundamental expertise in information security technologies within South Africa.

A.2.3.4.2 National Laser Centre (NLC)

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

1. Additive Manufacturing – Develop and transfer novel technologies to advance the competitiveness of South African manufacturing industry through efficient final part production, and superior manufacturing system performance.
2. Laser Materials Processing – Develop and transfer manufacturing processes to reduce operational costs and improve efficiencies for industries of Manufacturing, Transport and Power Generation through the improvement of material properties of structural or functional equipment, or the material processing of raw material or production components in industrial processes.
3. Health Technology – Develop and transfer PoC diagnostic assays for devices which are Affordable, Sensitive, Specific, User-friendly, Robust, Equipment free, Deliverable to users (ASSURED).
4. Enterprise Creation and Development – For the Photonic Prototyping Facility to provide 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.

A.2.3.4.3 Rental Pool Programme and African Laser Centre (ALC)

NLC, as a knowledge intensive technology centre specialising in laser technology and its applications seeks to grow laser science in the country thereby make a contribution to propel South Africa along a path towards a knowledge based economy. Our national programmes portfolio of programmes is designed to:

- Support laser-based research by making available equipment to researchers at South African universities;
- Support research collaborations between South African and African researchers under the auspices of the **ALC** Program;
- Support Human Capital Development within the context of the rental pool program, and directly supporting HCD and training programmes to support the objectives of the **ALC**;
- Encouraging an increased and concerted drive to push R&D outputs towards technology transfer.

There is generally a shortage of skills in science, engineering and technology (SET) in South Africa as well as in Africa. Further, the current scientific and engineering community is ageing and continued emphasize is required to transform the research community in South Africa. Therefore there is a strong need for South Africa to make significant investments in human capital development, taking into account the current decline of interest in science as a career for scholars. The NLC's Rental Pool program and **ALC** programmes are principally directed programmes that seeks to train a corps of top laser researchers with postgraduate qualifications as key drivers. These programmes directly supports South Africa's international research and innovation competitiveness while responding to social and economic challenges of the country. 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.

A.2.3.4.4 National Integrated Cyberinfrastructure System (NICIS)

This is a national initiative of the DST implemented by the CSIR. NICIS will promote scientific and industrial development through the provision of:

- High-performance computing capability through the Centre for High Performance Computing (CHPC);
- High speed network capacity through the South African Research Network (SANReN); and

- A national research data infrastructure that implements services that enable sound data management practices and support efficient data-driven scientific and engineering discoveries through the Data Intensive Research Initiative of South Africa (DIRISA).

These will be integrated hierarchically into globally connected systems and into local system systems, providing seamless access for the research and teaching community. South Africa needs a strong and effective system of science, technology and innovation to be internationally competitive and relevant. The core sites of research, i.e. universities, industrial laboratories, science councils and other sites of higher education, research and innovation need to interact with each other and with the world of science without being disadvantaged by their geography. To date NICIS has been incubated within the CSIR Meraka Institute. As of 1 April 2018 NICIS will be a stand-alone entity within CSIR.

A.2.4 SO3: Conduct Relevant Research to foster Industrial Development

Since 2006, with the development and implementation of the CSIR Beyond 60 Strategy, the organisation has predominantly focused on the development of scientific capability and associated infrastructure and human capital. While this strategy has been successful in its objectives (evident by the steep rise in accredited publication and the increase in SET staff over that period), our ability to foster industrial development, as per our mandate, has been eroded. This has been partially corrected through the CSIR Growth and Impact Strategy (2011). Over the past 5 years a number of programmes have been initiated to re-establish the CSIR capabilities for fostering industrial development including the Flagship Program, the Industrial Innovation Program and more recently Project Synapse (all discussed further in this section). Equally, a number of Research, Development and Innovation initiatives aimed specifically at Industrial support have been developed which will be further discussed below.

A.2.4.1 Research Impact Areas

A.2.4.1.1 Industry Research Impact Area

Titanium Beneficiation

A complete beneficiation value chain for the abundant Titanium bearing minerals mined in SA is lacking. There are clear benefits to developing and commercialising a primary Ti metal production process as well as downstream Ti processing technologies for the production of various Ti products. Our aim is to develop key technology building blocks to beneficiate Ti metal with the focus on the direct reduction of $TiCl_4$ to Ti powder and developing technologies to produce high value Ti products for stimulating a local downstream manufacturing industry. In the 2017/18 financial year we successfully demonstrated the pilot-scale manufacture of Ti products and will now move on to the development the technology to commercial scale. Concurrently we will develop commercially relevant prototypes, particularly through additive manufacturing technologies to demonstrate the potential value addition industries that will extend the current local titanium value chain.

Additive Manufacturing

Additive manufacturing is a key component of the new industrial paradigm. The CSIR has led the application of lasers in South African industry and is partnering with industry to develop novel additive manufacturing technologies, particularly the use of high-power lasers for the deposition of Titanium and steel alloys. Our aim is to develop a platform for additive manufacturing of aerospace structural components using our world-leading technology. This will provide an opportunity for South Africa to benefit from its substantial Titanium reserves and to create a significant export capability and provide global competitiveness. The aeroswift project (an industrial scale additive manufacturing platform) has progressed to the stage of producing its first flown parts for the aerospace industry. In the coming years we will further demonstrate and test the capabilities of the platform as well as develop associated technologies with respect to high-powered lasers, laser welding technologies with unique metals and metal alloys, post production technologies and novel build geometries.

Enterprise creation and development

There is a lack of credible expertise to develop and implement technology-based economic development strategies, assess and package economic development opportunities, and to create and develop technology-based enterprises. Our aim is to assist local and provincial governments with the development and implementation of sector and local economic development strategies, with the creation of enterprises and with the transfer of technology. This will include the design and establishment of enterprise support programmes such as incubators and supplier development programmes, and the capacitation of industrial parks and estates. This has been a particular focus of the Industry Innovation Program (IIP) and Enterprise Creation for Development (ECD). Over the past 2 years we have launched the Nanomaterials Industry Development Facility and the Biomanufacturing Facility which in combination have supported 25 SMMEs to gain market entry and realized the entry of over 60 new technology products into the South African market. Moving forward we will launch the Photonics Prototyping Facility and the Biorefinery facility in the next year under the same model. We will also continue to support local and provincial government as well as rural communities to identify and implement new technologies through the ECD program.

Technology Localisation

The local manufacturing industry can benefit significantly from localisation of established and proven technologies (as opposed to lengthy redevelopment). Local industry however struggles to identify, source and implement relevant technologies to improve productivity and competitiveness. Our aim is to develop and implement programmes to facilitate and stimulate enterprise development and growth in support of technology localisation. This includes programmes such as the Technology Localisation Implementation Unit (TLIU), and the National Foundries Technology Initiative (NFTN). Through these programmes we have assisted 80 firms so far and will target a further 65 in the next financial year.

Digital Economy and ICT for Industrialisation

The core of the 4th industrial revolution is increased digitalisation and digital integration of manufacturing processes and digital revolutions within the service industry. We need to utilise our IT technologies and infrastructure to create economic opportunities in manufacturing, in wireless applications and the commercialisation of software technologies. This area focusses on building the intelligence and communication capabilities in local products/equipment (e.g. locomotive, mining equipment) that will allow for greater performance (e.g. adaptability, reliability, predictability, safety). We also focus on the development of platforms for creating opportunities for the youth and new market entrants as well as utilisation of unused broadband spectrum for economic development. This will enable the greater participation of industry with local content and products to increase productivity and competitiveness leading to increased exports or import substitution.

Laser-based Engineering

There are a number of gaps in the South African market for laser-based engineering product in that there is no South African developed high-power laser system and sources for laser-based engineering and manufacturing (cladding, joining, cutting and laser shock peening). The current commercial laser-based engineering systems are not designed and optimised for the above processes and there is a lack of South African laser surface engineering, laser joining and laser refurbishment technologies to repair high-value components for SOEs.

In response the CSIR has developed optical technologies and lasers in close cooperation with users of laser-based engineering. These include modifying existing high-power lasers using existing CSIR know-how and patents. We have developed technologies towards a reduction in operational costs for SOEs in the manufacturing, transport and power generation. Using this base we will continue to support local industry with laser-based engineering. In the coming year the developed capability will form the basis of a new service entity (CSIR spin-out) while the CSIR will continue to develop novel laser engineering applications.

Resource Efficiency – National Cleaner Production Centre-South Africa

The South African manufacturing sector has traditionally been resource-intensive in nature. With limited water resources, finite natural resources and the cost of energy, this sector needs to adapt manufacturing practices to be more resource efficient to remain competitive. The NCPC-SA promotes the efficient utilisation of resources through the provision of relevant assessments (water, electricity, resource utilisation and waste production), development of intervention plans and training programmes for industry. The NCPC has developed efficient programmes for addressing electricity utilisation and minimizing waste production. Moving forward the centre will add water utilisation assessments and intervention plans to their suite of offerings.

A.2.4.1.2 Built Environment Research Impact Area

Economic and Social Infrastructure

There is a clear need to maintain and upgrade South Africa's existing infrastructure, and to develop the technologies that will form the basis for the infrastructure of the future. South Africa's economic growth and its ability to provide basic services to its people will be fatally undermined if there is no concerted effort to maintain and re-build our transport, water, energy and ICT infrastructure. The CSIR is coordinating two of the SIPs (Higher Education Infrastructure and Expanding access to Communication Technology) and is providing specialist support (including, for example, in the form of environmental impact assessments) to a number of other SIPs. Our interventions in support of economic and social infrastructure takes two forms the development of policies and the design of technological solutions.

Transport Infrastructure

The transport infrastructure and operations system is a critical component of SA's socio-economic activity and also provides significant, direct benefit to communities through improved access and mobility. The national problem is sub-optimal performance of the transport system, structurally as well as operationally, due to the deterioration of road and rail infrastructure and systems; a lack of expertise in construction, maintenance and management techniques for roads; a sub-optimal public transport system and sub-optimal rural access road infrastructure. Our aim is to develop guidelines for the design and management of low-volume access roads; test the use of roller compacted concrete and ultra-thin reinforced concrete surfacing for roads.

Coastal Infrastructure

A number of ports are not performing optimally in terms of structure as well as functionally, leading to increased costs, delays and decreased safety. Our aim is to use the coastal modelling platform to improve the design, operation and management of all our ports. Progress has been made in this area and we will compliment this research in the coming year with advanced modelling and digital integration of a variety of sensors and technologies for efficient and smart port operations (aiming at partial autonomous operations).

A.2.4.1.3 Energy Research Impact Area

Development of an Energy Industry

Analysis of the energy industry requires tools that will enhance decision making in industrial and SMME development in the energy sector. Currently decisions on industrial development are made with minimal scientific and analytical input. Therefore there is room and opportunity for developing analytical tools for industrial value chain development to be used by research institutions and government to inform policy decisions on industrial development in the sector. The CSIR has established an Energy research centre which is now fully operational. We

have begun to develop analytical tools for industrial development and applied science-based tools for analysis of industrial development scenarios and policy analysis in the energy sector. Additional research will focus on facilitating strategic dialogue on industrialisation in the Energy Sector in South Africa through developing position papers and provide advice at national level. Econometric data on the developments in Energy Industries will be developed and maintained. Industry Business Cases research will cover the entire value chain of the energy sector from technology components to project development. Additionally we will continue to convert the CSIR to an energy autonomous campus which will serve as a research facility to fully understand the intricacies of grid supply and demand as well switching technologies for increased incorporation of renewable energy production into the South African power grid. A final component of the Energy Centre research focus is the identification and/or development of suitable technologies across the renewable energy value chain.

A.2.4.1.4 Natural Resources Research Impact Area

Green Economy Solutions

There is a shortage of effective tools for embedding sustainability into development planning and a need for new knowledge and technologies to unlock the green economy development opportunities evident in the biomass and waste sectors. Our intent is to generate knowledge and create tools to effectively integrate sustainability into development policy, assessment, planning and management for SA's transition to a Green Economy. We have provided new scientific evidence and decision support tools for unlocking green economy growth from the solid waste sector (SASCOST model) which will be formally introduced and rolled out to a number of municipalities in the coming year. We have also developed a forest and waste biomass biorefinery R&D platform developing technologies and directed chemical engineering, chemistry, and biology capabilities enabling green economy development. This will be formally launched in the coming year although technical solutions have already been developed and currently being adopted by industry role players. Work in this area will focus on creation of sustainable SMMEs in niche biorefinery areas in the short term. We will also continue implementation of the National Waste RDI Roadmap.

A.2.4.1.5 Health Research Impact Area

Pharmaceutical and medical device manufacturing

The CSIR has focussed efforts for improving health outcomes towards improving service delivery within local and national health departments and, particularly, at clinic level. In line with amplifying the industrial support component of the CSIR mandate we have identified 2 areas to support the local health industry. The first intervention in the next year is the initiation of a national pharmaceutical manufacturing support initiative to assist in the establishment of new pharmaceutical manufacturing entities (see point 5 under section A2.4.3.2). Secondly we

have begun to investigate the creation of a medical device and diagnostic incubator. This aims to assist local manufacture of medical devices with respect to manufacturability and adhering to local and international standards.

A.2.4.2 Strategic Programmes

These programmes are indicative of CSIR efforts in supporting industrial development through science and technology. However, the CSIR intends to intensify to higher levels the Research, Development and Innovation efforts that will foster industrial development in order to meet the national imperatives of shifting to a knowledge-intensive economy and to address the triple challenges of unemployment, poverty and inequality.

A.2.4.2.1 Industry Innovation Program (IIP)

The CSIR, in the past 5 years, has particularly established Industry Innovation Program with the objectives of enhancing industry competitiveness and creating jobs. The program is characterised by addressing the real industry challenges that include quality of the product, escalating cost of manufacturing, imports-exports deficit, skills shortage in key sectors, and lack of innovative products for new markets. The program allows for the implementation of high technological innovations to stimulate economic development. Activities within the program include providing access to large scale (prototyping and pre-commercial manufacturing) infrastructure, equipment, expertise and access to business and technical networks. RD&I activities range from laboratory scale validation through to technology prototyping and pilot manufacturing, through the following sub-programmes:

- **Photonics Prototyping Facility (PPF)** – hosted at the CSIR's National Laser Centre (NLC), provides an environment in which the Photonics industry and research community can productise their technologies to a point of market-readiness.
- **BIDC** – a world-class facility established to translate biomanufacturing concepts and technologies into market-ready products and services.
- **Biorefinery Industry Development Facility** – aims to reduce the barriers and risks for existing and new industry players who are developing, testing and adapting biorefinery technologies to South African biomass sources.
- **Nanomaterials Industrial Development Facility (NIDF)** – established with the aim of making an impact through transfer of nano-based technologies to industry. The facility comprises the basic infrastructure such as buildings and equipment for the support of the nano-materials, plastics and cosmetics industries as well as the expertise required for its operation
- **Nano-micro Device Manufacturing Facility (NMDMF)** – concerns the combination of nano-materials such as functional nanoparticles and polymer nanocomposites with micro-

manufacturing technologies such as the fabrication of micro-chips, electronics, micro-channelling of fluids and light emitters, in processes such as printing, embossing and templating.

The program's highlights include: 60 innovation products transferred into the market, 25 SMMEs supported, 113 interns supported, and 182 jobs created. It is envisaged that the program will gain momentum in this coming financial year with significant interest shown from local industries and local subsidiaries of multinational companies to participate in the program.

A.2.4.2.2 Flagship Program

Flagships are characterised by large impact-driven complementary projects that are at the development and implementation stages focussing on outputs generated over time from R&D activities. The integration of these projects creates a distinctive advantage. Flagships have clear, specific, measurable, achievable, time-bound objectives which are directed at specific needs of a particular stakeholder. Primarily, the outcome of the flagships is the adoption of the solutions by a particular stakeholder (end-user). The outputs of the flagship program include developed local capacity, infrastructure utilisation, patents and know-how, technology packages (pre-commercialisation validated data package), advanced technologies as well as differentiated services. Over the past 4 years the CSIR has implemented and two Flagship projects:

The Safety and Security Flagship seeks to position the CSIR as a SET partner for key safety and security stakeholders such as the South African Police Service and the South African National Parks Board by integrating the CSIR's cross-functional research and development capabilities with the objective of improving their crime-prevention capacities. To date the team have developed a pilot integrated command and control operations centre and gone on to demonstrate this capability for SAPS (Garsfontein community policing forum) and have developed and transferred this capability for SANParks for the prevention of rhino poaching.

The Health Flagship was aimed at demonstrating the implementation of a community orientated antenatal care package at the primary health-care level. The flagship helped establish CSIR as a technology partner to the National Health system. The team implemented a number of technologies, including a point-of-care diagnostic tool (operable by clinic practitioners in rural clinics) for the detection of foetal defects. The technology, through extensive clinical validation, has shown to be effective in improved detection of potential foetal abnormalities while decreasing the number of unnecessary patient referrals. The implementation of various technology components are continuing in collaboration with the National Department of Health and the Medical Research Council.

New Flagship projects will be developed in the coming year in line with focus areas identified through Project Synapse.

A.2.4.3 Emerging Strategic initiatives: Project Synapse

The CSIR invested significantly towards the development of a new organisational strategy that aims to amplify the organisation's focus on industrial development, building on the strength of its science, engineering and technology base. This approach is informed by the mandate, specifically section 4, which specifically 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
- Fostering and training of manpower.

In developing the strategy, the CSIR undertook a rigorous analysis of its external and internal context. The external context included the global socio-economic and technological trends, including advances in technology and the frontier sciences. Models from countries that are leading the digital revolution such as Platform Industrie 4.0 and Labs Network 4.0 in Germany (Industrie 4.0), the Industrial Internet Consortium and the Smart Manufacturing Consortium in the USA, UK Catapults and the Australian Industry 4.0 Test Beds were also examined, and learning from these and other countries will be used to refine our programmes. A thorough analysis of South Africa's socio-economic challenges in the context of the region and the world was undertaken, and the triple challenges of poverty, inequality and unemployment were prioritised in selecting the suite of programmes that the CSIR will focus on to make South Africa economically competitive. An analysis of the internal operating environment focused on the organisation's business model, architecture, business systems and processes, and the prevailing culture and values with a view to establish what is working well, what needs to be amplified and/or improved and what should be done away with outright. The ultimate goal of the internal analysis was to determine how best the CSIR can capitalise on its multidisciplinary capabilities to engage industry and other stakeholders on high impact initiatives.

It is expected that the strategy and implementation plan would be concluded by the end of the 4th quarter of 2017/18. There already is an emerging suite of priority focus areas at different levels of clarity. In addition to the programmatic focus areas, analysis of the internal operating environment revealed areas of quick wins that would improve organisational efficiency, among other things. The CSIR will, however, commit to specific activities in the 2018/19 Shareholder's Compact, which will be further refined in the 2018/19 financial year. These activities associated with the strategy refinement will include (i) establishing global buy-in of the initiatives defined in the identified strategy by key stakeholders in the NSI,

notably policy makers, industry players, funders, innovation and skills development partners; (ii) mobilising partners and funding around the programmes identified to create appropriate innovation ecosystem around each initiative to increase chances of success (iii) establishing the capability within the CSIR to role out of the strategy; (iv) reviewing and defining the CSIR's new KPIs for the CSIR in keeping with the new strategy; and (v) pursuing a change management strategy within the CSIR and in the NSI.

A.2.4.3.1 Programme Focus

The approach adopted in defining areas of intervention for the CSIR is to develop industry-facing translational research programmes to bridge the gap between research, development and industrial application at pace and scale. This approach responds directly to the lack of large scale industrial research and development infrastructure in the country, and the dti priorities of infrastructure-driven industrialisation with public infrastructure programmes driving stronger support for local manufacturing, advanced manufacturing with primary focus on sectors where South Africa can compete on global markets, and programmes that leverage South Africa's resource advantage. These initiatives also present a unique approach for the CSIR and its partners in the innovation ecosystems created around each programme to assist South African companies to adopt, catch up and excel in the implementation of Industry 4.0 technologies to revolutionise manufacturing and service delivery.

The CSIR strategic programmes will aim to improve the performance of the South African economy by focusing on improving that of small and medium enterprises (SMMEs) with a view to strengthen supply chains and improve competitiveness in key economic sectors. The objective is to enhance their processes, specifically quality (of production and products), efficiency (cost and resources), speed and flexibility, as well as to modernise manufacturing in line with the Industry 4.0 technologies that are profoundly shaping how companies and countries compete now and in the foreseeable future. The interventions are being defined jointly with industry and policy stakeholders and are directed at specific competitiveness bottlenecks in the sector; i.e. the CSIR would like to jointly develop industry-facing infrastructure as strategic assets to the sector.

To be successful, the initiatives must attain national level programme status; with the support of the industry (private and public) players in question, and policy makers and development funding institutions such as DST, the dti, TIA, IDC, DBSA and innovation partners such as universities and other research institutions locally and abroad. The rationale for this approach is that all role players in the system would be required for the programmes to achieve the desired impact. In addition, the CSIR on its own will never have all the capabilities needed to deliver on all the requirements for the sector; industry will need to be imbedded into the programmes for these to address sectoral challenges. The support of key departments will be required to put in place the relevant policy instruments/adjustments and to mobilise resources. The CSIR also appreciates that different business models may be required; the contract R&D model may not work well for such initiatives as multiple stakeholders have to invest in different

ways for the programme to work.

Critically important is that the interventions to be implemented should create opportunities for:

- Creating an Industry 4.0 show case (Internet of Things [IoT], cloud computing and big data analysis underpinning competitive manufacturing platforms and support services, new technologies, new applications, new products and services platforms);
- Support to existing and new industries, and fostering new models of working with industry and R,D&I partners;
- Fast-tracking development of functional solutions and commercialisation of technologies;
- Creation of the industry like environments for workforce transformation (skills, diversity), notably artisans;
- Technological and business model innovation; research and development; and
- Provision of support infrastructure for regulatory/standards and policy development.

Five cross-cutting thematic areas will apply to all the manufacturing-related initiatives, notably product innovation (includes life-cycle management approach to product design); manufacturing process (e.g. forming, joining, machining technologies); manufacturing automation (includes precision measurement and automation); manufacturing systems (includes planning, manufacturing execution and control, operations management etc.) and business model innovation.

A.2.4.3.2 Emerging Programmes

1. Industry 4.0 Capability Development

Critical to the Project Synapse strategic intent is the development of cutting- edge capabilities within the CSIR, and its innovation ecosystem partners in the national system of innovation (NSI), notably SMMEs, to facilitate competitive manufacturing service delivery. The CSIR will thus strengthen and nurture its emerging competences in Industry 4.0-related capabilities. Digital technologies will underpin the current and new industry-facing translational research platforms that are under development. Such technologies will include applications of information and communication technologies, in particular the Internet of Things (IoT), big data analytics, and cloud computing will be harnessed to enable novel manufacturing and service delivery processes, as well as new business model innovation. The CSIR will strive to embed some of the applicable technologies to its own organisational processes as a way of developing a deeper understanding of the concept of the digital enterprise.

