

CSIR SHAREHOLDER'S COMPACT

Cycle commencing 1 April 2017



science
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Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

CSIR
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Overview of Shareholder's Compact

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

- Strategic planning documents:
 - Strategic Plan (Appendix A);
 - Annual Performance Plan: 2017/18 (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



science
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Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

SHAREHOLDER'S COMPACT

FOR THE CYCLE COMMENCING 1 APRIL 2017

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 2017/18 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 2017/18; 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 2017;
- 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 2017.
- 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 2018.

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 2017/18 planning cycle; the CSIR’s Risk Management Strategy; the CSIR’s Fraud Prevention Plan; the Materiality Framework; the Budget and Cashflow for 2017/18; 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 three categories and their associated strategic objectives are:

SO1 Conduct high-quality and relevant research and technological innovation to foster industrial and scientific development. This strategic objective is achieved through the selection and implementation of a range of R&D programmes.

SO2 Build and transform human capital. The CSIR's scientific and technical contributions are only possible through the skills and capabilities of our scientific staff (which we refer to as our Science, Engineering and Technology (SET) base). The ongoing development, renewal and transformation of the SET base 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.

SO3 Maintain a sustainable and well-governed organisation. 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 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.8 for a detailed description of each KPI) are:

Learning and Growth

- **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 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.*



- **New patents:** *Patents provide a lead indicator of impact through commercialisation, and serves to protect the valuable Intellectual Property (IP) created by CSIR scientists.*
- **Contract Research and Development (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.*
- **Royalty and License income:** *Royalty and licence income is an indicator of successful technology transfer and commercialisation.*

Human Resources and Transformation

- **Total size of SET base:** *SET staff include staff on Researcher, Research and Development, Technical and Project Management career ladders, research managers, post-docs, studentships, interns and staff in fixed positions who primarily work on Research, Development and Innovation (RD&I) projects. Bursars and vacation workers are excluded. SET staff is a measure of the CSIR's capacity to deliver on RD&I projects.*
- **Number and Percentage of SET base who are Black/Female:** *These indicators, refer to the number and proportion of Black and Female South African citizens in the SET base. These measures capture the level of demographic transformation within the RD&I capacity of the organisation.*
- **Number and Percentage of Chief Researchers who are Black/Female:** *These indicators, refer to the number of Black and Female South Africans who are Chief Researchers. The Chief Research level is the highest research level at the CSIR and Chief Researchers are expected to conceptualise and lead large Research, Development and Innovation (RD&I) programmes. These measures capture the level of demographic transformation at the research leadership level.*
- **Number and Percentage of Principal Researchers who are Black/Female:** *These indicators, refer to the number of Black and Female South Africans who are Principal Researchers. The Principal Research level generally consists of SET staff who are nationally-recognised specialists in their area of expertise, and who lead large RD&I programmes at the CSIR. These measures capture the level of demographic transformation at the research leadership level.*
- **Number and Percentage of SET base with a PhD:** *These indicators, provide a measure of the quality of our SET capacity*

Financial, Investment and Organisational

- **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.*
- **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.*
- **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.
- 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.



	Indicator	Target for 2016/17	Forecast for 2016/17	Target for 2017/18
Scientific & Technical	Publication Equivalents	490	490	500
	Journal Articles	300	300	310
	New Technology Demonstrators	30	40	40
	New Patents	≥15	15	≥15
	Contract R&D Income (Rm)	R 1,914 m	R 1,930 m	R 2,128 m
	Royalty and License Income (Rm)	R 2.9 m	R 4 m	R 5.2 m
Learning & Growth	Total Size of SET Base	2,100	2,050	2,100
	– Number of SET Base who are Black	1,260	1,230	1,280
	– Percentage of SET Base who are Black	60%	60%	61%
	– Number of SET Base who are Female	755	740	785
	– Percentage of SET Base who are Female	37%	36%	37%
	– Number of SET Base with a PhD	375	365	411
	– Percentage of SET Base with a PhD	18%	18%	20%
	Total Chief Researchers	–	20	22
	– Number of Chief Researchers who are Black	–	1	2
	– Percentage of Chief Researchers who are Black	–	5%	9%
	– Number of Chief Researchers who are Female	–	3	4
	– Percentage of Chief Researchers who are Female	–	15%	18%
	Total Principal Researchers	–	228	240
	– Number of Principal Researchers who are Black	–	48	53
	– Percentage of Principal Researchers who are Black	–	21%	22%
	– Number of Principal Researchers who are Female	–	42	45
– Percentage of Principal Researchers who are Female	–	18%	19%	
Fin. & Gov.	Total Income (Rm)	R 2,611 m	R 2,659 m	R 2,863 m
	PPE Investment (Rm)	R 103 m	R 117 m	R 108 m
	Net Profit (Rm)	R 58 m	R 94 m	R 64 m
	B-BBEE Rating	Level 2	Level 3	Level 2
	DIFR	≤0.3	0.1	≤0.2

Table 2.1: CSIR Key Performance Indicators: 2017/18



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 2017/18 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 this Shareholders Compact may change due to variations and changes in the market and in society, the spirit thereof will remain unchanged.



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THE CSIR SHAREHOLDER'S COMPACT

Agreed to and signed in Pretoria on 28 Feb 2017.