The technologies that the CSIR will develop and nurture in its current and proposed future programmes will thus include internet of thing (IoT), big data analytics, cloud computing, robotics, artificial intelligence, cyber physical systems, and machine learning,

over and above its existing capabilities in advanced manufacturing. The CSIR will also strengthen and expand the roll-out of PLM internally and to its industry partners.

2. The Engineered Assembled Products Platform: Participating in Global value chains

This high value manufacturing support initiative focuses on those sectors with ability and absorptive capacity to capture a share of the global high value activity. South Africa has demonstrated excellence in the aerospace, automotive, capital equipment, electro-technical and defence industries, where we already participate in high value global value chains. In aerospace, the competitiveness issues include the need for design and certification capabilities for high value complex systems, structures and full products. From a technological perspective, the automotive sector requires assembly of kits, production parts and sub-assemblies that require automation, advanced manufacturing (precision engineering metallurgy, quality control systems) for Tiers 1 and higher, light weighting, readiness for electric vehicles revolution and technology localisation support. Longer-term requirements will also include readiness for a hydrogen economy. The capital equipment Original Equipment Manufacturers (OEMs) in South Africa require the transition from mechanical engineering to mechatronics and intelligent systems. The electro-technical sector has a need for expanded research and development, design capabilities and intelligent technologies and systems – some of the excellent pockets of local technology development and research are being acquired by foreign companies. The defence industries are a significant source of design manufacturing and assembly of complex systems that could benefit other sectors in the cluster, and because defence R&D expenditure is declining, the sector could benefit from R&D expenditure associated with other clusters.

Irrespective of the challenges, these sectors are already highly innovative, and have the ability and absorptive capacity to capture a share of the global high value activity, and advances in these sectors will have spill-over effects in other sectors. The strategy here is to expand the volume and value of exports, and to develop world-class supply chains to support the OEMs in these spaces. The engineered assembled products platform will support Tier 1 and higher level suppliers with various capabilities in product design, manufacturing process, manufacturing execution and advanced manufacturing techniques, precision engineering underpinned by artificial intelligence and digitalisation and other technologies. The intent is to develop vibrant supply chains with cutting-edge capabilities, and to develop capabilities to absorb and diffuse inbound technologies. This is considered a primary platform for learning of and demonstrating Industry 4.0 technologies and processes, including internet of thing (IoT), big data analytics, cloud computing, robotics, artificial intelligence, cyber physical systems, machine learning, 3D visualisation, 3D printing and other advanced manufacturing techniques already in our arsenal.

3. Advanced Material Platform: Converting the country's resource advantage to a materials advantage

The focus of this particular platform would be to develop advanced materials required by the automotive, aerospace, defence industries and for other high value applications, and is intricately linked to the assembled products engineering platform. The idea is to focus on the specified needs of the various sectors, and to respond by developing materials to meet such specifications. The CSIR will adopt a concurrent engineering digital manufacturing approach to advanced material development using integrated, cyber-enabled system (3D-visualisation, simulations, analytics and e-collaboration tools) to simultaneously create product and manufacturing processes. Such an approach will allow the CSIR in partnership with innovation institutions and enterprises in South Africa to look for functional solutions, and is predicated on the CSIR strategically positioning itself with players in the supply chain in the iterative development of materials with the desired properties for industry. Such positioning will enable the ability to ascertain demand in order to perform industry relevant innovation, facilitate the development of functional solutions by able to iteratively work closely with players in industry in system level design, optimisation and testing, and will allow industry players and ultimately South Africa to capture value. Value capture in this instance is associated with technical and commercial development activities reinforcing each other, pursuit of new business models and creation of networks where requisite capabilities can be acquired or developed. The CSIR already has some critical materials programmes such as the titanium and aluminium beneficiation and the bio- and nano-composite, 3D printing and other advanced manufacturing techniques that will form a strong basis for this programme. The diverse natural resource endowment of the country presents a rich feedstock matrix ranging from oil and gas, and minerals as well as forestry, agricultural, industrial and domestic waste.

The capabilities to be developed will focus on fibre and composite technologies, metallurgy, high performance machining, multiple chemistries and chemical modifications, applied physics, advanced materials science and manufacturing.

4. The Bioprocess Hub: Harnessing advances in technology to support a fledgling industrial biotech industry

The bioprocess hub will harness the advances made in biotechnology to enhance the performance of the bio-industry and chemicals and materials sector. The vision is to develop high value chemicals and materials through combined bio- and chemical conversions of biological and petrochemical feedstocks to generate products that have higher added value than either biofuels or bioenergy. The initiative will exploit diversified feedstocks for the chemicals manufacturing industries, address the finite nature of the petroleum resource and reduce the costs of complex chemical processes in the production of high value chemicals from petroleum. A key difference between this platform and others in our emerging portfolio, notable the Advanced Materials initiative

is the outlook while there are technologies that can be readily harnessed for use by industry, there is immediate scope for research into novel products and processes.

The aim is to create new capabilities in the country to reduce the costs of value addition to some petrochemical-based substrates; to make bio-based products competitive with petrochemicals; and address reliability issues of bio-based feedstocks that are currently not reliable, limiting the scale of commercial processes. Waste regulation could boost the opportunity to promote agriculture, forestry and domestic waste through biorefineries (circular economy), and it will help us to reach a target of zero waste.

Technology development will focus on approaches such as converting low value C1 compounds (methanol) and greenhouse gases (methane, carbon monoxide, CO₂), which are available at low cost, into higher value substrates and materials through novel enzymatic processes. Synthetic biology and genetic engineering will be harnessed for the creation of artificial pathways in malleable bacterial strains to capture C1 substrates, and fermentation type approaches will be adopted for synthesis of high value chemicals through fermentation. Synthetic biology, genomics and genetic engineering techniques will also be harnessed for conversion of a range of other substrates to high value products. The programme will integrate computational capabilities such as computational enzyme and microorganism design process modelling, data analytics and digital technologies in synthetic biology. Other capabilities to be integrated into the initiative will include bioprocess engineering, metabolic engineering, synthetic biology, bio catalysis, natural product and other chemistries, process design, engineering and modelling. Ultimately, we aim for greener manufacture of normal and high value chemicals and material substrates with a smaller environmental footprint.

The focus of this initiative, which will straddle the materials, pharmaceuticals and agro-processing sectors, is to develop new and better industrial processes, lower energy inputs, lower waste emission and beneficiate waste. This platform takes a different perspective from bioprocess initiatives that are focussed strictly on the conversion of biomass only.

5. The Pharmaceuticals Initiative: Addressing gaps in national manufacturing capabilities to reduce trade balance of payments deficits

The pharmaceuticals sector in South Africa is import driven, and it's the fifth largest contributor to the negative balance of trade payments. The sector has a two-tiered market with huge challenges of equitable access; with the private sector comprising 79% of market value, serving only 16% of the population (2015), while the remaining expenditure of 21% serves 84% of the population (2015 data). South Africa is reliant on Asian imports for critical drugs, and critical drug shortages have recently been experienced. The challenge is that there is limited capacity for manufacture of active pharmaceutical ingredients. These include limited and/or outdated local infrastructure, high cost of local cGMP setup (equipment imports, labour sector) and the lack of key pharmaceutical manufacturing skills. The CSIR's strategic response is to address import substitution through contribution to local pharmaceuticals manufacturing capabilities,

specifically flow chemistry and related skills. Specifically, the CSIR will contribute to process chemistry and scale-up, in particular flow chemistry for API manufacturing. Related technologies to be developed may include catalysis, process modelling, analytics and the supporting digitalisation to achieve end-to-end green process design for pharmaceutical production.

6. The Agro-processing Initiative: Adding value to produce and redistributing value

The objectives of this intervention are to take advantage of and reinforce the growth that is being experienced in this high performing sector, improve value addition to produce, and expand the product mix (to include healthy food ingredients, novel food and feed products, novel proteins). This initiative will aim to redistribute wealth back to the primary producers, creating a distributed, inclusive economy. A longer-term outlook will adopt a perspective of developing solutions for resilient farming technologies in water and space-limited environments.

The strategic capabilities to be developed in the short term will include building on the existing bioprocess hub, thermo-mechanical processing, fermentation technologies, malting and brewing, chemical characterisation and analytics, and process engineering and modelling. This initiative will build on capabilities developed in the Biomanufacturing Industry Development Centre (BIDC) and the work done by the ECD unit in enterprise development in agro parks and eco-industrial zones.

7. Nexus Initiative: Enabling industrial development

The nexus initiative is a strategic decision-support capability designed to address issues of the interaction between the natural environment and industrial development activities, in particular issues related to trade-offs that need to be made where there are competing demands for natural resources such as water, food and energy. The platform will take into consideration issues of climate change and the impact on resource availability. Key questions for this platform will include the availability of water, energy and land to achieve the aspirational industrial growth and food security, availability of the resources in light of projected climate futures and land use, and the trade-off implications on socio-economic development. Integral to the platform will be the question of how innovation can be utilised to circumvent bottlenecks in resource availability in order to expand the resource envelope within which industry can grow.

The platform will further explore understanding the impact of climate change on industrial development, quantifying the costs of climate change to industry (e.g. effect of extreme events on operations), identifying adaptation mechanisms through innovation, and quantifying the costs of mitigation on the continent. The capability basis for this platform will include economics, resource modelling, climate modelling, and scenario planning, among others.

A.2.4.4 CSIR investment into the advancement of Project Synapse

A.2.4.4.1 Emerging programmes

For each of the new programmes, the CSIR will invest into refining the focus of the programme with industry stakeholders, as well as to:

1. Develop an innovation ecosystem (including universities, industry, etc.);
2. Develop the appropriate business model for each initiative;
3. Mobilise resources for the specific initiative;
4. Identify the SMMEs to work with; and
5. Define the capabilities to be built for each intervention.

A.2.4.4.2 The Internal Operating Environment: Change management

The business model, organisational architecture, the tools, systems and processes to support the defined initiatives were also reviewed and quick wins identified. The CSIR will invest significantly into a change management process to position the organisation to deliver on the vision of the strategy.

The CSIR will thus put in place an implementation and roll-out capability to address issues of programmatic focus, organisation architecture, business models, systems and processes in line with the recommended global best practises.

A.2.4.4.3 Defining new measures and KPIs

In line with the new organisational strategy, it is expected that new KPIs will be developed. These can be categorised as short, medium and long term, and some will be associated with the implementation of Project Synapse itself. In addition, KPIs associated with the suite of programmes will be developed.

These could include:

1. Institutional design, systems and processes
 - Roll out capability established
 - Implementation of organisational redesign (if recommended)
 - New culture and values
 - ICT strategy and road map
2. Support to service delivery

- Establishment of the municipal service delivery platform
 - Demonstration platform established in a specific municipality
3. CSIR revenue
 - Ring-fenced parliamentary grant for industrial development activity
 - Contract income earned from industry (public and private)
 - Income co-invested into technology platforms
 4. Capability development
 - Number of engineers associated with product design, manufacturing process, manufacturing execution and manufacturing systems
 - Investment into new industrial infrastructure
 5. Technology licencing and start-up creation
 - New CSIR start-ups created
 - Number of new licences issued
 6. Technology incubation, access to infrastructure and skills
 - Number of SMMEs incubated on industry-oriented platforms (e.g. BIDC)
 - Number of industrialists trained
 7. Improvements in efficiencies of existing industries
 - Value associated with energy/water savings by SA industry due to CSIR support
 - Value associated with infrastructure maintenance savings, e.g. turbine blade repairs for heavy industries
 - Number of companies supported to upgrade their manufacturing and production processes
 8. The creation of new industries
 - New SMMEs established in new industries, e.g. titanium, biotechnology
 9. Technology localisation
 - Number of locally developed technologies to replace imported technologies
 - Value associated with import substitution
 10. Building an inclusive economy
 - Number of enterprises in townships and rural areas
 - Number of products and services in rural and township communities
 11. Long-term impact on economy
-

- Growth in contribution by targeted sector to GDP
- Growth in contribution by targeted sector to employment
- Reduction in trade deficit in targeted sector

A.2.5 SO4: Infrastructure Renewal and Development

As a Science Council, CSIR's facilities infrastructure and its location directly impacts on the work conducted and the organisation's accessibility to the wider research community. In order for the CSIR to effectively implement its R&D strategy, it therefore requires an appropriate, safe and secure environment within which to do its work. There is a continuous need for provision of facilities that best serve the needs of the research community and enable the achievement of world class research work in line with CSIR strategy.

The CSIR has in the past invested significantly in equipment and facilities which supports scientific development and it is expected that this trend will continue as new areas of research also continue to evolve with time. However, in order to get even closer to supporting the industry development needs, the CSIR has in the past five years embarked on the development of 5 R&D facilities that will provide capability for industrial innovation initiatives prototyping, up-scaling, pilot manufacture and testing allowing translation of science into market ready products. These facilities include the PPF, the BIDC, the Biorefinery Industry Development Facility (BIDF), Nanomaterials Industrial Development Facility (NIDF), and Nano-micro Device Manufacturing Facility (NMDMF) as described in the section above. It is expected that the development of R&D facilities will gain momentum as the CSIR Industry Development Strategy articulation advances.

In addition to ongoing investments in scientific equipment and general CSIR facilities the CSIR has embarked on two significant long-term interventions in support of infrastructure renewal and development – the Energy Autonomous Campus and the Campus Master Plan.

A.2.5.1 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: 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 program, 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 power plants generating 1MW of power have already been installed, and further interventions will include the installation of 1.9MW of rooftop Photovoltaic (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.

A.2.5.2 Campus Master Plan

The CSIR has developed a Campus Master Plan (“The Research Campus of the Future”) with the aim of providing a facilities management framework for delivering on its future R&D needs. The Campus Master Plan serves as a blueprint that will guide special development and capital investment plan in the next 10 years. The plan envisages the development of a sustainable, modern, forward-thinking research campus where the natural, built, social and institutional environments are integrated in a visually transforming image of the CSIR, where heritage is preserved and future growth and development is encouraged and accommodated. It is a campus where people and ideas can move freely in a pleasant atmosphere, where a homogenous identity of the Campus creates a sense of structure and belonging and yet allows individual identity for the Operating Units.

In order for the Campus Master Plan to be realised the following objectives have been set:

- 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; and
- Develop a Growth Strategy to anticipate the need for new research areas;

An Implementation Plan has been formulated so that the Master Plan can become a reality instead of another stagnating document. The Plan includes a “roadmap” for the Master Plan and details the different catalytic phases and precincts to be targeted during different phases of implementation. In addition a number of projects have been recommended for funding in the short to medium term. The priorities and funding of these projects will be determined by the CSIR Executive and the Board.

The Implementation Plan is supplemented with Design Guidelines to inform the development of the built and landscaped environment in a homogenous and holistic manner. The guidelines cover the general, urban design, architecture and landscape environments. Phase One of the project, estimated to be implemented over a 10 year period and costing above R2 billion, will include:

- Upgrade buildings on the Campus to modern standards but retain its heritage;
- Support a high tech campus and sustainability;
- Create a place where nature and technology meet;

- Enhance the public environment and landscape;
- Improve motorised and non-motorised connectivity within the Campus; and
- Provide a sociable place to meet, discuss and relax.

A number of sub-projects, through which the Campus Master Plan will be realised, have been identified:

1. The establishment of modern public engagement areas, including a Visitor's Centre,
2. The construction of a pilot manufacturing facility that can house various pilot projects,
3. The construction of shared interdisciplinary research laboratories to facilitate collaboration between researchers from different disciplines to tackle socioeconomic challenges,
4. The refurbishment of existing buildings to modern standards in terms of interior finishes and space utilisation, and
5. The development of a smart-intelligent and sustainable campus that is energy autonomous, water wise and vehicle free.

During the coming financial year the emphasis will be on establishing a sound financial basis for the implementation of the Campus Master Plan. This will include investigating the possibilities of long-term support from National Treasury and the implementation of public-private partnerships.

A.2.6 SO5: Maintain a Sustainable and Well-Governed Organisation

A.2.6.1 Financial Management

The provision of accurate and timely financial information to external stakeholders, customers and CSIR management is key to ensuring financial compliance requirements are met and key decision makers have the necessary relevant information in order to make informed decisions to ensure the continued financial sustainability of the CSIR.

In addition, the CSIR will strive to maintain its sound track record with regards to receiving unqualified audit reports from the Auditor-General. To this end a dedicated team of finance professionals will be retained to support the CSIR in meeting its key performance indicators and delivering to the mandate whilst ensuring continued good financial governance practices are in place.

Strengthened stakeholder relationships are necessary to grow the impact of the CSIR's work. Our stakeholder engagement approach allows us to prioritise our stakeholders, partners and clients, and enables a longer-term strategic, rather than transactional, view of addressing national priorities and stakeholder needs with key partners. A business development framework has been developed to support CSIR strategic objectives, provide a structured

approach to scanning the environment; identifying priority challenges, initiatives and the relevant partners to work with; developing the appropriate value propositions to execute effective programmes; and successfully communicating the impact of our work.

CSIR, as the largest RDI organisation of its kind on the African continent, is committed to innovation-led development in the SADC region and the continent as a whole. As such we aim to contribute to the implementation of the Science, Technology and Innovation Strategy for Africa (STISA-2024) and the Programme for Infrastructure Development in Africa (PIDA). Through the DST we host a number of African delegations and engage with DIRCO and NEPAD. We also have a number of research programmes that span into the continent such as SANBio and Road Maintenance projects through East-Africa. It is key that the CSIR activities in the future be aligned behind a comprehensive "Africa Strategy" which is currently under development. Through the strategy we have the vision to establish the CSIR as the hub of a vibrant African network of innovation hubs providing capabilities to solve Africa's developmental challenges.

In the funding domain, the CSIR has put in place strategic partnerships with the [Industrial Development Corporation \(IDC\)](#) and the Development Bank of South Africa to enhance CSIR support to the private sector. Specific areas of cooperation have been identified for each partnership, and strategic and technical engagements are aimed at scoping initiatives for joint collaboration and national impact. The CSIR has renewed its partnership with the Technology Innovation Agency and will leverage this capability specifically to advance research from technology development through to final commercialisation.

A.2.6.2 Knowledge Transfer

The CSIR plays a significant role in national development, enabling socio-economic transformation of society, by creating opportunities for entrepreneurs and private firms to meaningfully and productively participate in economic activity through the licencing and commercialisation of CSIR technologies and intellectual property.

The overall strategic objective of the [Licensing and Ventures \(L&V\) Office](#) is to facilitate increased impact by the CSIR through strengthening and increasing the technology transfer activities in the organisation by:

- Providing support and advice with respect to market research, [IP management](#), commercialisation and technology transfer activities;
- Building networks with relevant stakeholders and funding organisations and linking opportunities with funding;
- Creating a technology transfer policy environment conducive to innovation; and
- Increasing the awareness of technology transfer opportunities and providing capacity building interventions.

A.2.6.3 Strategic Partnerships

The CSIR as a Research and Technology organisation must be client-focused if the CSIR wants to achieve the purposes for which it is created. The CSIR produces, integrates and transfers science and technology to help support Government, resolve the challenges of society and support industrial competitiveness. The CSIR is vital to the innovation chain and responsible for bridging the gap between basic research and practical application. This role in the national system of innovation requires the CSIR to develop partnerships with HEIs, RTOs, Government Departments and Industry.

The CSIR prioritises partnerships that enable a longer-term strategic, rather than transactional view of addressing national priorities and stakeholder needs. The CSIR and its Strategic Partners as far as possible integrate organisational strategies, where the CSIR is immersed in the partner's environment to develop an understanding of the real-world problems the partner experiences. The partnership integration is achieved through:

- Co-developing strategy to achieve a common vision,
- Co-creating new long-term strategic programmes to address the partner's challenges;
- Co-developing solutions by creating integrative teams consisting of both parties;
- Co-funding the creation of new innovative technologies; and
- Co-owning intellectual property to exploit global markets.

A business development framework has been developed to support this approach. The CSIR strategic objectives to support strategic partnerships are to, provide a structured approach to understand the sectorial and customer environment; identify priority challenges and initiatives in the national interest; identify the relevant partners to work with; develop appropriate value propositions to execute effective programmes; and successfully communicate the impact of our work.

A customer survey was conducted to determine customer expectation. The results are that customers expect the CSIR to support them to be competitive in manufacturing, product commercialisation, localisation and SMME development. Their requirements are becoming more complex with expectations from the CSIR to offer further support in science and engineering in line with the jobs of the future. Service offerings valued by stakeholders are market insights, long-term perspectives of technologies, integrated technology solutions, advanced production and business incubation. The CSIR needs to translate our science and technology solutions into technology development roadmaps, commercial business cases and future employment perspectives. The customers expressed the need for more industrial and business engagement, collaborative implementation of long-term strategic programmes, with multi-disciplinary research co-ordinated across the NSI. The customer requested initiatives that cover youth issues, skills development, foresight, policy research, research and development funding coordination and prioritisation that offer industrial and commercialisation

opportunities. Innovation also requires manufacturing readiness involving process or production scale-up, product/service development and business scale-up and establishing and scaling-up of the value chain. Delivering on the expectation requires investment, but also alternative skill sets to exploit market opportunities utilising technology inventions from the CSIR and is in line with the project Synapse process and the prioritised partners for the next financial year.

SOE partners are finding it increasingly difficult to motivate for single source supplier approval for strategic programmes to be done in partnership with CSIR as per signed Memorandum of Agreements. The programmes follow an integrative approach of co-creating solutions in the national interest. The contracting process is exacerbated by the lack of a single point of entry at Treasury that can potentially facilitate the contracting processes and more support is required to facilitate the process. The SOE partnerships additionally require transitioning to larger jointly supported strategic initiatives that can involve several SOEs and the public sector to leverage both funding and human resources that will be of benefit to all the parties. These common requirements for capabilities and innovation between the SOEs would facilitate more open dialogue and shared a vision for Research Development and Innovation across partnerships.

The CSIR approach to strategic partnerships harnesses the CSIR's multidisciplinary capabilities in supporting national imperatives and service delivery objectives of government departments. The CSIR is giving priority to strategic relationships with the departments of Health, Water Affairs, Environmental Affairs, Home Affairs, Performance Monitoring and Evaluation, among others. The CSIR will also increase its support to local governments in infrastructure and service delivery and has recently signed agreements of cooperation with the Municipal Infrastructure Support Agency (MISA), [South African Local Government Association \(SALGA\)](#) and [COGTA](#). The support that will be provided to these agencies will include decision making and service delivery capacity strengthening to districts considered by governments to be in distress, as well as spatial planning and decision support, knowledge management and exchange, climate change preparedness and water governance issues.

The CSIR is expanding collaboration with industry partners. The CSIR and a group of partners consisting of the Limpopo Provincial Government, Anglo American and Exxaro have, over the last few months, been establishing a Regional Socio-Economic Development platform to deliver regional social, economic and environmental development in Limpopo. The platform has initiated the first economic development initiatives in agro-processing, biodiesel, broadband ICT services and supplier and enterprise development. The initiatives are supported by the dti, [Human Sciences Research Council \(HSRC\)](#), [Agricultural Research Council \(ARC\)](#), Transnet, Eskom, de Beers and Ivanhoe platinum with an additional partner to be added to the platform to increase potential impact

In addressing national challenges, the CSIR aims to cooperate with and complement other players in the national system of innovation. The CSIR partners with [RTOs](#) and [HEIsto](#) undertake research and development that contributes to economic growth and addresses

development challenges of South Africa. Through collaboration, the CSIR builds networks that contribute to the strengthening of its science and technology base, as well as that of South Africa.

In the funding domain, the CSIR has put in place strategic partnerships with the IDC, Public Investment Corporation (PIC), Technology Innovation Agency (TIA) and the Development Bank of South Africa to enhance CSIR support to the private sector. Specific areas of cooperation have been identified for each partnership, and strategic and technical engagements are aimed at scoping initiatives for collaboration and national impact.

The CSIR's Parliamentary Office supports the CSIR in achieving its mandate by enabling and maintaining relationships and profiling the CSIR with key portfolios in Parliament and the National Executive.

The Parliamentary Office takes leadership in facilitating the CSIR's engagement with parliament for accountability purposes such as the presentation of operational plans and annual reports. In addition to these formal interactions with Parliament and the National Executive, ongoing stakeholder conversations and engagement opportunities receive priority attention. The office, along with the CSIR legal team, plays an important role in communicating legislative and policy developments. The Parliamentary Office positions the CSIR as a trusted advisor/partner on scientific and technical matters to Parliament and the National Executive, as appropriate, and facilitates the participation of CSIR experts who provide technical inputs into initiatives brought before Parliament. To this end, the CSIR will support Parliament as and when required.

A.2.6.4 Marketing and Communication

The work of the CSIR is increasingly shaped by mounting expectations to support private and public sectors on various initiatives, specifically in the area of industrial development. The organisation has taken a strategic decision to reposition its innovation portfolio to make a direct contribution in this respect. The organisation intends to support industry more meaningfully, contributing to the competitiveness of the South African economy by supporting **SMMEs**, as well as large industry stakeholders.

It is thus important that the organisation effectively communicates its intention to make the necessary amendments to be able to increase its contribution to industrial development. The organisation's communication function will also support the centrally driven efforts to keep the organisation abreast of intentions and changes and will help reflect the increased industry participation. Additionally, from a marketing communications perspective, it is important that targeted communication initiatives contribute to bringing new business (contract research and development) to the CSIR and uptake of its technologies. Therefore, the promotional activities will also aim to market the capabilities and expertise of the organisation.

The Department of Science and Technology (DST) continues to drive its science engagement initiatives, with associated expectations for organisations such as the CSIR to improve and

increase its interaction with the public on issues of science. Another main objective of the DST science engagement strategy is to encourage learners and students to consider careers in the field of science, engineering and technology. This facet of communication, which has to date primarily been undertaken in the form of promoting CSIR work in multidisciplinary fields, is new and requires dedicated planning and execution.

The National Development Plan (NDP) identifies the science and technology sector as one of the key drivers for change, and a sector whose advancements and discoveries underpin economic development, as well as improvements in health systems, education and infrastructure, and related sectors. CSIR Communication has a duty to profile, both internally and externally, the work that the organisation is doing to contribute to the National Development Plan (NDP) and other government programmes.

To reach more audiences and increase its visibility, the CSIR must continue to be innovative in its communication methods – understand how the consumption of information is changing and adapt its communication strategies. This includes the increased use of technology and an openness and willingness to engage with the public.

A.2.6.4.1 Strategic Objectives

Marketing and Communication aims to raise the visibility of the organisation, and to create opportunities for stakeholders to engage with the CSIR and facilitate a shared vision of who we are and what we stand for internally and externally.

In support of the CSIR strategic objectives, the marketing and communication objectives are:

1. Raise the brand profile of the CSIR;
2. Create engagement opportunities between the CSIR and its stakeholders; and
3. Build and strengthen the employee-brand relationship.

1. Raise the brand profile of the CSIR

Rekindle a mass media campaign:

The CSIR will emerge from its current strategic repositioning aimed at sharpening its focus on industrial development, with an agreed, firm and formulated intent. This will be an ideal opportunity for the organisation to develop a mass media campaign to support such clearly articulated objectives.

Form media partnerships for sustained coverage:

For the CSIR to continue to grow its favourable media coverage, sound media relationships and the supply of current content will have to be supplemented by new partnerships with major media players. The organisation has made significant progress in partnering with the SABC,

community media and online publications in order to engage with the public, especially those in the rural areas. A focus on obtaining media coverage in niche publications that serve the industrial sectors which will be defined in the new organisational strategy, will form part of organisational communication support.

2. Create engagement opportunities between the CSIR and its stakeholders

- *Public outreach program:*

The CSIR engages with the public through different outreach programmes, including visiting schools to promote science, participating at science festivals such as Sciefest and Sasol TechnoX. The CSIR also organises open days in which different stakeholders are invited to the CSIR for technology demonstrations. The organisation supports science promotion activities organised by SAASTA.

- *Events:*

The CSIR will continue to host events that provide the organisation with an opportunity to interact with stakeholders while showcasing new and existing infrastructure as well as competences which can make difference to stakeholders. Such events include the CSIR conference and the launch of new facilities.

- *Partnering with historically disadvantaged universities:*

Our aim is to promote science in previously disadvantaged communities. Activities will include hosting local schools, science and mathematics teachers, community groups and so forth.

3. Build and strengthen the employee-brand relationship

- *Communicate organisational strategy:* One of the marketing and communication priorities will be to communicate the industrial development strategy to staff so that understand and own it.
- *Communicate Science Vision 2030:* Plans to communicate Science Vision 2030 to staff to enable them to tailor their activities and responses to this strategy.

A.2.6.5 Governance

The main areas that will continue to be addressed to sustain and enhance the CSIR's corporate citizenship are:

- The continued operation of an Ethics Hotline
- Contributions to B-BBEE based on the Department of Trade and Industry (dti) codes of good practice; and
- Maintenance and enhancement of environment, health and safety performance;

- A continued emphasis on research ethics through the institutionalisation of a Research Ethics Panel.

Ethics Hotline

The CSIR has a strong brand that is built on a set of values which encourages its employees to attain the highest ethical standards when dealing with internal matters, clients and stakeholders. The organisation has a responsibility to protect this reputation to ensure that it remains a respected and trusted Research and Development (R&D) institution.

As means of achieving this goal, the CSIR leadership created a safe and secure Ethics Hotline (The Hotline) which employees and other stakeholders can use to report any suspected unethical conduct and practices. The Hotline was established with effect from 18 July 2017 and is managed by an independent party with experience in the management of hotlines.

Implementation of the Hotline has been received positively by CSIR employees and management.

B-BBEE Status

The CSIR expect that it will maintain a Level 2 B-BBEE status. 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.

The CSIR remains committed and dedicated to providing its employees, contractors and visitors with an excellent health and safety environment at all its sites. Health and safety management in the organisation rests on enforcing compliance to the Occupational Health and Safety Act 85 of 2007 (OHS Act), implementing an occupational safety and health management system aligned to OHSAS 18001 and continually reviewing the organisation's safety management system to ensure effectiveness and efficiency.

Health and Safety

Over the past few years the organisation has observed certain trends which require urgent intervention in order to improve the state of health and safety on all CSIR campuses. The underlying issues identified include:

- 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
- Health and safety objectives not well articulated

The CSIR has confirmed its main objectives as being to achieve:

- Zero harm,
- Zero disabling injuries, and
- Zero fatalities.

In support of these objectives the CSIR has instituted a 10 Point H&S Improvement Plan. This Plan seeks to provide a pragmatic approach in improving H&S management in the organisation over the next 3 years.

A.2.6.6 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: Loss of institutional memory; business interruption due to power failures;
- 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. Discussions on these are held by the Executive committee and reported to the Audit and Risk committee.

A.3 Monitoring and Evaluation

A.3.1 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 are being achieved. The two components of our measurement framework are:

1. 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.
2. 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 basis.

These two sets are complimentary parts of a system that seeks to understand whether 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.

As detailed in Sections A.2.4 and A.2.5 we will, during the course of 2018/19, finalise major strategic interventions in support of SO3 (Project Synapse) and SO4 (the Campus Master Plan). Part of this process will involve the identification of suitable indicators to measure the implementation and impact of these interventions.

A.3.2 Additional Indicators

The CSIR will, during the 2018/19 financial year, 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 2019/20 Shareholder's Compact.

1. **The number of new start-up companies established.** This indicator will measure the success of the CSIR's efforts in establishing new private sector firms.
2. **The number of new licence agreements signed for CSIR-developed technologies.** Our current set of measures includes the total income derived from royalties and licence agreements. This proposed indicator will complement this existing indicator by tracking the extent to which CSIR-developed technologies are being diffused into the economy.
3. **The number of companies, including SMMES, supported to upgrade their manufacturing and production processes.** This indicator will measure the extent of our efforts to improve the competitiveness and effectiveness of existing private sector firms. A sub-indicator will measure the extent of this assistance to SMMEs in particular. The types of interventions could include technical support to production processes as well as initiatives in support of energy efficiency.
4. **Private sector income** This indicator will focus on the level of contract income derived from private sector firms (including State-Owned Enterprises), and will measure the CSIR's ability to respond to the needs of the private sector.

5. **Total value of private sector co-investment.** This indicator will measure the extent to which the private sector is willing to co-invest in the development of CSIR technologies. This is an important indicator of whether CSIR-developed technologies are responding to industry concerns.
6. **Total number of new products and processes introduced to the private sector.** This indicator will measure the total number of new products and processes, developed by the CSIR, introduced to the private sector. This is an important indicator of the impact our the CSIR's work on the South African economy.
7. **The number of CSIR trainees or interns who are placed in the private sector.** This indicator will measure the CSIR's contribution to the development of skills required by the private sector.

A.4 KPI Targets

KPI	Target: 2017/18	Forecast: 2017/18	Target: 2018/19	Target: 2019/20	Target: 2020/21	Target: 2022/23
SO1: Build and Transform Human Capital						
Total Size of SET Base	2,100	1,860	1,860	1,860	1,950	2,150
– Number of SET Base who are Black	1,280	1,160	1,160	1,180	1,250	1,390
– Percentage of SET Base who are Black	61%	62%	62%	63%	64%	65%
– Number of SET Base who are Female	785	687	687	687	720	810
– Percentage of SET Base who are Female	37%	37%	37%	37%	37%	38%
– Number of SET Base with a PhD	411	344	369	390	430	510
– Percentage of SET Base with a PhD	20%	18%	20%	21%	22%	24%
Total Chief Researchers	22	21	23	24	26	31
– Number of Chief Researchers who are Black	2	2	3	4	5	7
– Percentage of Chief Researchers who are Black	9%	10%	13%	17%	19%	23%
– Number of Chief Researchers who are Female	4	4	3	4	4	6
– Percentage of Chief Researchers who are Female	18%	19%	13%	17%	15%	19%
Total Principal Researchers	240	205	210	210	220	240
– Number of Principal Researchers who are Black	53	51	57	60	64	75
– Percentage of Principal Researchers who are Black	22%	25%	27%	29%	29%	31%
– Number of Principal Researchers who are Female	45	37	41	43	45	55
– Percentage of Principal Researchers who are Female	19%	18%	20%	20%	20%	23%
SO2: Conduct High-Quality Research to foster Scientific Development						
Publication Equivalents	500	500	480	480	500	520
Journal Articles	310	310	310	310	320	340
New Patents	≥15	15	≥15	≥15	≥15	≥15
Contract R&D Income (Rm)	R 2,128 m	R 1,868 m	R 1,970 m	R 2,101 m	R 2,227 m	R 2,370 m
SO3: Conduct Relevant Research to foster Industrial Development						
New Technology Demonstrators	35	40	50	55	55	55
Royalty and License Income (Rm)	R 5.2 m	R 4.1 m	R 4 m	R 4.8 m	R 5.2 m	R 7 m
SO4: Infrastructure Renewal and Development						
PPE Investment (Rm)	R 108 m	R 110 m	R 61 m	R 125 m	R 140 m	R 155 m
SO5: Financial Sustainability and Governance						
Total Income (Rm)	R 2,863 m	R 2,603 m	R 2,740 m	R 2,913 m	R 3,088 m	R 3,280 m
Net Profit (Rm)	R 64 m	R -32 m	R 0 m	R 17 m	R 34 m	R 60 m
B-BBEE Rating	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2
DIFR	≤0.2	0.07	≤0.2	≤0.1	≤0.1	≤0.1

Table A.1: CSIR Key Performance Indicators: 2017/18 – 2021/22

A.5 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 the CSIR is achieving its strategic objectives related to achieving outcomes and impact cannot be achieved by KPI assessment, 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.

Publication Equivalents

Indicator Title	Publication Equivalents
Definition	Publication equivalents consist of peer-reviewed journal articles, peer-reviewed conference papers, peer-reviewed book chapters and books.
Purpose	The quantity and quality of peer-reviewed research publications is a measure of the CSIR's research quality, capabilities and outputs. The impact of research publications is a contribution to the 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.
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.
Data 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, measures are in place to automatically include publications whose authors are affiliated to the CSIR.
Type of indicator	Output

Journal Articles

Indicator Title	Journal Articles
Definition	Peer-reviewed articles published in accredited journals. The list of accredited journals is maintained by the Department of Higher Education and Training.
Purpose	The quantity and quality of peer-reviewed research publications is a measure of the CSIR's research quality, capabilities and outputs. The impact of research publications is a contribution to the knowledge base.
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Indicator Title	Journal Articles
Performance assessment	The CSIR considers a performance above 95% of the target as acceptable. Performance in excess of the target is a positive result.
Data source	Data is entered into the CSIR Technical Outputs Database (TOdB) which provides the information for reporting
Data responsibility	CSIR Information Services
Method of calculation	Count of articles published in the calendar year ending in the financial year.
Data 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, measures are in place to automatically include publications whose authors are affiliated to the CSIR.
Type of indicator	Output

Technology Demonstrators

Indicator Title	Technology Demonstrators
Definition	<p>A technology demonstrator is:</p> <ul style="list-style-type: none"> • 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 intermediate output with the potential to be developed further into technology packages that can be transferred to various markets for socio-economic impacts; • An output at a Technology Readiness Level (TRL) 6 or higher, 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	Technology demonstrators provide a lead indicator of potential outcomes and impact that will be achieved through technology transfer by deploying the technology or commercialisation through licensing or spin-out of the technology.
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	<p>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:</p> <ul style="list-style-type: none"> • Technology Demonstrator Evaluation criteria; • Guidelines for submissions; • Guidelines for appointment of the panel; • Guidelines for appealing the decision of the panel and • Guidelines for 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.
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Indicator Title	Technology Demonstrators
Data limitations	None.
Type of indicator	Output

Patents

Indicator Title	Patents
Definition	Patents granted by a national authority in countries with an examining office.
Purpose	<p>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.</p> <p>Patent prosecution and maintenance are very costly. The decisions of whether to patent, where to patent and in how many countries to file applications are 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.</p>
Performance assessment	<p>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.</p> <p>The CSIR target is to achieve at least 15 granted patents annually, recognising that this target may be exceeded substantially in some years owing to awards in multiple countries.</p> <p>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.</p>
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	<p>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.</p> <p>In cases where notification of a patent is only received after the results for the financial year has been completed, that patent will be included in the subsequent financial year's results.</p> <p>Only co-owned patents or patents in the name of the CSIR are counted.</p>
Data 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

Contract R&D Income

Indicator Title	Contract R&D Income
Definition	Contract R&D income is income earned and recognised on contracts with external parties and includes ring-fenced allocations from DST.
Purpose	Contract R&D income indicates the value placed by stakeholders, customers and funding agencies on the research and development and services provided by the CSIR. Growth in contract R&D income reflects growth in the outcomes and impact achieved by the CSIR.
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.
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.
Data limitations	Income is declared by the project leaders based on the progress against the contractual deliverables and cost to completion. There are processes in place to ensure that project leaders are accountable for declaration of income.
Type of indicator	Output

Royalty and Licence Income

Indicator Title	Royalty and Licence Income
Definition	Royalties and licence income are derived from the licensing of formally-protected IP.
Purpose	Royalty and licence income is an indicator of successful technology transfer and commercialisation.
Performance assessment	Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. The CSIR considers a performance above 90% of the target as acceptable. Exceeding the budget target is a successful result and is not the consequence of an inappropriate target. The CSIR medium to long term target is to earn royalty and licence income equivalent to 1% of total income.
Data source	Royalty and licence income is invoiced using a specific account, which reflects the income appropriately on unit and CSIR income statements. 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.
Data limitations	Income is declared when the CSIR is entitled to receive the royalty and / or licence income
Type of indicator	Output

Total SET staff

Indicator Title	Total SET staff
Definition	SET staff include staff on Researcher, Research and Development, Research Application, Technical and Project Management 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.
Data limitations	Human Resources ensures the correct classification of staff in PeopleSoft
Type of indicator	Output / Efficiency

Number of SET staff who are Black and Female, respectively

Indicator Title	Number of SET staff who are Black and Female, respectively
Definition	Number of SET staff who are Black South African and Female South African, respectively.
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 5% 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 Black and Female SET staff at the end of the financial year.
Data limitations	Human Resources ensures the correct classification of staff in PeopleSoft

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

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.
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Indicator Title	Percentage of SET staff who are Black and Female, respectively
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 2 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.
Data limitations	Human Resources ensures the correct classification of staff on the Human Resources database.
Type of indicator	Equity

Number of SET staff with Doctoral qualification

Indicator Title	Number of SET staff with Doctoral qualification
Definition	Number 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 25% of all SET staff. The CSIR aims to achieve or exceed the annual target.
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 of above 95% of the target of the number of PhDs is 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	Head count of the number of SET staff with doctoral level qualifications at the end of the financial year.
Data limitations	Human Resources ensures the validity of data and that evidence of the qualification is on file.
Type of indicator	Input

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.

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Indicator Title	Percentage of SET staff with Doctoral qualification
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 1 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.
Data limitations	Human Resources ensures the validity of data and that evidence of the qualification is on file.
Type of indicator	Input

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.
Data limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output

Number of Chief Researchers who are Black and Female, respectively

Indicator Title	Number of Chief Researchers who are Black and Female, respectively
Definition	Number of Chief Researchers who are Black South Africans, and number of Chief Researchers who are Female South Africans.
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 have at least 5 Black Chief Researchers, and at least 7 Female Chief Researchers.
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Indicator Title	Number of Chief Researchers who are Black and Female, respectively
Performance assessment	Promotion or appointment to the Chief Researcher level 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	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Head count of the number of Black South African and Female South African SET staff who are classified as Chief Researchers at the end of the financial year.
Data limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output

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 5 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.
Data limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output

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
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Indicator Title	Number of Principal Researchers
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.
Data limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output

Number of Principal Researchers who are Black and Female, respectively

Indicator Title	Number of Principal Researchers who are Black and Female, respectively
Definition	Number of Principal Researchers who are Black South African, and number 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 have at least 78 Black South African Principal Researchers, and at least 65 Female South African Principal Researchers.
Performance assessment	Promotion or appointment to the Principal Researcher level 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	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Head count of the number of Black South African and Female South African SET staff who are classified as Principal Researchers at the end of the financial year.
Data limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output

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.

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Indicator Title	Percentage of Principal Researchers who are Black and Female, respectively
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.
Data limitations	Human Resources ensures the validity of data and that the required evidence is on file.
Type of indicator	Output

Investment in property, plant and equipment

Indicator Title	Investment in property, plant and equipment
Definition	The amount invested in 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.
Data limitations	Nil
Type of indicator	Input

Total income

Indicator Title	Total income
Definition	Total income is the total operating income earned. This include 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.
Data limitations	Nil
Type of indicator	Output

Net Profit

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, based on 3% of the sum of contract R&D income and royalty and licence income. 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.
Data limitations	Nil
Type of indicator	Output

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 No. 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 socio-economic 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 retain our current level 2 qualification while monitoring the effect of the changes in regulations that take effect in the 2016/17 financial year.
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.
Data limitations	The external audit ensures there is no subjectivity in the B-BBEE assessment.
Type of indicator	Equity

DIFR

Indicator Title	DIFR
Definition	A disabling injury is defined as an injury, including occupational illnesses, arising out of and during the course of employment which results in the loss of one or more working days other than the date of accident.
Purpose	Health and safety management in the organization
Desired performance	The CSIR aims to have a DIFR of less than 0.3. Our long-term aim is to reduce our DIFR to below 0.1.
Performance assessment	DIFR less than 0.3 is a positive achievement.
Data source	Monthly Headcount figures are obtained from the Human Resources Business Information System. Disabling injury figures are obtained from the Medical Centre after being certified by the Risk Management Office as work related.
Data responsibility	CSIR Management Services
Method of calculation	DIFR is defined as the number of disabling injuries per employee hours worked, multiplied by a factor of 200,000
Data limitations	Nil
Type of indicator	Output

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B.1 Introduction

The CSIR Annual Plan is structured around our five strategic objectives.

B.2 SO1: Building and Transforming Human Capital

During the 2018/19 financial year the organisation will focus on the following objectives:

The CSIR's Human Capital Development focus remains the development of a transformed and highly skilled cadre of researchers who make an important contribution to knowledge generation as well as development of technologies and applications for industrial development. These are critical to the global competitiveness of South Africa's economy as well to job creation and poverty alleviation. Although the CSIR has contributed to developing human capital over the years, the growth and development of researchers especially among designated groups such as women, blacks, and the youth remains a big challenge. It can only be effectively addressed through continued investment, responsive programmes and collaboration among all institutions in the national system of innovation. The CSIR, therefore, remains a committed partner in developing human capital and growing diverse skills for the benefit of the CSIR and the country.

During the 2018/19 financial year the organisation will focus on the following objectives:

Long-term Objective	2018/19 Objectives
Improving the qualification profile of the SET Base	
<p>Improve the number and proportion of our SET base with a doctoral qualification. In support of this objective we will continue to support the MSc and PhD studies of scientific staff, as well as our support of PhD students at universities.</p>	<ul style="list-style-type: none"> – Continuous investment in pipeline and professional development programs – Strengthening partnerships with the Higher Education Institutions (HEIs) – Review of the Human Capital Development policies including Bursary, Internship, Studentship, Post-Doctoral, Sabbatical, Exchange and Researcher Professional Development Policies.
Improving the transformation profile of the SET Base	
<p>Improve the number and proportion of Black South African and Female South African SET Staff. In addition we have added a particular focus on the level of transformation at the most senior levels of our SET base Chief and Principal researchers. Special attention will be paid to support designated groups to grow from to senior levels of the CSIR career ladders (Principal and Chief Researchers).</p>	<ul style="list-style-type: none"> – Align recruitment initiatives to support the transformation agenda of the organisation. – Replace like for like especially in cases of staff turnover of black professionals. – Target specific middle and senior management positions for the improvement of the transformation profile of the SET base
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Long-term Objective	2018/19 Objectives
Creating an enabling internal environment for talent management	
<p>Ensure that the CSIR internal environment is conducive for the attraction, development and retention of talent by ensuring that CSIR policies and talent management practices are world class and relevant to the needs of the organisation.</p>	<ul style="list-style-type: none"> – Review of the Human Capital Strategy – Review of the Human Capital Operating Model – Human Capital Policy Review – Implement effective recruitment and retention strategies – Review the remuneration strategy – Conduct an engagement survey

Table B.1: SO1: 2018/19 Objectives

B.3 SO2: Conduct High-Quality Research to Foster Scientific Development

B.3.1 Research Impact Areas

Long-term Objective	2018/19 Objectives
Mechatronic Manufacturing	
<p>Manufacturing: Demonstration facilities for technologies resulting in industry uptake, PLM implemented to enable skills development, industry competitiveness & jobs (esp SMMEs)</p> <p>Mining: New mining solutions resulting in higher output, productivity and safety</p> <p>Medical Devices: Innovation Cluster established to support the industry, innovative products & devices, improved competitiveness & growth, new jobs</p> <p>Mobility/transport: Establishment of Electric Vehicle Technologies Centre of Excellence including traction and drive control systems utilizing advanced fuel systems (H2); advanced transport management systems; improved vehicle monitoring and diagnostics; reduced train derailments</p>	<ul style="list-style-type: none"> - Establishment of Learning Factory - Establishment of PLM Technology Centre - Mining Equipment Manufacturers of South Africa PLM Pilot - Medical Devices TIP implementation - Electric Vehicle Technologies Centre of Excellence
Polymer nanocomposites	
<p>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</p>	<ul style="list-style-type: none"> - Drug delivery systems: Proof of concept for reformulated antimalarial and anti-TB drugs in animals - Encapsulated Probiotics: License of pharma polymer system for human probiotics, and development of GRAS polymer system for encapsulating probiotics for animal and human health - Adsorbents: Technology demonstrator and in-field studies for adsorption and regeneration of materials for remediation of phosphates, nitrates and chromium from water. - Technical textiles: Manufacture and testing of high temperature filter bags for different industries - Biopolymers: Design new formulations from locally sourced material. Development of casings for use in disposable diagnostics kits - Composites: Re-establishment of composites research with focus on advanced composites
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Long-term Objective	2018/19 Objectives
Support for the National Bio-Economy Strategy	
<p>Increase the conversion of bioscience R&D into commercialised products and technologies</p>	<ul style="list-style-type: none"> - Conversion of biosciences R&D outputs into commercialised products and technologies. - Provide technology incubation for SMMEs. - Provide RDI services to established private sector companies. - Create new bio-manufacturing opportunities and spin out companies linked to the Units technology platforms - Product diversification (Certified reference material with matrix matches relevant to African needs - Innovative analytical approaches in response to emerging food safety issues. - Innovative PoC biosensor tools for food safety testing - Expansion of high throughput screening platform to support local pharmaceutical R&D. - Provide rural communities access to agro- and food-processing technologies and reduce high child mortality and profile of over- and under-nutrition - Expansion of scope of functional foods. - Diversify product prototype lines to include various other types of food. - Agro-processing development initiatives to reverse economic losses through modern technology based methods - Enable local industry to ensure better utilisation of resources and infrastructure through the BIDC model. - Expansion of scope of functional foods - Diversify product prototype lines to include various other types of food
Mining	
<p>To assist to develop 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.</p>	<ul style="list-style-type: none"> - Upgrade and expand facilities at the CSIR Cottesloe regional (Mining Precinct) site in Johannesburg, continue driving implementation of the SAMERDI initiative - Drive Modernisation of Current Mining focusing on OHS and Efficiency Improvements. - Drive Mechanisation initiatives under SAMERDI. - Lead development of Non Explosive Rock Breaking Research. - Integrate Mining Geophysics with Rock Engineering to assist in determining ground stability - Integrate mine design of narrow seam mining with environmental impact assessments
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Long-term Objective	2018/19 Objectives
An integrated and multi-sectoral decision support centre	
<p>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.</p>	<ul style="list-style-type: none"> – 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	
<p>Establish a dedicated capability to assess and deliver Incubate service delivery capabilities in two domains.</p>	<ul style="list-style-type: none"> – 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/Synthetic Aperture Radar algorithm development, initial model testing and scoping of possible decision support tools in Oceans and Coasts Information Management System Platform
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Long-term Objective	2018/19 Objectives
Energy Infrastructure	
<p>Develop technologies that support the maintenance of the energy infrastructure.</p>	<ul style="list-style-type: none"> - Carry out an assessment of the status of energy efficiency in the various end-use sectors in South Africa - Carry out an assessment of the state of play of the various existing and emerging energy efficiency and demand response technologies on the market - Use a combination of computer modelling software and laboratory or field testing to predict the performance of the emerging EE and DR technologies and integrated systems in a variety of end-use sectors, thereby mitigating technical risks for large scale deployment. - Identify technologies for further development to meet the needs of various end-use sectors - Use CSIR owned LiDAR equipment to provide commercial resource measurements to addresses a niche market not exploited in South Africa yet by supplying this service at extremely competitive rates - Carry out an assessment of the state of the art of the various Energy Storage Technologies (ESTs) in order to identify opportunities for improvements - Compile an up-to-date case summaries of on-going energy storage demonstration projects globally - Working with technology developers and other research institutions, develop tools and methodologies (including codes and standards) for evaluating and reporting technical performance of various ESTs. - Working with technology developers, demonstrators and other research institutions conduct life-cycle investment assessments of ESTs to understand hardware and balance-of-system cost levels required to achieve the desired cost and performance targets. - Conduct laboratory or field testing to predict the performance of the emerging ESTs and integrated systems for a variety of use cases, thereby mitigating technical risks in real life deployment. - Establish a real-world research platform for designing and operating a primarily renewables-based energy system at the lowest possible cost that will provide answers to key questions such as the optimal energy mix, integration considerations, demand side management solutions smart grid design, visualization and control considerations for future micro grids.
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Long-term Objective	2018/19 Objectives
Building Design	
<p>Improve the design, maintenance and efficiency of buildings by developing design guidelines for public buildings; developing new building materials and construction methodologies</p>	<ul style="list-style-type: none"> - A building performance platform to advance the use of context-sensitive science, technology and innovation approaches and solutions in building infrastructure for the improved performance of the shared built environment particularly social infrastructure (health and education buildings). - Ten year technology roadmap for sustainable human settlements - Prototype modular smart clinic - Development of high-performance building and construction materials, including high-strength cement blends and geo-polymer products that are greener and cheaper. Some of the materials will be enhanced for better thermal performance using phase change materials. - Commercialisation of meta-kaolin cement and geo-polymer green brick - Conceptual design of a Modular Building Platform or Skeleton and Infill System to underpin a wide range of building types making use of a matrix of components across a wide variety of platforms.
Coastal Infrastructure	
<p>The development of methods and guidelines for the optimum design of ports and coastal structures, as well as for the planning and operations of ports.</p>	<ul style="list-style-type: none"> - Operationalise the first version of Oceans and Coasts Information Management System, including decision support tools based on oceans and coastal science - Operationalise SEAFAR Maritime Domain Awareness System - Further development of the underwater 3D imaging technology to increase speed of operation and functionality - Investigation of the 3D imaging base technologies for synthetic aperture sonar and underwater communications applications.
ICT Infrastructure	
<p>Address the lack of quality data, analysis and tools on South African broadband network infrastructures and spectrum, and to inform the policy, decision-making, design and coordination of broadband development and spectrum usage.</p>	<ul style="list-style-type: none"> - 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 - A massively network virtualization platform for enabling global view, programmability and control of network elements and functions that is operationally accessible to operators anytime anywhere
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Long-term Objective	2018/19 Objectives
ICT Infrastructure (ctd)	
	<ul style="list-style-type: none"> - An open massively scalable mobile IPTV (mIPTV) system that integrates public Internet based media content ingestion, scheduling, broadcasting and video-on-demand (VOD) capabilities without viewer stream break-up, with improved low rate rural network performance and operationally accessible to micro-workers anytime anywhere - A blueprint for low-cost network elements and user interfaces tools and/or devices
Climate Change	
<p>The development of models and systems for predicting climate futures, and associated applications which define the impact of climate change in selected sectors.</p>	<ul style="list-style-type: none"> - Develop the Variable-resolution Earth System Model (VrESM) for projecting climate futures - Develop application models in the fields of agriculture, human health, air quality, and stream-flow / dam-levels - Continue to develop the observation platform and basic research to enhance domain expertise in the ocean-atmosphere-terrestrial environments - Initiate water-energy-resource nexus research program
Ecosystem Services	
<p>Develop appropriate maps, models, tools and frameworks to improve understanding of the relationship between ecological infrastructure and development options, and to enhance the design and management of multifunctional landscapes, coasts, oceans and rivers that deliver equitable and sustainable benefit flows to society and the economy in support of social development.</p>	<ul style="list-style-type: none"> - Enhance assessment of ecosystems (freshwater, terrestrial, coastal and marine) and their services through direct observation and remote sensing to improve decision-making and assessment of trade-offs - Develop operational support for rural landscapes, catchments and cities (coastal and inland) through development of long-term conceptual model/s of interactions between social-ecological systems, the ecosystem services they generate, ecological infrastructure, human wellbeing, equity and poverty. - Develop observational and measurement capability, long term databases, process understanding and modelling capability in coastal and shelf sea environments for operational support to maritime industries, management and authorities.
Renewable Energy	
<p>Technologies and processes to increase the share of renewable energies in South Africa's overall energy consumption</p>	<ul style="list-style-type: none"> - Carry out an assessment of the status of energy efficiency in the various end-use sectors in South Africa - Carry out an assessment of the state of play of the various existing and emerging energy efficiency and demand response technologies on the market
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Long-term Objective	2018/19 Objectives
Renewable Energy (ctd)	
	<ul style="list-style-type: none"> - Complete the indoor reliability and outdoor test facility, sample product, and conduct test protocols to provide a reliability test facility in SA for buyers to utilize during procurement, contract negotiations, and Operation and Maintenance to ensure lowest LCOE - Establishing robust technology-neutral standards and codes with all stakeholders which will enable and provide assurance to all players in the energy eco-system (policy makers, utilities, IPPs, and consumers etc) - Innovatively design cost-effective, simple and easy to install mounting structures, trackers etc and non-module components (approximately 60% of the total cost of a typical PV system) thereby reducing the cost of BOS resulting in lowest LCOE.
Holistic and integrated approach to national security	
<p>Address safety and security risks by means of a new holistic integrated approach taking into account how economic and social factors influence safety and security.</p>	<ul style="list-style-type: none"> - Ongoing work in wildlife trafficking and new areas including infrastructure security (water and electricity) at provincial level and municipal level, disaster management at provincial level and municipal level, and mitigating terrorism at national level. - Development of integrated interventions across different government departments and other stakeholders, for mitigating risks and realizing new futures by developing cross-organizational and multidisciplinary capabilities for mitigating risk.
Security sector capability development	
<p>Assist national institutions in the safety and security sector with technology and engineering systems support in order to deliver on their strategic objectives</p>	<ul style="list-style-type: none"> - Develop a full understanding of what the different governing entities (e.g. DPE, DPSA, Treasury (and GTAC), SITA, AG, etc.) require from national, provincial and local government - Support government departments with EA research, assessments and implementation to enable strategy development on a national level - Initiate the development of standardised artefacts, templates and methodologies for EA related work in support of all levels of government - Multimodal Biometrics: developing multimodal biometric system that would take advantage of the strengths of the various biometric modalities to authenticate identities of persons. - Multifactor authentication: developing multi-factor authentication systems using smart tokens coupled with biometric authentication to authenticate identities of people. - Network Intrusion Detection: development of network intrusion detection technology
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Long-term Objective	2018/19 Objectives
Security sector capability development (ctd)	
	<ul style="list-style-type: none"> - Network Penetration Testing – Develop network penetration testing skills Test and Evaluation Framework - Embedded Security – Develop capability, technologies and mechanisms that defend and protect information systems and critical infrastructure. - Data Confidentiality and Integrity – Development of technologies that impact the security and confidentiality of transactions, documents and biometric information.
Multi-agency command, coordination, and control	
<p>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</p>	<ul style="list-style-type: none"> - Implement the ability to graphically configure the dynamic rule-based engine. - Create the framework for the information fusion engine. - Configure a set of useful information fusion algorithms e.g. automatically extracting and linking a timeline for a user's patrol based on fusion of their blue force tracking and the events that they created - Develop the software framework and environment that will allow new models, algorithms and analysis services to be added in easily. - Configure all models, algorithms and analytics to run within the software framework. - Implement an algorithm for tracking analytics for the automatic and optimised extraction of waypoints from blue force tracking for operator routing and navigation. Different modes should also be available e.g. human, vehicle, UAV etcetera. - Implement image analytics to automatically detect, recognise and draw links between shoe prints from the same footwear. - Implement image analytics to automatically distinguish between humans and animals from camera trap still images. - Implement a simple anomaly detection model for maritime vessel sensor data. The model should first just perform analysis on the historic sensor data to determine possible anomalies at a data level e.g. large jumps in vessel positions indicating bad data.
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Long-term Objective	2018/19 Objectives
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.	<ul style="list-style-type: none"> - Development of capabilities for Simulation based decision support for acquisition and operational support for Airforce - Development of Capabilities for an independent, current, cost-effective weapons integration capability - Development of capabilities for current, cost-effective wind tunnel infrastructure and aerodynamic test and evaluation capabilities in support of guided weapons development and weapons integration - Development of insight, analysis and assessment capabilities for independent advice on propulsion systems - Development of capabilities for non-destructive testing of mechanical structures
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	<ul style="list-style-type: none"> - Development of a system level decision support capability to facilitate the development and integration of technologies across the Landward Operations spectrum - Development of tools, processes and technologies for characterization of conventional and unconventional threats experienced in the Landward theatre of operations - Development of tools, processes and technologies for protection against conventional and unconventional threats experienced in the Landward theatre of operations - Development of tools, processes and technologies for vehicle mobility optimisation across the varying terrains in the Landward theatre of operations" - Development of tools, processes and technologies for improved effectiveness of the soldier as a system within a system
SANDF Platform Protection	
Increase the survivability of SAAF and SA Navy platforms against optical (including infra-red) and radar-guided weapons	<ul style="list-style-type: none"> - Aircraft characterisation: Continue to characterise the RF and IR signature of aircraft through simulation and measurements, and advising our clients on optimal placement of countermeasures." - Atmospheric characterisation: Develop models for the influence of atmospheric conditions on counter measure performance. Verify and validate models by means of measurement. - Countermeasures: Develop a countermeasures and pointing system to assist in directed counter measure designation. - Incorporate counter measure models into the overall missile/aircraft engagement simulation. - Doctrine development: Continuous development and update on operating procedures to improve survivability.
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Long-term Objective	2018/19 Objectives
SANDF Platform Protection (ctd)	
	<ul style="list-style-type: none"> - Combined RF/IR survivability capability: Develop incremental capability for an IR/RF EW test range technology. - Survivability prediction confidence: develop tools for assessment of confidence in survivability prediction
National Surveillance and Situational Awareness	
<p>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</p>	<ul style="list-style-type: none"> - Radar and EO Sensor network design: Design, develop and test sensor networks for specific applications. - Image enhancement through computational imaging (EO and Radar) - Target of interest: Design, develop and test target detection, recognition and tracking algorithms. - Hosting platform sensor integration: Mount and integrate lightweight sensors on elevated platforms for better situational awareness. Develop mechanical motion simulators. Test and evaluate motion simulators. - Scene Background/atmosphere: Understand the scene background including atmosphere, sea surface and land (multispectral: Optical and RF). Develop models for reflections from the background. Develop background mitigation techniques. - Doctrine and training: Evaluate the client's existing doctrine and procedures for deploying sensor networks. Advise client on optimal doctrine to increase effectiveness. Develop an augmented reality environment to assist the client with training on new technologies. - Multi-sensor info presentation: Develop technology for effective management of data from various sensors. Determine fusion and display strategies for effective commander display. Develop test and evaluation multi-sensor information presentation in the field with real commanders. - EO Sensor: Develop specification and evaluation requirements for EO sensors for forensic investigations and evidence purposes. Develop image processing and calibration algorithms for improved image and video quality. - Satellite/space: Develop technology for processing of multispectral and hyperspectral data from UAVs and satellite sensors. Improved remote sensing for Identification of intruder/unwanted plants. Apply multispectral and hyperspectral techniques to camouflage detection and counter-camouflage. Develop procedures for satellite sensor calibration and validation of satellite data. - Camouflage: Develop techniques to evaluate camouflage effectiveness in various spectral bands. Develop and evaluate counter camouflage techniques. - Radar Sensor: Develop specification and evaluation requirements for next generation radar sensors and processing.
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Long-term Objective	2018/19 Objectives
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.	<ul style="list-style-type: none"> - Implementation of the National Cyber Security Policy Framework - SANDF cyber defense capability that can defend against current and future cyber threats, non-nation threats - Effective and Efficient National Cybercrime Combatting Capability
Unmanned Defence Systems	
Support the strategic, operational and tactical potential of unmanned systems.	<ul style="list-style-type: none"> - Develop Systems Development and Integration capability for the development of novel unmanned aircraft systems - Development of small to medium UAV systems for sub-system and in-field experimentation. - Development of a demonstrator Gas Turbine system
Special Forces Capability	
We will maintain capabilities to support and maintain a Maritime, Airborne/Landwards and Combating Terrorism Special Operations Capability for Special Operations	<ul style="list-style-type: none"> - Developmental engineering challenges/ requirements focused on Maritime and Airborne/ Landwards Special Operations operational capability development and maintenance. - Applied operational research challenges/ requirements focused on Maritime and Airborne/Landwards Special Operations operational challenges. - Engineering challenges/ requirements to optimise main maritime and airborne/ landwards equipment for urgent Special Operations operational deployments. - SCAMP acquisition of integrated maritime special operations main equipment. - Tactical Escape Safety Simulator (TESS) program. - Maritime security and risk analysis for the marine mining industry. - Establishment and maintenance of specialised Environmental Asset Protection (EAP) capabilities. - Establishment and maintenance of Multi-Intelligence Technology Integration Center (MITIC) and Threat Intelligence Cyber Forensics Center (TICF)
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Long-term Objective	2018/19 Objectives
E-Health	
<p>Develop a standards framework for interoperability of eHealth systems, and establish a national regime for implementation of interoperability standards.</p>	<ul style="list-style-type: none"> - eHealth: The focus will be on addressing the problem of fragmentation of health information systems by implementing (in partnership with the Department of Health) a national regime for standards-based health systems interoperability. This will include 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 (such as the Health Patient Registration System and the National Health Information Exchange).
Health Technology	
<p>Develop a portfolio of medical devices, sensors and information systems to provide Point-of-Care assistance for foetal health, cardiovascular diseases, blood screening, and medical visualisation and analysis</p>	<ul style="list-style-type: none"> - Develop the PoC platform where laser-based medical devices, sensors and information systems to provide PoC assistance, comprising screening for various micro-organisms such as HIV-1, Malaria, Typhoid and TB will be designed. - Continue development of a portfolio of intelligent, connected, sensor devices targeted at impact in the health, infrastructure and safety and security markets that realise the benefits of emerging technologies like IoT and Big Data
Burden of Disease	
<p>Provide low cost and tailored protein expression, protein characterisation and pilot manufacturing services in human and animal health for therapeutic proteins, vaccines and adjuvants, and develop cutting-edge knowledge based science in gene engineering, cellular biology and pharmaceuticals chemistry that supports the development of innovative pharmaceutical products.</p>	<ul style="list-style-type: none"> - Build on Novel approaches to understand, diagnose and manage disease mechanisms at cellular and molecular level - Establish a bioengineering capability - Understand host's determinants for optimal response to therapy and develop a pharmacogenomics-based diagnostic intervention for patients with clinical end-users. - Exploit the novel biochemical mechanisms to create new effective drugs against resistant strain infections. - Provide cutting edge, cost efficient, yet high throughput tools for screening drugs against specific genetic profiles - Develop novel malaria transmission/infection blocking models and identify natural products active against malaria. - Establish a bioengineering capability with a clear focus to develop biomimicry tools such as organ on chip, in silico predictive models including microfluidics based systems.
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Long-term Objective	2018/19 Objectives
Urban Modelling	
Decision and planning support, on city and regional development futures, through advanced spatial analysis and modelling; Enabling smarter decision making, with a particular focus on Urbanisation.	<ul style="list-style-type: none"> – Enhance access to stakeholders via UrbanSim technology. This is done through the development of a “cloud based” UrbanSim. – Establish a customised Cellular Automata model for developing country context. A TD will be developed and customised for SA context. – Continue with planning support. Policy impact on spatial prioritisation of investment. – Explore alternative input models re: economics; demographics and environment into Cellular Automata model and UrbanSim. In-house capability will be developed on at least one of the input models. – Continue to develop spatiotemporal data analysis capability through a range of implementation projects.
Spatial Prioritisation Policy	
Develop policies on the spatial prioritisation of infrastructure investment, and develop an enhanced spatio-temporal capability for advanced spatial planning.	<ul style="list-style-type: none"> – Continue to grow competence in human settlement planning and design. – Develop tools / guidelines such as the second draft of the Guidelines for Human Settlement Planning and Design (Red Book). – Continue to enhance the current body of knowledge on crime science – Develop the final version of an urban innovation knowledge hub.

Table B.2: SO2: Research Impact Areas 2018/19 Objectives

B.3.2 Strategic Programs

Long-term Objective	2018/19 Objectives
Emerging Research Areas	
National Centre for Nanostructured Materials (NCNSM): 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)	<ul style="list-style-type: none"> – Amka products available to the market and first royalty income realised – Commercial level production of highly nucleated polypropylene nanocomposites – Large-scale production of ZnO and MoS2 nanoparticles – Optimization of lab-scale production of graphene oxide – Large-scale production of silver decorated Clay nanoparticles – Miniaturised breathalyser finalised – Characterisation Facility achieves ISO17025 accreditation – Initiation of nanofiber-based low pressure desalination project
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Long-term Objective	2018/19 Objectives
Synthetic Biology: Translation of Synthetic Biology R&D with the aim to introduce a strong focus on developing bioengineered tools that will bring precision medicine tools closer to the industry	<ul style="list-style-type: none"> - Expansion of high throughput screening platform to support local pharmaceutical R&D. - Establish a bioengineering capability with a clear focus to develop biomimicry tools such as organ on chip, in silico predictive models including microfluidics based systems. - Exploit the novel biochemical mechanisms to create new effective drugs against resistant strain infections. - Provide cutting edge, cost efficient, yet high throughput tools for screening drugs against specific genetic profiles.
Mobile Autonomous Systems: Developing autonomous systems with the intelligence to navigate environments that are unstructured, dynamic, cluttered and are able to interact with humans. Developing capabilities that enable flexible and adaptable systems for industrial processes.	<ul style="list-style-type: none"> - Building capabilities in data analytics, computer vision, and machine learning to support automation and real time decision support. - Building capabilities in computer vision and machine learning which would support intelligent autonomous decisions - Establish capability in intelligent systems to optimise operations in industrial environments
Thematic Program	
Support the development of new areas of science, engineering and technology (SET) and enhance existing SET platforms	<ul style="list-style-type: none"> - Support additional 4 long term thematic projects - Support additional 4 focussed thematic projects - Support existing (8) long term thematic projects - Support the continuation/maturation of finalized projects where necessary (leveraged funds)

Table B.3: SO2: Strategic Programs 2018/19 Objectives

B.3.3 Emerging Strategic Initiatives

Long-term Objective	2018/19 Objectives
Integrated Water Research Centre	
Develop and implement an Integrated Water Research Centre	<ul style="list-style-type: none"> - Develop Framework, Strategy and Operational Plan - Source and secure financial resources to execute operational plan - Source and recruit (or migrate from existing water research groups with CSIR) suitable Human Capital to execute operational plan

Table B.4: SO2: Emerging Strategic Initiatives 2018/19 Objectives

B.3.4 Ring Fenced DST Initiatives

Long-term Objective	2018/19 Objectives
National Intergrated CyberInfrastructure Systems	
<p>To provide a world class national integrated cyberinfrastructure system that enables research, innovation and learning comprising a national high performance computing facility (CHPC), a national research and education network (SANReN) and a national research data infrastructure (DIRISA) accessible across the research and higher education sector through integrated eResearch and eLearning services and the development of relevant human capital</p>	<ul style="list-style-type: none"> - Fully operationalize NICIS as a separate operating centre within CSIR - ≥ 1 PetaFlop high performance computing capacity available 90% with 70% average utilisation - Total available broadband capacity at 3200Gbps - 4-6 Pb data storage available with 90% service accessibility
ICT RDI Roadmap	
<p>The investment is aligned with the ICT RDI Roadmap and utilised to ensure CSIR contribution to RDI that brings the country closer to the goals of the ICT RDI Roadmap.</p>	<ul style="list-style-type: none"> - 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
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Long-term Objective	2018/19 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	<ul style="list-style-type: none"> – See Additive Manufacturing and Laser-based Engineering in Section B4.1 – Develop and transfer PoC diagnostic assays for devices which are Affordable, Sensitive, Specific, User-friendly, Robust, Equipment free, Deliverable to users (ASSURED). – For the Photonic Prototyping Facility to provide 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 management the following National Programmes: <ul style="list-style-type: none"> – Through the Rental Pool Programme 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. – Support three sub-programmes, The African Laser Centre (ALC) i.e.: Mobility, bursaries and training

Table B.5: SO2: Ring-Fenced DST Initiatives 2018/19 Objectives

B.4 SO3: Conduct Relevant Research to Foster Industrial Development

B.4.1 Research Impact Areas

Long-term Objective	2018/19 Objectives
Titanium Beneficiation	
Develop key technology building blocks for the establishment of a SA Titanium metal industry	<ul style="list-style-type: none"> – After a significant breakthrough in pilot scale production of titanium powders, 2018/19 will be focused on progressing the technology to TRL7 as well as developing a suite of associated demonstration products for the automotive and aerospace industries.
Additive Manufacturing	
Development of additive manufacturing platforms to create new manufacturing processes for the aerospace and other sectors (Aeroswift and associated technologies)	<ul style="list-style-type: none"> – Demonstration of aerospace capabilities through the production of prototypes for testing in the aerospace and automotive industries – Continued development and improvement of aeroswift functionality (build geometries, enhanced deposition and welding) – Development of associated polishing and processing of manufactured parts for industrial application
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Long-term Objective	2018/19 Objectives
Additive Manufacturing (ctd)	
	<ul style="list-style-type: none"> - Development of novel welding technologies for additional metals and metal composites
Enterprise Creation and Development	
<p>Assist local and provincial government with the development and implementation of sector and local economic development strategies, with the creation of enterprises and with the transfer of technology.</p> <p>Technology and business support for new market entrants across through prototyping facilities (IIP programme</p>	<ul style="list-style-type: none"> - Establish a strong internal business development capacity - Strengthen and expand implementation capacity - Align economic activities with CSIR Industrial development strategy - Twenty technology-based enterprises established. - Ten technologies transferred to industry. - Training of ten economic development practitioners.
Technology Localisation	
<p>Support of the long-term industrialisation and industrial diversification of the economy in prioritised industrial sectors through technology localisation. This includes programmes such as the AISI, the Bio-composites Centre of Competence (BCC) and the NFTN.</p>	<ul style="list-style-type: none"> - Increase the number of industrial development programmes and projects – These projects aim to make a difference to industry by identifying needs and providing solutions to stakeholders. - Support supplier development programmes in support of public procurement. This activity aims to strengthen the country's capability to localise production and services. - Integrated focused skills development programmes, including technical training such as resources efficiency, cleaner production, Innovation, R&D and training for academics, technicians and engineers. - Technology transfer and new industries development - Develop and implement manufacturing systems to address competitiveness - Conduct assessments to identify, evaluate & recommend implementable RECP cost saving options
Digital Opportunities	
<p>Our aim is to develop an innovative Micro Enterprise Media Engine platform with content ingestion, programme scheduling and timed play-out service for virtual television stations.</p>	<ul style="list-style-type: none"> - Continue with the development of an innovative Micro-Enterprise Media Engine (MEME) platform with the addition of a Video on demand (VOD) service - 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
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Long-term Objective	2018/19 Objectives
Laser-based Engineering	
<p>The development and transfer of laser-based surface engineering and refurbishment applications that will support the refurbishment and maintenance of existing equipment, plant, and infrastructure requirements of the South African industry.</p>	<ul style="list-style-type: none"> - Develop optical technologies and lasers in close cooperation with users of laser-based engineering. Modifying existing high-power lasers using existing CSIR know-how and patents. Maintain an expertise base in advanced manufacturing by serving SMMEs through laser-based manufacturing services to provide the SMMEs with a global competitive edge by enabling innovated design and production technologies. - Reduction in operational costs for industries of manufacturing, transport and power generation. This will be achieved through the extension of the life expectancy of high-value infrastructure, assets and components to increase maintenance intervals, to reduce down-time and to minimise replacement costs.
National Large Scale Engineering Capability	
<p>Establish a Complex-Product Lifecycle Management initiative/demonstration centre for industry which will target all engineering disciplines through the integration of critical cross-functional activities.</p>	<ul style="list-style-type: none"> - Establishment of PLM capability and office - Develop business plan for a Next Industrial Revolution (NIR) research factory - Official launch of NISI - NISI officially established and facilities opened to industry. NISI website established
Resource Efficiency – National Cleaner Production Centre-South Africa	
<p>The NCPC-SA promotes the efficient utilisation of resources through the provision of relevant training programmes for industry.</p>	<ul style="list-style-type: none"> - Conduct 180 assessments (water, energy, waste and materials) to identify, evaluate and recommend implementable RECP cost saving options - Achieve a 10% increase in savings by increasing uptake (including SMEs) by upscaling of tools available to a larger group of companies
ICT for Industrialisation	
<p>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.</p>	<ul style="list-style-type: none"> - 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
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Long-term Objective	2018/19 Objectives
ICT for Industrialisation (ctd)	
	<ul style="list-style-type: none"> - 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 virtualization 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 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
Transport Infrastructure	
<p>Improve the quality of road engineering by developing better materials; design and construction methods; and maintenance and performance monitoring standards</p>	<ul style="list-style-type: none"> - 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) - Establishment of Road Research Capacity in at least six African and Southeast Asian countries - Development and utilisation of new-generation Road Technologies to develop better construction and maintenance processes - Development of next-generation road construction products which will facilitate the creation of new start-ups or strengthen existing private sector companies - Identification and trialling of smart sensors and technologies - Development of advanced performance models for high volume roads (e.g. pavement deterioration models) - Development and trialling of advanced binder technologies (organic/polymeric/cementitious)
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Long-term Objective	2018/19 Objectives
Green Economy Solutions	
<p>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</p>	<ul style="list-style-type: none"> - 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 unlocking green economy growth from the solid waste sector - Launch the forest and waste biomass biorefinery R&D platform - Roll out and transfer of the CSIR Waste Source Separation technology (SASCOST) model to local municipalities

Table B.6: SO3: Research Impact Areas 2018/19 Objectives

B.4.2 Strategic Programs

Long-term Objective	2018/19 Objectives
Industry Innovation Partnership	
<p>Support targeted industrial sectors through providing access to large-scale prototyping and pre-commercial manufacturing infrastructure, equipment, expertise and access to business and technical networks.</p>	<ul style="list-style-type: none"> - Official Launch of the Biorefinery and Photonics facilities - Amka products available to the market and first royalty income realized - Commercial level production of highly nucleated polypropylene nanocomposites - Large-scale production of ZnO and MoS2 nanoparticles - Support six (6) SMMEs and four (4) established companies in bio-based technology/process development - Develop 2-3 photonics based prototypes in collaboration with industry. - Upscaling of sawdust waste to nanocrystalline cellulose production; and demonstration technology for beneficiating sawdust into beneficiation into pine oil and subsequent conversion to phytosterols
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Long-term Objective	2018/19 Objectives
Flagship Program	
The objective of the flagship programme is to address identified societal issues through large integrated interventions.	– Identify and Initiate at least 2 new flagship programs (aligned industrial priorities identified through Project Synapse).

Table B.7: SO3: Strategic Programs 2018/19 Objectives

B.4.3 Emerging Strategic Interventions

The CSIR will, during the 2018/19 financial year refine its strategic initiatives in support of industrial development. However, there are programmes which are emerging, which the CSIR will pursue during the coming year. These include;

The Engineered Products Platform:

Participating in Global value chains, where South Africa has demonstrated excellence in automotive, aerospace and defence industries, where we already participate in high value global value chains that it can leverage to expand exports building on recognised success to date. These sectors are already highly innovative, and have the ability and absorptive capacity to capture a share of the global high value activity, and advances in these sectors will have spill over effects in other sectors. The strategy here is to expand the volume and value of products, and to develop world class supply chain to support the OEMs in these spaces. The assembled products platform will Tier 1 and higher level suppliers with various capabilities in product design, manufacturing process, manufacturing execution and advanced manufacturing platform to include advanced manufacturing techniques, precision engineering etc.

The Pharmaceuticals Initiative;

Addressing gaps in national manufacturing capabilities to reduce trade balance of payments deficits. The Pharmaceuticals sector in South Africa is import driven, and it's the 5th largest contributor to the negative balance of trade payments. The sector has a two tiered market, with the private sector comprising 79% of market value, serving only 16% of population (2015), while the remaining expenditure, 21% serves 84% of the population (2015 data). The SA reliant on Asian imports for critical drugs, and critical drug shortages have recently been experienced. The challenge is that there is limited capacity for manufacture of active pharmaceutical ingredients. These include limited and/or outdated local infrastructure, high cost of local cGMP setup (equipment imports, labour sector) and lack of key pharmaceutical manufacturing skills. The CSIR strategic response is to address import substitution through contribution to local pharmaceuticals manufacturing capabilities, specifically flow chemistry and related skills. Specifically, the CSIR will contribute to process chemistry and scale-up (including biocatalysis), in particular flow chemistry for API manufacturing (emerging capacity). The CSIR is in discussions with the dti, the dst and the private sector in advancing this programme.

Four cross cutting thematic areas will apply to all the manufacturing related initiatives, notably product innovation (includes life cycle management approach to product design), manufacturing process (e.g. forming, joining, machining technologies), manufacturing automation (includes precision measurement and automation) and manufacturing systems (includes planning, manufacturing execution and control, operations management etc).

For each of the new programmes, the CSIR will invest in:

- Refining the focus of the programme with industry stakeholders and in
- Developing an innovation ecosystem (University industry)
- Developing the appropriate business model for each initiative
- Mobilising resources for the specific initiative
- Identifying the SMMEs to work with
- Defining the capabilities to be built or each intervention.

The Internal Operating Environment: Change Management

The business model, organisational architecture, the tools systems and processes to support the defined initiatives were also reviewed and quick wins identified. Thus the CSIR will invest significantly into a change management process to position the CSIR to deliver on the vision of the strategy.

The CSIR will thus put in place an implementation and roll out capability to address issues of programmatic focus, organisation architecture, business models, systems and processes in line with the recommended global best practises.

B.5 SO4: Infrastructure Renewal and Development

During the 2018/19 financial year the CSIR plans to invest R 61 million in Property, Plant and Equipment.

The [Campus Planning Development Office \(CPDO\)](#) has been established to oversee the implementation of the Campus Master Plan. During this financial year the CPDO will focus on the following interventions:

- The development of a investment/funding strategy, including the possibilities of funding from National Treasury and the establishment of public-private partnerships;
- Sourcing of funding for the initial priority projects (including the Visitor Centre and a shared Laboratory space);
- The preparation of detailed feasibility studies for the prioritised list of projects.

The Energy Autonomous Campus project will proceed with the first phase of the installation of rooftop photo-voltaic plants, as well as feasibility studies for the installation of a wind turbine and a Biogas plant. During this period demand-side interventions to reduce electricity demand by 5% will also be identified.

B.6 SO5: Financial Sustainability and Governance

The CSIR is forecasting a net loss of R31.9 million for the 2017/18 financial year. The forecasted loss is as a result of the negative financial and economic climate in South Africa and a reduction in total operating revenue and contract income of 9% and 12% respectively compared to the 2017/18 budget.

Based on the forecasted loss for the 2017/18 financial year, a break-even net margin is budgeted for 2018/19 financial year. The CSIR has experienced high growth in contract income and SET base in the past years, this growth is however no longer sustainable in 2018/19 and therefore the organization needs to stabilize and consolidate its position to ensure sustainable growth into the future.

Notwithstanding the budgeted break-even margin of 2018/19, the CSIR will remain financially sustainable and continue as a going concern through the continued active management of expenses and also through the implementation of Project Synapse.

Despite having to decrease growth projections for contract income from the 2017/18 budget, the 2018/19 budgeted contract income of R1.97 billion increases by 5% from the 2017/18 forecast.

Conservative balance sheet practices, including working capital and cashflow management, will continue to allow CSIR to leverage its investment in scientific equipment and infrastructure. This investment is determined by taking into account considerations such as strategic alignment, return on investment and available cash flow.

The continued growth of income streams and securing of strategic business partnerships with key clients will remain important in the forthcoming financial year to strengthen the balance sheet.

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% in total operating revenue (see Table B.8). Contract income and baseline grant funding increase on a comparative basis by 5% respectively.

Income from the South African public sector and South African private sector is budgeted to increase by 8% and 16% respectively, based on secured contracts and through active engagement with stakeholders and clients to secure contracts for proposals submitted.

International contract income is budgeted to decrease by 8% as a result of some large contracts not continuing.

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.

B.6.2 Expenditure

Total expenditure is budgeted to increase by 4%, with employee remuneration costs, operating expenses and depreciation budgeted to increase by 6%, 1.1% and 1.9% respectively.

The increase in employee related costs is determined by taking into consideration the human capital development costs, annual planned salary increase as well as the decrease in 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.

Operating expenses is budgeted to increase slightly by 1.1%. Included in the current financial years operating expenses are contract-specific expenses which are offset by the associated income; this explains the decrease in operating expenses.

Based on the current economic climate and the decreased growth projections on contract income, strict cost containment measures have been implemented in the CSIR.

The slight increase in depreciation is due to affordability considerations and the availability of cash flow. 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 masterplan has not been included in the budget as this is dependent on the securing of external funding.

B.6.3 Royalty income and other income

Royalty income is budgeted at R4.1 million and includes anticipated royalty flows. Royalty income is budgeted to decrease with R1.1 million (27%) from the 2017/18 budget. The decrease in the budget of 2018/19 and the forecast for 2017/18 is a result of royalty streams terminating or transferring in the next financial year. It is anticipated that sales volumes for royalties on non-commodity products will be lower in the next financial year and hence the expected royalty stream has been decreased. The CSIR is finalising fourteen new license agreements on which nominal returns are expected by the end of the 2018/19 financial year.

Included in the 2017/18 forecast is other income of R1.7 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.

Included in the 2018/19 forecast is other income of R5.9 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 2018/19 budget indicates a break-even net margin against the 2017/18 budgeted net profit of R 64 million. The R 64 million decrease in net margin is due to a reduction in total operating revenue and contract income of 9% and 12% respectively. The reduction in contract income from the 2017/18 budget is due to the negative economic climate and thus contracts not being secured as planned, delays on large contracts, and stringent legislative requirements resulting in time consuming tender processes.

As a result of the decrease in total operating revenue and contract income, all expenses are strictly managed resulting in an operating expense increase of only 1.1% from the 2017/18 forecast.

Investment income is expected to amount to R 39.4 million.

Table B.8 provides the high-level CSIR statement of comprehensive income reflecting the forecast for 2018/19 and the budget for 2018/19. A statement of comprehensive income for the Medium Term Expenditure Framework (MTEF) period is provided in Table B.9.

	Forecast 2017/18 (R'000)	Budget 2018/19 (R'000)
Total Operating Revenue	2,602,815	2,740,284
Contract R&D Income	1,867,643	1,969,524
Public – South Africa*	1,402,061	1,514,445
Private – South Africa	182,957	213,742
International	180,417	166,703
Parliamentary Grant – Ring-fenced*	102,208	74,634
Parliamentary Grant	729,359	766,760
Royalty income	4,082	4,000
Other income / (expenditure)	1,731	–
Total Expenditure	2,674,482	2,779,684
Employees' remuneration	1,532,118	1,624,285
Operating expenses	1,060,609	1,072,070
Depreciation	81,755	83,329
Operating Profit before Investment Income	(71,667)	(39,400)
Investment Income	39,744	39,400
Net profit before non-guaranteed employees' remuneration (Performance bonus)	(31,923)	0
Non-guaranteed employees' remuneration (Performance bonus)	–	–
Net profit	(31,923)	0

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

The CSIR forecasts a net profit of 0 for 2018/19. This is a short-term deviation and we expect to return to profitability during the 2019/20 financial year.

Table B.8: Statement of Comprehensive Income

Category	2018/19 R'000	2019/20 R'000	2021/22 R'000
Baseline Parliamentary Grant	766,759	807,780	852,209
Parliamentary Grant	737,247	776,615	819,330
National Laser Centre	29,512	31,165	32,879
Ring fenced allocation	285,437	303,273	319,952
Laser Loan Programme	8,664	9,149	9,653
African Laser Centre	4,733	4,988	5,273
Implementation: ICT R&D Strategy	64,724	68,348	72,107
Cyber Infrastructure (NICIS)	207,316	220,778	232,919
Total	1,052,196	1,111,053	1,172,161

Table B.9: Medium Term Expenditure Framework allocation to the CSIR (excl VAT)

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.10 provides a summary projected balance sheet.

One needs to consider the budgeted cash balance of R812 million in conjunction with the current liabilities of R1 billion. The current ratio (current assets/current liabilities) is expected to remain at about 1.2.

B.6.6 Investment in property, plant and equipment

The budgeted investment in property, plant and equipment for the 2018/19 financial year is R61 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 cashflow.

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 three 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 its environment, health and safety record.

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

	Forecast 2017/18 (R'000)	Budget 2018/19 (R'000)
ASSETS		
Non-Current assets	825,663	815,523
Property, plant and equipment	794,535	791,862
Interest in Joint Ventures and Associates	22,744	19,011
Interest in subsidiaries	5,436	4,650
Trade and other receivables	2,948	–
Current Assets	1,176,958	1,220,586
Trade and other receivables	277,203	294,947
Inventory and contracts in progress	107,896	113,595
Cash and cash equivalents	791,859	812,044
TOTAL ASSETS	2,002,621	2,036,109
EQUITY AND LIABILITIES		
Reserves	992,243	992,243
Retained earnings	992,243	992,243
Non-current liabilities	10,764	10,872
Post-retirement medical benefits	10,764	10,872
Current liabilities	999,614	1,032,994
Advances received	537,460	565,846
Trade and other payables	462,154	467,148
TOTAL EQUITY AND LIABILITIES	2,002,621	2,036,109

Table B.10: Projected CSIR statement of financial position

- Improve its performance on employment equity in line with its employment equity goals,
- Review its 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: 2018/19

Indicator	Q1	Q2	Q3	Q4
SO1: Build and Transform Human Capital				
Total Size of SET Base	1,860	1,860	1,860	1,860
Number of SET Base who are Black	1,160	1,160	1,160	1,160
– Percentage of SET Base who are Black	62%	62%	62%	62%
– Number of SET Base who are Female	687	687	687	687
– Percentage of SET Base who are Female	37%	37%	37%	37%
– Number of SET Base with a PhD	352	361	369	369
– Percentage of SET Base with a PhD	19%	19%	20%	20%
Total Chief Researchers	20	20	20	23
– Number of Chief Researchers who are Black	1	1	1	3
– Percentage of Chief Researchers who are Black	10%	10%	10%	13%
– Number of Chief Researchers who are Female	3	3	3	3
– Percentage of Chief Researchers who are Female	15%	15%	15%	13%
Total Principal Researchers	205	207	209	210
– Number of Principal Researchers who are Black	52	54	55	57
– Percentage of Principal Researchers who are Black	25%	26%	26%	27%
– Number of Principal Researchers who are Female	38	39	40	41
– Percentage of Principal Researchers who are Female	19%	19%	19%	20%
SO2: Conduct High-Quality Research to foster Scientific Development				
Publication Equivalents	64	129	241	480
Journal Articles	60	120	150	310
New Patents	3	7	9	15
Contract R&D Income (Rm)	R 304 m	R 817 m	R 1,235 m	R 1,970 m
SO3: Conduct Relevant Research to foster Industrial Development				
New Technology Demonstrators	0	0	0	50
Royalty and License Income (Rm)	R 1 m	R 2 m	R 2 m	R 4 m
SO4: Infrastructure Renewal and Development				
PPE Investment (Rm)	R 15 m	R 30 m	R 46 m	R 61 m
SO5: Financial Sustainability and Governance				
Total Income (Rm)	R 422 m	R 1,137 m	R 1,718 m	R 2,740 m
Net Profit (Rm)	R 0 m	R 0 m	R 0 m	R 0 m
B-BBEE Rating	Level 2	Level 2	Level 2	Level 2
DIFR	≤0.2	≤ 0.2	≤0.2	≤0.2

Table B.11: CSIR Quarterly Targets: 2018/19

Governance Structure

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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 T. Majozi (Chairperson)
- Dr. T Dlamini (CEO)
- Adv. G Badela
- Ms P. Baleni
- Dr P. Goyns
- Dr A. Llobell
- Dr R. Masango
- Ms M. Maseko
- Mr J. Netshitenzhe
- Ms A. Noah

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

Research, Development and Innovation

Dr P. Goyns (Chair)
 Dr A. Llobell
 Dr R. Masango
 Mr J. Netshitenzhe
 Mr Thami Mtshali (co-opted member)
 Mr Rudi Heydenrich (co-opted member)

Audit and Risk

Ms A. Noah (Chair)
 Adv. G Badela
 Ms P. Baleni
 Ms M. Maseko

Human Resources and Remuneration

Adv. G Badela (Chair)
 Ms P. Baleni
 Dr P. Goyns
 Mr J. Netshitenzhe
 Dr R. Masango

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

Age	Sex	Race	Qualification	Years	Position on other Boards
Prof T. Majozi (Chairperson)					
45	Male	Black	<i>University of Manchester Institute of Science and Technology</i> PhD (Process Integration) <i>University of Natal</i> M.Sc (Engineering) B.Sc (Chemical Engineering)	3	<i>Director</i> A1 Consulting Engineers CC Zyblue Pty Ltd
Dr. T Dlamini (Chief Executive Officer)					
48	Male	Black	<i>University of Witwatersrand</i> B.Sc Chemistry B.Sc (Hons) Chemistry PhD Chemistry, Catalysis <i>University of South Africa</i> Masters in Business Leadership	1	<i>Council Member:</i> University of KwaZulu Natal Council <i>Advisory Board Member:</i> University of Stellenbosch, Centre for Renewable and Sustainable Energy Studies <i>Advisory Committee Member:</i> National Nanotechnology SHE Advisory Committee
... continued on next page					

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Age	Sex	Race	Qualification	Years	Position on other Boards
Dr R Masango					
43	Female	Black	<p><i>Pennsylvania State University</i> PhD (Nuclear Engineering) M.Sc (Nuclear Engineering)</p> <p><i>Lyceum College</i> Diploma in Project Management</p> <p><i>Cape Peninsula Univ. of Tech.</i> B. Tech Degree (Chemical Engineering)</p>	3	<p><i>Executive Director</i> Mzansi Energy Solutions and Innovations (Pty) Ltd (Mzesi) Mzesi Energy Mzesi Academy</p> <p><i>Non-Executive Director</i> ArioGenix Face to Face Foundation Redhorn Holdings Mzesi Water & Construction Yonga Energy Tingo Technologies Amanzi Technologies Certo Project Integrators Africa Energy Wise Solutions Zondibex Miyezi Investments</p>
Ms A Noah					
51	Female	Black	<p><i>University of Cape Town</i> B.Sc (Electrical Engineering)</p> <p><i>International Management Centre</i> MBA</p> <p><i>University of the Witwatersrand</i> Executive Development Programme</p> <p><i>Harvard Business School</i> Advanced Management Program</p>	3	<p><i>Chairperson</i> Energy Access Partnership</p> <p><i>Board Member</i> The SA National Energy Association</p>
Dr PH Goyns					
44	Male	White	<p><i>University of the Witwatersrand</i> PhD (Energy Studies) M.Sc (Mechanical Engineering) B.Sc (Mechanical Engineering)</p>	7	None
Dr A Llobell					
63	Male	White	<p><i>University of Sevilla</i> PhD (Biology) M. Sc (Biological Sciences)</p>	3	<p><i>Chief Executive Officer</i> BioGold International</p> <p><i>Managing Director</i> Biogold Network EM, SA</p> <p><i>Shareholder and Director</i> Bio Innovation (Pty) Ltd</p> <p><i>Shareholder</i> ANB Investments (Pty) Ltd</p>
... continued on next page					

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Age	Sex	Race	Qualification	Years	Position on other Boards
Ms P Baleni					
51	Female	Black	University of the Witwatersrand B.Proc LLB	3	Employee Gauteng Provincial Government Chairperson MERSETA Council Member Wits University Council Board Member IIASA NMO (RSA) Trustee Rev LW Mbete Trust
Ms M Maseko					
42	Female	Black	University of South Africa B Compt (Hons) CA (SA)	3	Director Leruo Corporate Consulting Member Independent Regulatory Board of Auditors SA Institute of Chartered Accountants Partner PSTM CAs
Adv G Badela					
60	Male	Black	Leningrad Polytechnic Institute M.Sc (Electromechanical Engineering) University of Johannesburg M.Sc (Engineering Management) Brunel University M.Sc (Packaging Technology) University of South Africa LLB Gordon Institute of Business Science MBA	7	Director Amagcisa Integrated Solutions AMAGCISA Holdings ENRICO BABEMA BAGAWA Intrepidus Forensics
Mr J Netshitenzhe					
62	Male	Black	University of London M.Sc (Financial Economics) Post-graduate Diploma (Economic Principles) Institute of Social Sciences, Moscow Diploma (Political Science)	3	Executive Director Mapungubwe Institute for Strategic Reflection Director Nedbank Group Nedbank Life Healthcare Group Lushite Trading (Fledgling) Topaz Sky Trading 316 (Fledgling) Betescape (Dormant) Member African National Congress NEC Camel Rock Trading 434 (Dormant) Centre for Education in Economics and Finance Africa

Table C.1: CSIR Board

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 four portfolios:

- **Finance** – Chief Financial Officer, Ms Zanele Ngwepe
- **Research, Development and Innovation** – Group Executive: RDI, Dr Molefi Motuku
- **Human Capital** – Group Executive: Human Capital, Ms Sithembile Bhengu
- **Legal, Compliance and Business Enablement** – Group Executive: Legal, Compliance and Business Enablement, vacant (acting, Dr Rachel Chikwamba)

The current initiatives, Project Synapse and the Campus Master Plan, will be moved into the office of the CEO. This will ensure that there is sufficient leadership support and oversight to drive these initiatives forward. Dr Rachel Chikwamba will continue to lead Project Synapse for the duration of the project.

In addition to reducing the size and cost of executive these new arrangements will streamline the decision making process, ensure balance of competencies in ExCo, improve the efficiency of support services and simplify the management of innovation and stakeholder engagement, amongst others.

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

Age	Sex	Race	Qualification	Years	Position on other Boards
Ms Z Ngwepe, Chief Financial Officer					
39	Female	Black	CA (SA)	0	None
Dr R Chikwamba, acting Group Executive: Legal, Compliance and Business Enablement					
48	Female	Black	<i>University of Queensland</i> M.Sc (Agricultural studies) <i>Iowa State University</i> PhD (Genetics) <i>Gordon Institute of Business Science</i> MBA	13	<i>Member</i> Academy of Science of South Africa Global Governing Board, ICRISAT South African Medical Research Council Board <i>Advisory Board</i> Institute for Science and Technology Education, UNISA Wits Health Consortium (Pty) Limited <i>Chair of Advisory Board</i> Applied Center for Climate & Earth System Science
Dr M Motuku, Group Executive: Research, Development and Innovation					
52	Male	Black	<i>University of Alabama, Birmingham</i> PhD (Materials Engineering) M.Sc (Materials Engineering) <i>Tuskegee University</i> B.Sc (Mechanical Engineering) B.Sc (Physics) <i>James Park College, SA</i> Engineering Trade Certificate/Artisan <i>Shikoane Matlala Technical College</i> N6, National Technical Certificate	6	<i>Council Member</i> Southern African Institute of Mining & Metallurgy Vaal University of Technology Council Member and Audit & Risk Committee <i>Board Member</i> DST/National Research Foundation Centre of Excellence in Strong Materials, Witwatersrand University <i>Director</i> Boundary Estate Home Owners Association
Ms S Bhengu, Group Executive: Human Capital					
40	Female	Black	<i>University of South Africa</i> PGD Management, Human Resources Bsc Hons Social Science	0	<i>Director</i> Expo for Young Scientists NOCs

Table C.2: CSIR Executive Management

Risk Management Strategy (Plan)

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D.1 Introduction

The underlying premise of Enterprise Risk Management (ERM) is that 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. ERM deals with risks and opportunities affecting value creation or preservation and is defined as follows:

“Enterprise Risk Management is a process, effected by the Board, Executive Management and personnel, applied in strategy setting and across the operations of the enterprise, designed to identify potential events that may affect the entity, and manage associated risk to be within acceptable levels, to provide reasonable assurance regarding the achievement of entity objectives.”

Uncertainty presents both risk and opportunity, with the potential to erode or enhance value. Enterprise Risk Management (ERM) enables the organisation to effectively deal with uncertainty and associated risk and opportunity, 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.

The CSIR has classified the top risks into the following broad categories:

- Systemic risks.
- Strategic risks.
- Operational risks.

Systemic risks originate from the environment within which the CSIR operates, and the risks emanate from local and global macro-economic factors and national challenges affecting the National System of Innovation and the National Government Business Enterprise space in which the CSIR operates.

Strategic risks directly impact on the ability of the CSIR to deliver on its mandate, and are related to the manner in which the organisation identifies, quantifies, and mitigates any risk that affects or is inherent to its business strategy, strategic objectives, and strategy execution.

Operational risks are those risks affecting the systems, people and processes through which the CSIR operates. Such risks include the risk of a change in value caused by actual losses that are associated with inadequate or failed internal processes, people and systems, or from external events (including legal risk), and are different from the expected losses.

This document sets out the CSIR's risk management framework. It describes CSIR's risk management:

- Objectives;
- Benefits;
- Principles;
- Responsibilities; and
- Guidelines.

D.2 Background to Enterprise Risk Management

Risk management as set out in the King III Code of Corporate Governance (King III) and revised in King IV and the PFMA 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.

It is important to note that the Risk Management Plan is, of necessity, an evolving document. The contents of the plan reflect the current risk management requirements of CSIR. The document is reviewed and updated annually by the Audit and Risk Committee (The Committee) of the CSIR Board.

D.3 Risk Management Statement

The CSIR is committed to a process of risk management that is aligned to the principles of the King IV Report and the PFMA. It is expected that all operating units/centres/portfolios, operations and processes are subject to the Risk Management Plan.

The CSIR is a diverse and multidisciplinary entity. The organisation executes its business through several operating units, centres and portfolios with different risk profiles, and working together to manage organisational risk.

Different risk-related portfolios or assurance provider functions will align their various goals, objectives, implementation and reporting processes into one cohesive and structured framework. All of CSIR's business, financial, technological, legal and operational risk exposures will be identified, assessed, prioritised and appropriately managed.

All risk management efforts will be focused on supporting CSIR's strategic objectives. Equally, they must ensure compliance with relevant legislation, uphold the CSIR's good corporate governance record and fulfill the expectations of employees, communities and other stakeholders.

Effective risk management is imperative to the CSIR. The realisation of the CSIR's Shareholder's Compact depends on being able to take calculated risks in a way that does not jeopardise the direct interests of stakeholders. Sound management of risk will enable

CSIR to anticipate and respond to changes in our business environment, place adequate controls in our operational environment as well as make informed decisions under conditions of uncertainty.

All employees have a role in risk management as envisaged in Section 57 of the PFMA.

D.4 Objectives of ERM

The objectives of this plan are to assist the CSIR make informed choices which:

- Provide a level of assurance that current significant risks are effectively managed;
- Improve business performance by assisting and improving 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.

D.5 Benefits of ERM

The benefits of ERM to the CSIR include:

- **Aligning risk and strategy** – The CSIR considers the current and emerging risks in evaluating the strategy, setting related objectives and developing mitigating mechanisms.
- **Enhancing risk response decisions** – ERM provides the rigour for the CSIR to identify alternative risk responses – risk avoidance, reduction, sharing, transfer and acceptance.
- **Reducing operational surprises and losses** – The CSIR gains enhanced capability to identify potential events and establish responses thereby reducing surprises and associated costs.
- **Identifying and managing multiple and cross-enterprise risks** – The CSIR faces a myriad of risks affecting different parts of the organisation and ERM facilitates effective responses to the interrelated impacts and enhances an integrated response to multiple risks.
- **Seizing opportunities** – By considering a full range of potential events, the organisation is positioned to identify and proactively realise opportunities.
- **Improving deployment of resources** – Risk information allows the organisation to effectively assess overall funding requirements and enhance funding allocation.
- **Increasing probability of achieving objectives** – ERM helps the CSIR achieve its performance targets and assists with the prevention of loss of resources. Controls and risk interventions will be chosen on the basis that they increase the likelihood that the CSIR will fulfill its intentions / commitments to its stakeholders.

D.6 Principles of ERM

The CSIR's risk management plan is applied to all operational aspects of the organisation and will consider external strategic risks arising from or related to our partners in projects, government departments, the public and other external stakeholders, as well as wholly internal risks.

The CSIR's positive approach to risk management means that the CSIR not only looks at the risk of things going wrong, but also the impact of not taking opportunities or not capitalising on CSIR strengths.

All risk management activities are aligned to CSIR values and principles, objectives and organisational priorities and aim to protect and enhance the reputation and standing of the organisation.

Risk analysis forms part of organisational strategic planning, investment and project appraisal procedures. Risk management is founded on a risk-based approach to internal control, which is embedded in day-to-day operations of the organisation.

The CSIR's risk management approach informs and directs organisational work, and institutes confidence on the reliability of CSIR risk control strategies and therefore provide assurance. Managers and staff at all levels have a responsibility to identify, evaluate, manage and report risks.

Risk Management in the CSIR is proactive and reasoned. Risks are identified, objectively assessed, and actively managed. In determining appropriate controls, the cost of controls and the impact of risk occurring is balanced with the benefits of reducing risk. The CSIR also recognises that some risks can be managed by transferring them to a third party, for example through insurance.

D.7 Legislative Requirements

The PFMA and related Treasury Regulations assign extensive responsibilities to the CSIR. These include:

- Ensuring that the CSIR has and maintains effective, efficient and transparent systems of financial and risk management and internal controls; and
- Ensuring that risk assessments are conducted regularly to determine emerging risks and that these are adequately mitigated.

CSIR's legislative and compliance requirements are not limited to the PFMA and Treasury regulations, additional regulatory and compliance requirements include amongst others the following:

- The Scientific Research Council Act;

- The Occupational Health and Safety Act; and
- The Labour Relations Act, Electronic Communications Act and so forth.

D.8 CSIR Risk Management Model

The objective of risk management is to ensure a proactive identification, understanding and assessment of risks, including activities undertaken that yield risks which could impact on business objectives. This is executed through various risk management and governance mechanisms and risk management oversight bodies. These include:

- Independent board sub-committees;
- Risk management in all key operations throughout the CSIR;
- The Enterprise Risk Management Office facilitates, coordinates and monitors effective risk management;
- Assurance from Internal Audit Services on the control environment; and
- External audit assurance on CSIR financials.

The CSIR employs a holistic and integrated approach to managing risk within the organisation.

D.8.1 Risk management roles and responsibilities in the CSIR:

The risk management roles and responsibilities within CSIR are distributed as follows:

1. Operating Units/Centres/Portfolios

- Identify, evaluate, mitigate and monitor risks;
- Ensure adequate resourcing;
- Implement business unit plans and processes;
- Perform self-assessments;
- Provide input / information / assistance in the development of strategy, policy and all other risk activities; and
- Ensure and foster a risk-aware culture.

2. Enterprise Risk Management Office

- Develop and implement a coordinated and uniform risk management system across the organisation;
- Facilitate the development of organisational risk management plan and standards;
- Assist in providing a consolidated view on risks across the CSIR and management thereof – risk reporting;

- Facilitate awareness and entrenchment of risk management within the organisation; and
- Ensure appropriate corrective actions are implemented on all audit findings made by Internal Audit Service (IAS) and other auditing bodies.

3. Internal Audit Service

- Provide objective assurance to the Board on the effectiveness of risk management process;
- Highlight any additional risks that result from their audit;
- Review the management of key risks.

4. Executive Management

- Hold Unit Management accountable;
- Provide leadership and guidance;
- Ensure the control environment supports risk management; and
- Oversee management of risks.

5. CSIR Board

- Provide oversight role;
- Approve the risk management plan;
- Approve the fraud prevention plan;
- Approve organisational policies, Conditions of Service, Approval Framework and Shareholder's Compact;
- Provide assurance to stakeholders; and
- Accountable for the CSIR's overall governance of risk.

D.9 CSIR Top Risks

Table D.1 highlights the organisational top risks.

Table D.1: Overview of CSIR's Top Risks

CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
Systemic Risks				
(Originate from macro-economic & national challenges affecting the NSI & National Government Business Enterprise space in which the CSIR operates.)				
1. Inability to achieve/meet contract income targets	CSIR failing to operate a financially sustainable and profitable business as a result of not achieving required levels of contract income. With up to 90% of the CSIR's income coming from Government and state owned entities, uncertainty in the economic environment and a tight fiscus will negatively affect the CSIR's financial sustainability	<ul style="list-style-type: none"> Renewed strategic business development efforts to diversify sources of income locally and internationally Revisiting the Integrated Marketing and Communication Strategy to improve the profiling of the organisation's value proposition Securing long term relationships with new strategic clients. Trend analysis, fore sighting and opportunity identification integral to business planning processes. 	<ul style="list-style-type: none"> Strategic repositioning of the organisation through Project Synapse, a growth strategy of the organisation to open up new market opportunities. Position CSIR as a key partner for government departments and state owned enterprises. Invest in the development of private sector partnerships. Put together a focused strategic marketing plan to better position the CSIR's unique multidisciplinary position. 	<p>EXCO – 30 June 2018</p> <p>EXCO – ongoing</p> <p>EXCO – ongoing</p> <p>EXCO – 30 Sep 2018</p>
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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
Financial Sustainability and Governance	Protracted procurement processes and the requirement the constraints of procuring services from the CSIR placed on government departments by National Treasury	<ul style="list-style-type: none"> Engagement with government departments to ensure that CSIR becomes a standing item on the departments' budget Distinguishing our service offerings from services that others in the private sector can provide, offering SET-based solutions 	<ul style="list-style-type: none"> Engage with National Treasury to ensure that the unique value proposition of the CSIR as an institution that supports a capable government is understood. 	EXCO – 30 June 2018
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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>Strategic Risks</p> <p>(Directly impact on the ability of the CSIR to deliver on its mandate.)</p>				
<p>1. Stagnation and decline in the CSIR growth trajectory.</p>				
<p>Build and transform human capital</p>	<p>Loss of skills in general but in particular loss of critical skills that support R&D in strategic areas and challenges in transforming the CSIR SET base</p>	<ul style="list-style-type: none"> • The CSIR is putting in place a human capital strategy that will facilitate the recruitment and retention of critical skills • Ensure a diversified workforce and create an environment that is attractive to staff • Accelerated researcher development programmes for designated groups • Ensuring staff engagement • Project Synapse as a growth strategy should lead to exciting new programmes that will attract diversified skills into the organisation 	<ul style="list-style-type: none"> • CSIR currently reviewing its recruitment and retention strategy and tactics with emphasis on recruiting critical and scarce skills, while prioritising transformation of the workforce • Put in place leadership development programmes • Implement the findings of the CSIR culture and values review to create an environment attractive to a diversified workforce 	<p>Group Executive: Human Capital – Ongoing</p> <p>Group Executive: Human Capital – 30 Sep 2018</p> <p>Group Executive: Human Capital – 31 Mar 2018</p>
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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>Conduct Relevant Research to Foster Industrial Development</p>	<p>The CSIR has been experiencing high growth which has started to level off in the past couple of years. The growth has also been associated predominantly with growth in government and state owned company business, with very little income coming from industry players</p>	<ul style="list-style-type: none"> The CSIR has invested in the development of industrial development related infrastructure such as the Bio-manufacturing Industry Development Facility, the Biorefinery Industry development Facility, and others that address industry requirements The thrust of Project Synapse as a growth strategy for the organisation is placing emphasis on industry informed research and development, as well as establishment of translational research capabilities In developing its industrial development strategy as part of Project Synapse, the CSIR is consulting robustly with key stakeholders internally, and in both private and public sectors 	<ul style="list-style-type: none"> The CSIR is consolidating its offerings and capabilities after a period of high growth. The CSIR is strategically repositioning its value proposition to industry. 	<p>EXCO – 30 Sep 2018</p> <p>EXCO – 30 Sep 2018</p>
<p>... continued on next page</p>				

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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>2. Poor quality of R&D outputs and outcomes.</p> <p>Conduct High-Quality Research to Foster Scientific Development.</p>	<p>The shortfall in funding to address all the equipment and infrastructure needs across the CSIR could result in the CSIR having obsolete and outdated infrastructure (in certain research areas) which can result in poor quality of R&D outputs and outcomes. This could also increase the risk of projects not being delivered on brief and on time.</p>	<ul style="list-style-type: none"> Capital planning and budgeting process. Emphasis on good laboratory practices. Motivations to National Treasury as part of the Medium Term Expenditure Framework process. Infrastructure maintenance schedule/plan. Sharing of expensive research infrastructure amongst research entities and universities (e.g. the rental pool programme) Ongoing evaluation of research facilities. 	<ul style="list-style-type: none"> Strategic Capital investment Plan to implement CSIR Campus Master Plan Private and public sector partnerships to invest the Campus masterplan. 	<p>EXCO – 31 Mar 2019</p> <p>Campus Planning Development Office – 31 Mar 2019</p>
<p>Conduct High-Quality Research to Foster Scientific Development.</p>	<p>Loss of scarce skills from strategic areas due to increased national and global demand (e.g. ICT and Cybersecurity professionals who are lost to other sectors in the country and internationally)</p>	<ul style="list-style-type: none"> Strategies to identify critical skills and put in place measures to retain current capabilities The CSIR is currently ranked as a Top employer and will aim to retain that status 	<ul style="list-style-type: none"> Human Capital strategy under development Project Synapse as a growth strategy should ensure new programmes that are attractive to scarce skills Review and improvement of the CSIR value proposition to the employees in line with global trends. 	<p>Group Executive: Human Capital – 31 Sep 2018</p> <p>EXCO – Ongoing</p> <p>Group Executive: Human Capital – 30 Sep 2018</p>

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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>Operational Risks</p> <p>(Include financial, legal & compliance risks & are those risks affecting systems, people and processes through which the CSIR operates)</p>				
<p>1. Inability to continue offering products and services to the clients during and post a disaster event.</p>				
<p>Conduct High-Quality Research to Foster Scientific Development.</p>	<p>The current risk of CSIR's inability to continue with operations during and post a major event is low from a sustainability point of view but high in some pockets of the business i.e. a lack of business resilience strategy. This is as a result of lack of business continuity management (BCM) framework, Business Impact Analysis to support the development of the BCM strategy and implementation thereof.</p>	<ul style="list-style-type: none"> ICT disaster recovery plan for some mission critical systems and infrastructure. Emergency response plan. 	<ul style="list-style-type: none"> Review current BCM arrangements e.g. Emergency response plan and disaster recovery plan. Develop and implement BCM policy Complete a Business Impact Analysis to guide the development and implementation of a BCM strategy. 	<p>ERMO – 31 March 2019</p> <p>ERMO – 31 March 2019</p> <p>ERMO – 31 March 2019</p>
<p>2. Risk of association emanating from third party service providers.</p>				
<p>Financial Sustainability and Governance</p>	<p>CSIR contracts service providers to assist with the provision of specialised services in areas where there is lack of internal capacity, e.g. CSIR ethics hotline. CSIR's brand/reputation might be negatively impacted by the association with service providers. This also presents certain risks given the current corporate governance failures and corruption allegations in entities external to the CSIR.</p>	<ul style="list-style-type: none"> Due diligence process during the service provider selection process. Supplier Relationship Management (SRM). 	<ul style="list-style-type: none"> 3rd party risk management framework. Improve the SRM process. 	<p>ERMO – 30 June 2018</p> <p>Strategic Procurement – Ongoing</p>
<p>... continued on next page</p>				

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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>3. Loss of Intellectual property (IP) and business operations due to cyber/information security attacks.</p> <p>Conduct High-Quality Research to Foster Scientific Development</p>	<p>CSIR is significantly dependent on its ICT network and infrastructure. Cybersecurity threats include spam, malware attacks, denial of network service attacks and hacking. Unavailability and/or breach to CSIR's ICT infrastructure and network will have a significant impact on the operations of the organisation and may result in loss of critical intellectual property.</p>	<ul style="list-style-type: none"> • Information Security Office 2015 25 JUNE • Access and authentication controls • Disaster Recovery Plan • Daily data back-up. • Secondary/Back-up Data Centre. • Regular and ongoing vulnerability assessments and intrusion detection tests (Penetration testing and remedial of vulnerabilities). Security assessment to identify any potential gaps in our ICT ecosystem. • CSIR IT Governance structures. 	<ul style="list-style-type: none"> • Implementation of the CSIR Information Security Programme 	<p>Chief Information Security Office – Ongoing</p>

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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
4. Non-compliance to regulatory and compliance requirements. Financial Sustainability and Governance	CSIR is a heavily legislated business and non-compliance to regulatory and compliance requirements could result in reputational damage, audit findings, fines, imprisonment and perception of poor corporate governance.	<ul style="list-style-type: none"> • Established organisational compliance function. • Regular monitoring of compliance by the ERMO, Legal Services and Internal Audit Services. • Appointment of a Compliance Specialist • Governance for a which provide oversight to organisational compliance initiatives. 	<ul style="list-style-type: none"> • Develop a compliance management framework and compliance universe for CSIR. 	ERMO – 30 June 2018
<i>... continued on next page</i>				

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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>5. Poor health and safety culture</p> <p>Financial Sustainability and Governance</p> <p>CSIR activities are inherently high as a research and technology organisation. A poor health and safety 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. With greater focus on industrial development, the CSIR operates increasingly high risk research facilities (e.g. P3 containment laboratory) 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 at.</p>	<ul style="list-style-type: none"> • 10 point Health and Safety Improvement Plan • Health and Safety being led by the CEO • Health and safety awareness training and communication • Emphasis on good laboratory practices that encourages responsible research practices e.g. waste management. • EHS representatives appointed for each building/area. • Regular EHS inspections, Assessments and audits (OHSAS 18001). • Deployment of safety managers. • Incident Management and Emergency plans. 	<ul style="list-style-type: none"> • Campus Master Plan incorporates requirements. • Consequence management in line with JUST Culture where safety improvement is achieved by empowering employees to proactively monitor the workplace and participate in safety efforts in the work environment. 	<p>CPDO – Ongoing</p> <p>EXCO – Ongoing</p>	
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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
6. Reputational damage to CSIR brand due to scientific fraud / plagiarism Financial Sustainability and Governance	Based on the CSIR's track record and assessment of controls, management believe that sufficient measures are in place to mitigate the occurrence of scientific fraud / plagiarism. Despite the relatively low probability of occurrence, the reputational risks is however very high which could potentially lead to poor research outcomes and skills exodus.	<ul style="list-style-type: none"> • Research Ethics Committee. • Research Advisory Panels / Committees. • Strategic Research Panel. • Strategic Research managers Forum. • CSIR Good Research Guide. • Pre and post review of research work. • Ongoing assessment of controls and promotion of scientific excellence and rigour. • Anti-plagiarism toolkit. • CSIR Code of Ethics. 	<ul style="list-style-type: none"> • None 	
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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>7. Slow rate of transformation</p> <p>Build and Transform Human Capital.</p>	<p>The CSIR has placed significant emphasis on the transformation of the SET base. However, the rate of transformation remains relatively slow</p>	<ul style="list-style-type: none"> • Human Capital Strategy currently under development with emphasis on diversification. • Transformation featured as Board agenda item. • Employment Equity Plan and ongoing monitoring thereof. • Transformation and Employment Equity Policy • Transformation and Employment Equity Committee. • Greater investment on HDC initiatives, in particular the accelerated Leadership Development Programme for designated groups. • Employee satisfaction surveys and appropriate response plans. • Ongoing employee engagement. • Targeted recruitment of SET base pipeline in order to contribute to transformation targets for designated groups. 	<ul style="list-style-type: none"> • Recruitment and retention of a skilled and diversified workforce. • Executive management transformation dialogues as a means of engaging in focused and constructive conversations on transformation. 	<p>Group Executive: Human Capital – 31 Mar 2019</p> <p>EXCO – Ongoing</p>
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CSIR Strategic Objective	Impact of Risk	Controls & Measures in Place	Remedial Action Plan	Action Owner & Due Date
<p>8. Inability to attract and retain critical SET base and support skills.</p> <p>Build and Transform Human Capital.</p>	<p>The CSIR is highly dependent on its ability to attract and retain skills both in the SET base and support groups. As a knowledge organization, the quality and quantity of CSIR outputs, outcomes and impact is directly related to the skills it possesses.</p>	<ul style="list-style-type: none"> Accelerated Programme in the SET base with a focus on designated groups Investment in bursars and studentships to develop SET base pipeline. Succession planning for both SET base and SET management and leadership. Skills retention 25 plan/strategy for JUNE 2015 SET base. Competitive remuneration structure and performance bonus scheme. Benefit sharing as informed by the Intellectual Property Rights Act. Voluntary career ladder assessment framework for the SET base. Emerging Researcher's Fund and Strategic Research Fund. 	<ul style="list-style-type: none"> Absorption of the studentship pipeline who graduate with MSc and PhD. Collaboration with Higher Education Institutions (HEIs) as well as affiliation of CSIR researchers with various SA universities. Develop a strategic approach to succession planning. Ongoing benchmarking of CSIR remuneration and rewards with the market. 	<p>Group Executive: Human Capital – Ongoing</p> <p>EXCO – Ongoing</p> <p>Group Executive: Human Capital – 31 Mar 2019</p> <p>Group Executive: Human Capital – Ongoing</p>

Table D.2: Overview of CSIR's Top Opportunities

Opportunity Description	Progress to Date	Further Remedial Action Required	Action Owner
<p>1. Strategic Repositioning: Project Synapse</p> <p>Project Synapse is a strategic repositioning of the CSIR's multidisciplinary value proposition with greater emphasis on industrial development. The initiative should result in greater relevance of CSIR offerings to industry in particular, and exciting RD&I programmes to attract skilled human capital.</p>	<ul style="list-style-type: none"> • Robust engagement with internal and external stakeholders resulting in buy in of the new organisational vision • Establishment of the Industrial Development Office/function with a dedicated Executive to drive Project Synapse. • Continued engagement of the CSIR stakeholder community e.g. Department of Science and Technology, DTI, National Treasury, CSIR and the private sector during the strategy development process. • An emerging suite of programmes to address critical industry needs • Management engagement (Presentation of the Industrial Development strategy to all Units and portfolios) • Work streams that represent core CSIR business functions. 	<ul style="list-style-type: none"> • An external advisory plan for Project Synapse comprising key stakeholders industry (private and public) players in question, and policy makers and development funding institutions and innovation partners such as universities and other research institutions locally and abroad. • Robust change management plan to target all pockets of stakeholders to the business. • Participation of broad base of CSIR staff in strategy development process • Stakeholder inclusive approach • Regular communication to staff and other stakeholders. 	<p>CEO – 30 Sep 2018</p> <p>CEO – 30 June 2018</p> <p>Executive Project Ongoing Director: Synapse –</p> <p>CEO – Ongoing</p> <p>CEO – Ongoing</p>

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Opportunity Description	Progress to Date	Further Remedial Action Required	Action Owner
<p>2. Organisational Reconfiguration</p> <p>The reconfiguration of CSIR executive portfolios presents an opportunity to address amongst others the following :</p> <ul style="list-style-type: none"> • Misalignment between strategy and operations, leading to inadequate implementation of various organizational imperatives and inefficiencies in operations; • The need to better align our strategic partnerships with our investment strategy, innovation strategy and operations; and • Streamlining our decision making and ensuring that there is single-point accountability. 	<ul style="list-style-type: none"> • Executive Management team appointed • Ongoing engagements with the Management team • Regular communication with staff 	<ul style="list-style-type: none"> • Recruitment for Group Executive: Legal, Compliance and Business Enablement • Development of various strategies (e.g. Human Capital strategy) as well as systems, processes and tools by the new portfolios to address the immediate challenges and in line with the strategic repositioning and intent of Project Synapse 	<p>CEO – 30 June 2108</p> <p>EXCO – 31 March 2019</p>
<p>3. Policy Review</p> <p>CSIR has developed and implemented a number of policies as a measure of good corporate governance and to manage and direct how the organisation in its decision making and normal business operations. These policies have in certain instances become outdated, contradictory and perceived to be counter-productive or introduce inefficiencies in the business operating model.</p>	<ul style="list-style-type: none"> • CSIR policy review project. • Review Contracting and approval process. • Review the approval framework. • Ongoing review of the procurement process (Improve on the current perceived inefficiencies). • Internal audit reviews 	<p>Continuous review and update</p>	<p>CEO – Ongoing</p>
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Opportunity Description	Progress to Date	Further Remedial Action Required	Action Owner
<p>4. Business models, systems processes and tools</p> <p>As part of Project Synapse, the CSIR is reviewing its business models, systems processes and tools with a view to improve our operational efficiencies.</p>	<p>Ongoing review and improvement of the overall business models, tools and processes as well as the internal operating environment with Project Synapse</p>	<ul style="list-style-type: none"> • Development of an ICT strategy and implementation of an integrated ICT supported business processes • Training and staff development 	<p>Chief Information Officer – 31 March 2019</p> <p>Group Executive: Human Capital – Ongoing</p>

Fraud Prevention Plan

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E.1 Definition of Terms

“Corruption” Directly or indirectly accepting or agreeing to accept any gratification from another person for his or her benefit or of others; and giving or agreeing to give any other person any gratification in order to influence that person directly or indirectly to exercise his powers, duties or legal obligations, whether for the benefit of that other person, or for the benefit of another person.

“Fraud” The unlawful and intentional making of a misrepresentation, resulting in actual or potential disadvantage to another individual or group.

“Theft” The unlawful and intentional misappropriation of another’s property, or property which is in his/her lawful possession, with the intention of depriving the owner of his/her rights permanently.

E.2 Executive Summary

The CSIR's Fraud Prevention Plan encompasses controls that have three objectives:

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

The Fraud Prevention Plan provides 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 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 and deployment of resources.
- **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 primary responsibility for awareness, enforcement, and investigation of incidents rests with the Enterprise Risk Management Office (ERMO).

The fraud prevention plan forms part of the Shareholders Compact to be approved by the CSIR Board.

Note: ERMO is currently developing an Incident Classification Matrix which prioritises the risks based on potential impact, informs relevant stakeholders to handle incidents and the priority of handling incidents and possible timelines. This will be relevant when dealing with fraud and corruption incidents and/or allegations.

E.3 Fraud Risk Areas

In the CSIR context, fraud could potentially manifest itself in the following areas:

E.3.1 Research

Use of research facilities and Intellectual Property for one's own benefit; and Falsifying research outputs (scientific dishonesty).

E.3.2 Systems

Where a process/system exists which is prone to abuse by employees, the public or other stakeholders, for example:

- Inadequate pre-screening of candidate employees;
- Procurement fraud such as collusion between CSIR employees and suppliers;
- Deliberate non-compliance with prevailing CSIR policies and procedures; and
- Non-compliance with the approval framework.

E.3.3 Finances

Where individuals or entities have fraudulently obtained money from CSIR, for example:

- Suppliers invoicing for work not done, or over-invoicing;
- Unauthorised transfer of funds from CSIR bank accounts; and
- Submission of fictitious subsistence and travel claims by employees.

E.3.4 PPE and Resources

Where equipment is utilised for personal benefit or stolen, for example:

- Theft of PPE;
- Theft or unauthorised use, or leakage, of confidential information;
- Theft of intellectual property; and
- Misuse and abuse of PPE.

E.3.5 Other

Activities undertaken by employees, which may be contrary to established policies, or fall below established ethical standards, for example:

- Related party transactions;
- Conflicts of interest;
- Nepotism;
- Non-disclosure of private business interests; and
- Omitting or refusing to report or act upon reports of fraud.

E.4 Principles Governing Fraud Prevention

The CSIR adheres to the principles of good corporate governance, which requires the conducting of business in an efficient, effective and transparent manner. This calls for commitment to fighting fraudulent and corrupt behaviour at all levels within the organisation.

The main principles upon which the fraud prevention plan of the CSIR is based are the following:

- Creating a corporate culture which is ethical, fair and intolerant to fraud;
- Deterrence 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 having the potential to impact the CSIR.

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

A person who holds a "position of authority" should report any suspected corrupt activity and/or an offence of theft/ fraud to the police as per the requirements of the Prevention of Corrupt Activities Act.

E.5 Elements of Fraud Management

The main objective of the Plan is to raise awareness about potential fraud and corruption, and to put fraud response and prevention strategies in place.

The components of the Fraud Prevention Plan are the following:

- Creation of fraud and corruption awareness amongst employees and relevant stakeholders through communication and education;
- Communication concerning the organisation's policies, procedures, rules, regulations and other prescripts (including the PFMA and supporting Treasury Regulations);
- Publicising of the disciplinary code and procedure;
- Implementation of sound internal controls to prevent and detect fraud and corruption;
- Implementation of an effective internal audit function;

- Institute an effective fraud and corruption investigating capacity;
- Ongoing risk assessments;
- Management structures to ensure effective implementation and maintenance of the Fraud Prevention Plan;
- A “zero tolerance” policy to fraud and corruption, including a fraud and corruption response plan, and take comprehensive steps for the proper resolution of reported and detected incidents, and allegations of fraud and corruption;
- Implement a confidential fraud and corruption reporting system;
- Install physical and information security management; and
- Provide for ongoing maintenance and review of the Fraud Prevention Plan.

E.5.1 Fraud Prevention

Fraud prevention strategies are the first line of defence and provide the most cost-effective method of controlling fraud within 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.

Key elements of CSIR's fraud prevention strategies include:

- Having a robust fraud prevention strategy;
- Promotion and adherence to CSIR Code of Conduct/Ethics;
- Risk-based decision making processes;
- Sound fraud risk management processes, including assurance testing of controls that have been put in place;
- A comprehensive fraud control plan;
- Employee and third party, due diligence;
- Fraud awareness training;
- ICT cyber security controls to prevent external penetration into IT systems and abuse by employees and to ensure reliable, accurate and up-to-date data; and
- Communication about investigation outcomes to demonstrate that allegations and incidences of fraud are treated seriously and appropriately dealt with.

E.5.2 Fraud Detection

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 defense is a robust suite of detection strategies to discover any of fraud and corruption as soon as possible to minimise any detrimental impacts. CSIR 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
- Ethics hotline to report allegations of fraud, corruption and unethical conduct.

E.5.3 Response

CSIR response strategies 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 26 of 2000, the CSIR Ethics Hotline Procedure and this plan. 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

E.5.4 Control Environment

Oversight by the Audit and Risk Committee

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.

Research ethics and code of business conduct

The CSIR subscribes to good business practices, as dealt with in the code of ethics. Management must be held accountable for complying with, and implementing, CSIR's systems, policies and procedures for preventing fraud, theft and corruption. This is addressed in job descriptions, delegations of authority, declaration of conflicts of interest, agreed work plans, performance contracts, and annual appraisals.

Trading partners e.g. suppliers, contractors, consultants and former employees

Goods and services are procured in accordance with the approved procurement policies and procedures.

Other control environment considerations

CSIR has a number of systems, policies, procedures, acts and regulations designed to ensure compliance with specific laws and basic internal controls.

All employees and relevant stakeholders are expected to comply with the applicable policies and procedures. A fundamental risk in this area is the lack of knowledge, awareness, effective communication and training relating to prevailing systems, policies and procedures in place at CSIR.

Non-compliance with policies and procedures is a risk which is addressed by developing clearly defined communication to create awareness of all policies and procedures. All employees acknowledge in writing that they have read policies and procedures on appointment.

Regular communiqués are circulated regarding policies and procedures.

A structured monitoring mechanism has been developed for keeping a proper record of the policies and procedures that are updated, and of new policies and procedures that are being developed in order to set clear targets and monitor progress.

Discipline

The disciplinary code and procedures prescribes appropriate steps to be taken in addressing disciplinary matters. The respective Human Resources Manager, Legal and CSIR internal Audit Services departments support the CSIR in instituting and completing disciplinary action in cases of fraud and corruption.

The consistent and efficient application of disciplinary measures is an integral component of effective fraud prevention and will be achieved by:

- Creating awareness amongst employees of conduct that is forbidden in terms of the code of conduct and disciplinary code;
- Ongoing training of managers in the application of disciplinary measures;
- Speedy finalisation of investigations and hearings; and
- Regular monitoring and review of the application of discipline with the objective of improving weaknesses identified.

Policies and procedures

Appropriate policies and procedures are necessary to ensure effective internal controls to mitigate fraud risks. The effectiveness of the existing policies and procedures is also tested during the course of audits, and shortcomings are addressed. Physical Security CSIR has implemented physical security controls which have been updated and continually refined, including the following:

- Visitors reporting to reception;
- Access control in the form of access cards for employees and other tenants;
- Proper management of issuing of access cards; and
- Use of security services.

Information Security

Large volumes of information are stored on computers. If improperly managed, sensitive data could end up in the hands of unauthorised individuals. Physical and logical access controls over the computer systems continually seek to achieve the following:

- Striking the right balance between allowing access to information to enable efficient operations, and denying inappropriate access to ensure that information is not compromised;
- Implementing preventative controls to limit access to unauthorised persons; and
- Implementing detective controls to determine whether unauthorised access is being attempted or unusual patterns of activity are occurring.
- CSIR has a computer usage policy to manage information security. CSIR ensures that all employees are sensitised on a regular basis to the fraud risks associated with information security and the utilisation of computer resources, and ensures that controls are developed to limit the risk of manipulation of computerised data;
- Regular communiqués are sent to employees pointing out security policies, with particular emphasis on e-mail, telephone and internet usage, and the implications of abusing these and other computer related facilities. Where employees are found to have infringed on prevailing policy in this regard, disciplinary action is taken; and
- Regular reviews of information and computer security are also conducted by CSIR. Weaknesses identified during these reviews are addressed and policies updated accordingly.

Monitoring

- A system is in place to facilitate the consolidation of all allegations of fraud and corruption. This enhances the management of fraud risk and threats that could be overlooked in the absence of such a system;
- A centralised register is kept for purposes of:
 - Recording all allegations;
 - Tracking progress on allegations with the relevant managers; and

- Facilitating the early identification of systemic weaknesses/risks, and inform managers and employees of these.
- Providing feedback to employees and reporters on the management and progress of allegations.

E.6 Conclusion

The CSIR has taken a proactive approach towards managing fraud risk in the organisation. It has adopted a zero tolerance approach towards fraud, theft and corruption and has taken the necessary measures to ensure the risks are managed effectively.

Materiality / Significance Framework

F.1 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 moral, ethical and legal standards.

Ethics involve the ability to distinguish right from wrong and a commitment to do what is right. Values are core beliefs, which 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 South Africa and the national laws and regulations, prescribe legal conduct that embodies values based on ethical principles, while respecting cultural diversity.

F.2 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 a framework of acceptable levels of materiality and significance with the relevant executive authority in consultation with the external auditors.”

(THE CSIR HAS HOWEVER BEEN EXEMPTED FROM SECTION 54 (2) AND THIS SCHEDULE DOES NOT INCLUDE THIS SUBSECTION.)

		Material
Section 50 (1)	<p>(1) The accounting authority for a public entity must –</p> <p>(a) exercise the duty of utmost care to ensure reasonable protection of the assets and records of the public entity;</p> <p>(b) act with fidelity, honesty, integrity and in the best interest of the public entity in managing the financial affairs of the public entity;</p> <p>(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</p> <p>(d) seek within the sphere of influence of that accounting authority, to prevent any prejudice to the financial interests of the state.</p>	<p>Significant audit findings that could negatively impact on the CSIR's operations and the attainment of strategic goals.</p> <p>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 Shareholders Compact. Any acts of dishonesty, infidelity and that are not in the best interests (from a research, financial and reputation perspective) and of the CSIR are viewed in a serious manner.</p> <p>The CSIR is committed to disclose any relevant information to its stakeholders. Materiality can only be determined if the nature of the information is known.</p> <p>The CSIR employs an ongoing enterprise risk management system as well as controls that are aimed at 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.</p>
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		Material
Section 55 (2)	<p>(2) The annual report and financial statements referred to by PFMA Subsection 55 (1)(d) must –</p> <p>(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;</p> <p>(b) include particulars of –</p> <p>(i) any material losses through criminal conduct and any irregular expenditure and fruitless and wasteful expenditure that occurred during the financial year;</p> <p>(ii) any criminal or disciplinary steps taken as a consequence of such losses or irregular expenditure or fruitless and wasteful expenditure;</p> <p>(iii) any losses recovered or written off;</p> <p>(iv) any financial assistance received from the state and commitments made by the state on its behalf; and</p> <p>(v) any other matters that may be prescribed; and</p>	<p>As per guidelines issued by National Treasury: Significance/materiality is calculated as 0.75% of revenue, which amounts to R 20 550 000.</p> <p>R 1 000 000. All cases are unique and will thus be treated as such. These will be subject to internal audit reviews.</p> <p>R 1 000 000. All cases are unique and will thus be treated as such. Issues that inform steps to be taken are:</p> <ul style="list-style-type: none"> • 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. <p>R 1 000 000 (excluding losses incurred through normal operating activities)</p> <p>Will disclose as prescribed.</p> <p>Will disclose as prescribed.</p>
<i>... continued on next page</i>		

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		Material
	(c) include the financial statements of any subsidiaries	All subsidiaries are consolidated.
Section 66 (1)	<p>(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 –</p> <p>(a) is authorised by this Act; and</p> <p>(b) in the case of public entities, is also authorised by other legislation not in conflict with this Act; and</p> <p>(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).</p>	The CSIR complies with this requirement.

Financial Plan

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G.1 CSIR Budget and Parliamentary Grant Cashflow 2018/19

G.1.1 CSIR Statements of Comprehensive Income over the MTEF period

	Forecast 2017/18 (R'000)	Budget 2018/19 (R'000)	Budget 2019/20 (R'000)	Budget 2021/22 (R'000)
Total Operating Revenue	2,602,815	2,740,284	2,913,133	3,094,233
Contract R&D Income	1,867,643	1,969,524	2,100,553	2,236,264
Public – South Africa	1,402,061	1,514,445	1,612,884	1,717,721
Private – South Africa	182,957	213,742	227,635	242,431
International	180,417	166,703	177,539	189,079
Parliamentary Grant – Ring-fenced	102,208	74,634	82,495	87,033
Parliamentary Grant	729,359	766,760	807,780	852,209
Royalty income	4,082	4,000	4,800	5,760
Other income	1,731	–	–	–
Total Expenditure	2,674,482	2,779,684	2,937,222	3,103,732
Employees' remuneration	1,532,118	1,624,285	1,721,742	1,825,047
Operating expenses	1,060,609	1,072,070	1,127,818	1,186,465
Depreciation	81,755	83,329	87,662	92,220
Operating Profit before Investment Income	(71,667)	(39,400)	(24,089)	(9,499)
Investment Income	39,744	39,400	41,370	43,439
Net profit before non-guaranteed employees' remuneration (Performance bonus)	(31,923)	–	17,281	33,940
Non-guaranteed employees remuneration (Performance bonus)	–	–	–	–
Net profit	(31,923)	–	17,281	33,940

Table G.1: Statement of Comprehensive Income – MTEF Period

G.1.2 CSIR Statements of Financial Position over the MTEF period

	Forecast March 2018 (R'000)	Budget March 2019 (R'000)	Budget March 2020 (R'000)	Budget March 2021 (R'000)
ASSETS				
Non-Current Assets	825,663	815,523	843,238	871,923
Property, Plant and Equipment	794,535	791,862	819,577	848,262
Interest in Joint Ventures and Associates	22,744	19,011	19,011	19,011
Interest in Subsidiaries	5,436	4,650	4,650	4,650
Trade and other receivables	2,948	-	-	-
Current Assets	1,176,958	1,220,586	1,270,245	1,338,561
Trade and other receivables	277,203	294,947	313,551	333,043
Inventory and contracts in progress	107,896	113,595	120,760	128,267
Cash and cash equivalents	791,859	812,044	835,934	877,251
TOTAL ASSETS	2,002,621	2,036,109	2,113,483	2,210,484
EQUITY AND LIABILITIES				
Reserves	992,243	992,243	1,095,524	1,043,464
Retained Earnings	992,243	992,243	1,009,524	1,043,464
Non-current liabilities	10,764	10,872	10,981	11,091
Post-retirement medical benefits	10,764	10,872	10,981	11,091
Current liabilities	999,614	1,032,994	1,092,978	1,115,929
Advances received	537,460	565,846	601,538	638,934
Trade and other payables	462,154	467,148	491,440	516,995
TOTAL EQUITY AND LIABILITIES	2,002,621	2,036,109	2,113,483	2,210,484

Table G.2: Statement of Financial Position over the MTEF Period

G.1.3 CSIR Cash Flow Statement

	March 2019 R'000
Cashflow from operating activities	
Cash receipts from external customers	1,950,081
Parliamentary Grant income	766,760
Cash paid to suppliers and employees	(2,682,570)
Cash generated from operating activities	34,271
Net finance income	39,400
Net cash from operating activities	73,671
Cashflow from investing activities	
Decrease in interest in joint venture and associates	3,733
Decrease in subsidiary loans	786
Decrease in non-current trade and other receivables	2,948
Acquisition of property, plant and equipment	(60,953)
Net cash utilised in investing activities	(53,486)
Cashflow from financing activities	
Increase in non-current liabilities	–
Net cash generated from financing activities	–
Net increase in cash and cash equivalents	20,185
Cash and cash equivalents at beginning of the year	791,859
Cash and cash equivalents at end of the year	812,044

Table G.3: CSIR Cash-Flow Statement**G.1.4 Twelve Month Cash Flow Projection for Parliamentary Grant: 2018/19 (including VAT)**

R'000	Total	April	July	Oct	Jan
	1,199,503	299,876	299,876	299,876	299,875
Baseline	840,462				
National laser Centre	33,644				
Laser Loan Programme	9,877				
African Laser Centre	5,396				
Implementation: ICT R&D Roadmap	73,785				
Cyber Infrastructure	236,339				

Table G.4: Cash-Flow For Parliamentary Grant

G.1.5 PPE Budget Summary

Category	2018/19 (R'000)
Buildings	12,706
R&D equipment	28,224
Computer, Information Technology (IT) and ICT equipment	18,665
Furniture and fittings	1,043
Vehicles	315
Total	60,953

Table G.5: PPE Budget Summary

Notwithstanding the fact that an item is included in the above budgeted amount, the investment in PPE remains subject to approval as per the Approval Framework of the CSIR and additional considerations such as strategic alignment, return on investment and available cashflow.

G.1.6 Alignment of Parliamentary Grant Budget and Strategic Objectives

Paragraph 7.2 of Practice Note 4 of 2009/10 states that “*National Treasury requires that there be a clear link between the strategy of the public entity and the legislative/policy environment, the operating environment, key performance measures and indicators, the financial projections, capital expenditure, borrowing plans and the risk management framework.*”

In this section we make an initial attempt at drawing the links between the fixed portion of our budget (consisting of the Parliamentary Grant and the Ring-Fenced allocations received from the DST) and our five strategic objectives. Although income derived from contract R&D work will also contribute to these strategic objectives the linkages between those components of our budget will not be included since the exact form of that income has not yet been determined. We note that contract R&D income will also contribute to our strategic objectives as follows:

- SO2 and SO3: the technical outputs that are produced and the services that are delivered;
- SO1: the employment of additional SET Staff and the additional training and development opportunities that may arise in the delivery of these contracts;
- SO4: additional investments in infrastructure and equipment that may be required in the delivery of these contracts.

At this stage we also do not distinguish, for budget purposes, between SO2 and SO3. As indicated in Section A.2.4 the CSIR is in the process of developing a comprehensive industrial development strategy and future versions of the Shareholder's Compact will more clearly distinguish our work in support of scientific and industrial development.

	Investment	Strategic Objective
Baseline Allocation to Business Units	R 337,479,313	SO2 & SO3
Portfolios and Support Functions	R 159,590,494	
Leadership Team	R 33,324,107	SO5
Research and Development Office	R 8,708,969	SO2 & SO3
Licensing and Ventures Office	R 8,092,907	SO2 & SO3
Finance	R 6,498,085	SO5
Legal, Audit & CFO Support	R 12,333,852	SO5
Strategic Communications and Stakeholder Relations	R 6,641,062	SO5
Human Resources	R 15,089,309	SO1
Information and Communication Technology	R 36,592,599	SO5
Management Services	R 9,982,094	SO4
Integrated Programmes	R 22,327,509	SO2 & SO3
Strategic Programmes	R 164,000,000	
Emerging Research Areas	R 45,000,000	SO2 & SO3
Thematic Programme	R 75,000,000	SO2 & SO3
Young Researcher Empowerment Fund	R 12,000,000	SO1
Flagship Programmes	R 32,000,000	SO2 & SO3
Non-Discretionary Special Initiatives	R 42,429,727	
Strategic Fund	R 10,000,000	SO2 & SO3
Strategic Research Panel	R 495,000	SO2 & SO3
Research Ethics Training	R 442,050	SO2 & SO3
Research Ethics Committee	R 52,565	SO2 & SO3
CSIR Board and sub committees	R 2,090,749	SO5
Communications Projects	R 5,000,000	SO5
Bursary program	R 1,376,930	SO1
HCD Programmes (Incl SSP)	R 10,000,000	SO1
Health & Wellbeing	R 1,000,000	SO1
CSIR Conference / Excellence awards	R 2,000,000	SO5
SEED Fund: L&V office	R 5,000,000	SO2 & SO3
Discretionary Allocations	R 35,677,726	
Energy Autonomous campus	R 10,000,000	SO4
Co-Investment Fund	R 10,000,000	SO2 & SO3
Project Synapse	R 30,231,899	SO2 & SO3
Campus Master Plan	R 8,000,000	SO4
Senior Researcher Acceleration Programme	R 10,000,000	SO1
Ring-Fenced Allocations	R 270,322,105	
Implementation: ICT R&D Roadmap	R 64,724,000	SO2 & SO3
African Laser Centre (NLC)	R 4,733,000	SO2 & SO3
Laser Loan Program (NLC)	R 8,664,000	SO2 & SO3
Cyber Infrastructure	R 207,316,000	SO2 & SO3
Total	R 1,052,196,000	

Table G.6: Link between Parliamentary Grant and CSIR Strategic Objectives

Strategic Objective	Investment	%
SO1: Build and Transform Human Capital	R 49,466,239	4.70%
SO2 & SO3: Conduct high-quality research to foster scientific development, and Conduct relevant research to foster scientific development	R 870,267,213	81.71%
SO4: Infrastructure renewal and development	R 27,982,094	2.66%
SO5: Financial sustainability and governance	R 104,480,454	9.93%
Total	R 1,052,196,000	100%

Table G.7: Summary of PG Investment by Strategic Objectives

G.2 CSIR Group 3 Year Financial Plan

G.2.1 Subsidiaries and Associate Companies

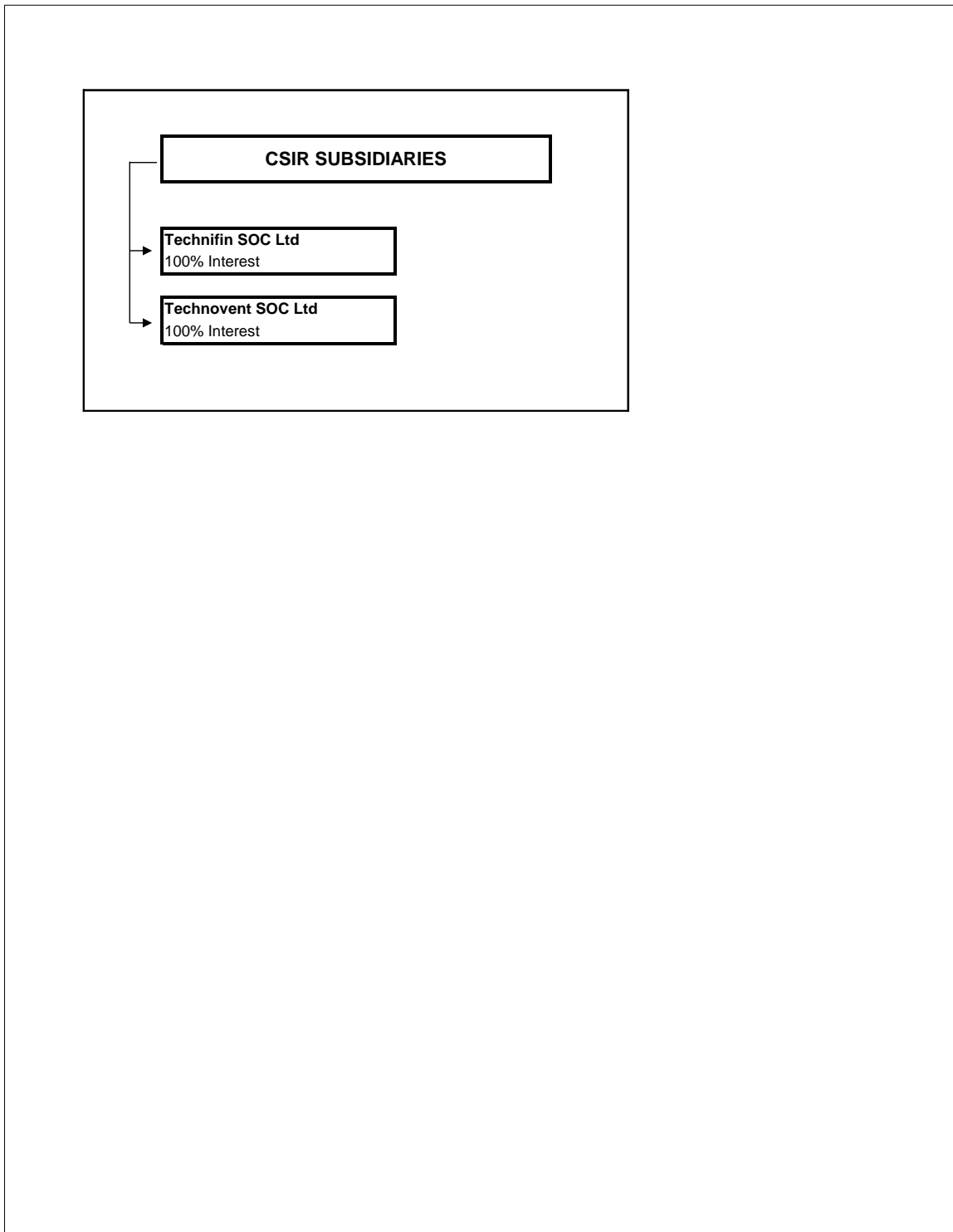
	Total	Technifin SOC Ltd	Technovent SOC Ltd	SERA (Pty) Ltd	Ellipsoid Technology (Pty) Ltd	Persomics AB
Incorporated		SA	SA	SA	SA	Sweden
% Holding		100%	100%	50%	50%	29.94%
	Annual Budget R'000					
Total Income	315	315	–	–	–	–
Contract R&D income	–	–	–	–	–	–
Finance Income	315	315	–	–	–	–
Other Income	–	–	–	–	–	–
Expenses	2,314	211	–	–	–	2,103
Operating Expenses	211	211	–	–	–	–
Employees Remuneration	–	–	–	–	–	–
Share of profit/(loss) of joint ventures & associates	2,103	–	–	–	–	2,103
Net Profit	(1,999)	104	–	–	–	(2,103)

Table G.8: CSIR Subsidiaries and Associated Companies: Income and Expenditure 2018/19

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.

G.2.2 CSIR Subsidiary Companies



G.2.3 CSIR Group Statements of Comprehensive Income

	Forecast 2017/18 (R'000)	Budget 2018/19 (R'000)	Budget 2019/20 (R'000)	Budget 2021/22 (R'000)
Total Operating Revenue	2,602,857	2,740,284	2,913,133	3,094,233
Contract R&D Income	1,867,643	1,969,524	2,100,553	2,236,264
Public – South Africa	1,402,061	1,514,445	1,612,884	1,717,721
Private – South Africa	182,957	213,742	227,635	242,431
International	180,417	166,703	177,539	189,079
Parliamentary Grant – Ring-fenced	102,208	74,634	82,495	87,033
Parliamentary Grant	729,359	766,760	807,780	852,209
Royalty income	4,082	4,000	4,800	5,760
Other income	1,773	–	–	–
Total Expenditure	2,674,562	2,779,895	2,937,464	3,104,007
Employees' remuneration	1,532,118	1,624,285	1,721,742	1,825,047
Operating expenses	1,060,689	1,072,281	1,128,060	1,186,740
Depreciation	81,755	83,329	87,662	92,220
Operating Profit before Investment Income	(71,705)	(39,611)	(24,331)	(9,774)
Investment Income	40,142	39,715	41,704	43,794
Share of profit/(loss) of joint ventures and associates	(1,351)	(2,103)	–	–
Net profit before non-guaranteed employees' remuneration (Performance bonus)	(32,914)	(1,999)	17,373	34,020
Non-guaranteed employees remuneration (Performance bonus)	–	–	–	–
Net profit	(32,914)	(1,999)	17,373	34,020

Table G.9: Group Statement of Comprehensive Income – MTEF Period

G.2.4 CSIR Group Statements of Financial Position

	Forecast March 2018 (R'000)	Budget March 2019 (R'000)	Budget March 2020 (R'000)	Budget March 2021 (R'000)
ASSETS				
Non-Current Assets	820,227	810,873	838,588	867,273
Property, Plant and Equipment	794,535	791,862	819,577	848,262
Interest in Joint Ventures and Associates	22,744	19,011	19,011	19,011
Interest in Subsidiaries	–	–	–	–
Trade and other receivables	2,948	–	–	–
Current Assets	1,183,327	1,224,170	1,273,921	1,342,317
Trade and other receivables	277,203	294,947	313,551	333,043
Inventory and contracts in progress	107,896	113,595	120,760	128,267
Cash and cash equivalents	798,228	815,628	839,610	881,007
TOTAL ASSETS	2,003,554	2,035,043	2,112,509	2,209,590
EQUITY AND LIABILITIES				
Reserves	993,176	991,177	1,008,550	1,042,570
Retained Earnings	993,176	991,177	1,008,550	1,042,570
Non-current liabilities	10,764	10,872	10,981	11,091
Post-retirement medical benefits	10,764	10,872	10,981	11,091
Current liabilities	999,614	1,032,994	1,092,978	1,155,929
Advances received	537,460	565,846	601,538	638,934
Trade and other payables	462,154	467,148	491,440	516,995
TOTAL EQUITY AND LIABILITIES	2,003,564	2,035,043	2,112,509	2,209,590

Table G.10: Group Statement of Financial Position over the MTEF Period

G.2.5 CSIR Group Cash Flow

	March 2019 R'000
Cashflow from operating activities	
Cash receipts from external customers	1,950,081
Parliamentary Grant income	766,760
Cash paid to suppliers and employees	(2,684,884)
Cash generated from operating activities	31,957
Net finance income	39,715
Net cash from operating activities	71,672
Cashflow from investing activities	
Decrease in interest in joint ventures and associates	3,733
Decrease in non-current trade and other receivables	2,948
Acquisition of property, plant and equipment	(60,953)
Net cash utilised in investing activities	(54,272)
Cashflow from financing activities	
Increase in non-current liabilities	–
Net cash generated from financing activities	–
Net increase in cash and cash equivalents	17,400
Cash and cash equivalents at beginning of the year	798,228
Cash and cash equivalents at end of the year	815,628

Table G.11: CSIR Group Cash-Flow Statement

G.3 5 Year Borrowing Plan



**MINISTRY
SCIENCE AND TECHNOLOGY
REPUBLIC OF SOUTH AFRICA**

Private Bag X727, PRETORIA, 0001, South Africa. Tel: (+27 12) 843 6798, Fax: (+27 12) 349 1041
Private Bag X9156, CAPE TOWN, 8000, South Africa. Tel: (+27 21) 469 5000, Fax: (+27 21) 461 1425

Prof Thokozani Majazi
Chairperson
Council for Scientific and Industrial Research
P O Box 395
PRETORIA
0001

Email: thokozani.majazi@wits.ac.za

Dear Prof Majazi

**COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH: APPROVAL OF THE 2015/16
– 2019/20 BORROWING LIMITS IN TERMS OF SECTION 66(3) (B) OF THE PUBLIC
FINANCE MANAGEMENT ACT**

In terms of section 66 (3) (b) of the Public Finance Management Act (PFMA), 1999 (Act No.1 of 1999) as amended, a Schedule 3B public entity may only borrow money, or issue guarantees, indemnities or securities if so authorised by notice in the Government Gazette by the Minister of Finance.

The purpose of this letter is to inform you that I have, with concurrence of the Minister of Finance approved the proposed borrowing limits for the CSIR for the five-year period 2015/16 2019/20 . The borrowing limits are approved as outlined below.

Borrowing instrument	Year ended 31 March				
	2016	2017	2018	2019	2020
	Amounts in R'000				
Performance Bond	20 000	20 000	23 000	25 000	25 000
Bid Bonds	3 000	3 000	4 000	4 000	5 000
Payment Guarantee	6 000	8 000	11 000	15 000	20 000
Advance Payment Guarantee	30 000	35 000	38 000	45 000	50 000
Total Annual Limit	59 000	66 000	76 000	89 000	100 000

2

The approval is granted on condition that, the CSIR should report annually to my Department and the National Treasury on utilisation of the borrowing plans and progress made toward implementation of projects secured through these borrowings.

Yours sincerely



MRS GNM PANDOR, MP
MINISTER OF SCIENCE AND TECHNOLOGY
DATE: 15-5-2015

Cc Dr Sibisi
CEO: CSIR
PO Box 395
PRETORIA
0001
Fax: 012 841 3549



MINISTER: FINANCE
REPUBLIC OF SOUTH AFRICA

Private Bag X115, Pretoria, 0001, Tel: +27 12 323 8911, Fax: +27 12 323 3262
PO Box 29, Cape Town, 8000, Tel: +27 21 464 6100, Fax: +27 21 461 2934

Ref. M3/15/25 (186/15)

Ms GNM Pandor, MP
Minister of Science and Technology
Private Bag X727
PRETORIA
0001

Dear Minister Pandor

**COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR) 2015/2016-2019/2020
BORROWING PLAN: REQUEST FOR THE IMPLEMENTATION OF SECTION 66(3)(b) OF
THE PUBLIC FINANCE MANAGEMENT ACT (PFMA)**

I refer to your letter dated 29th January 2015 regarding the abovementioned request.


I concur with your approval of the CSIR's request in terms of section 66(3)(b) of the PFMA. The guarantee amounts in terms of the application, for the five year period 2015/16 to 2019/20, are as follows:

- R59 million for the 2015/16 financial year;
- R66 million for the 2016/17 financial year;
- R76 million for the 2017/18 financial year;
- R89 million for the 2018/19 financial year; and
- R100 million for the 2019/20 financial year.

This concurrence is given on condition that the CSIR report to the National Treasury and the Department of Science and Technology, on an annual basis, on the utilisation of the guarantee limits and the progress on the implementation of projects secured through the guarantees.

I trust that the above is in order.

Kind regards


NHLANHLA M NENE, MP
MINISTER OF FINANCE
Date: 21/4/2015