Prof. Thokozani Majozi


On behalf of the CSIR's Accounting Authority

Agreed to and signed in Cape Town on 28 Feb 2017.

Mrs Naledi Pandor, Minister of Science and Technology


The Executive Authority

Strategic Plan

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A.1 The CSIR's 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

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 [National Development Plan \(NDP\)](#) and further articulated through the 9-Point Plan and sector-specific initiatives.

Scientific 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 climate change and the mismanagement of our natural resources.

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.1.1 CSIR Strategic Framework

An overview of the **CSIR Strategic Framework** is provided in [Figure A.1](#). 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 (academic 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.

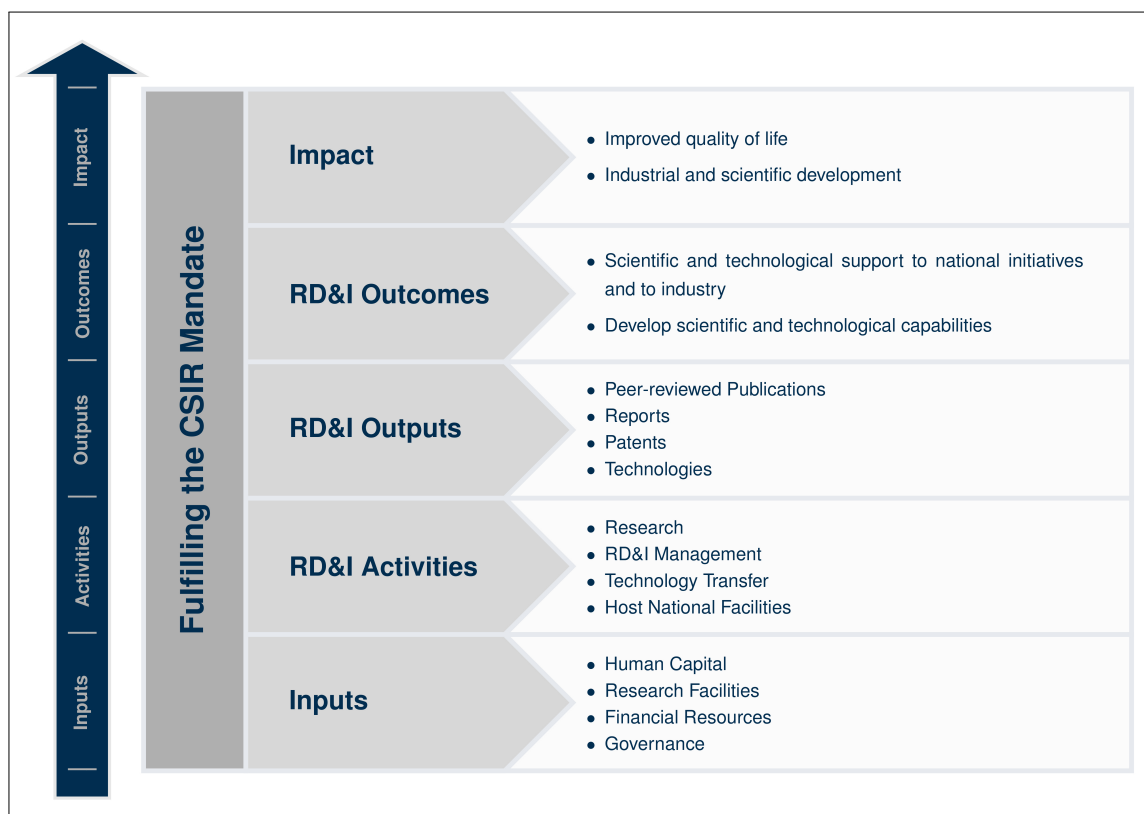


Figure A.1: CSIR Strategic Framework

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 scientific talent.
- A financially sustainable and well-governed organisation ensures that the focus can remain on the delivery of our scientific mission.

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 scientific 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.1.2 CSIR Business Model

The CSIR obtains approximately one-third of its operational budget from National Treasury in the form of a Parliamentary Grant. This grant is used to maintain the infrastructure of the CSIR, including our buildings and property; our research equipment and laboratories; and to support R&D in areas which other sources of funding are not yet available. The remainder of our income is derived from contract income. Although portions of this income are in the form of long-term contracts a substantial proportion of contract income is short-term in nature. Our ability to develop long-term plans are therefore contingent on our expectations about the nature and volume of these income flows, and are thus susceptible to external factors. These external factors could include fluctuations in the economy itself, changes in strategy or policy by our partners and the presence or absence of competing providers. Our commitment to financial sustainability may therefore, in some cases, lead to conflicts with our R&D strategy, and therefore result in deviations from that envisaged strategy.

A.2 Linking the CSIR Mandate to National Priorities

The practical application of the CSIR Mandate 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.2.1 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:

- Economy and Employment,
- Building a Capable State,
- Economic and Social Infrastructure,
- Transition to a Low-Carbon Economy,
- Transforming Human Settlements,
- Improving Health, and
- Building Safer Communities.

In Section A.4 we set out in detail the linkages between our proposed R&D interventions and the aims of the NDP.

A.2.2 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.

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

The DST Strategic plan articulates its contribution to the NDP goals and Medium Term Strategic Framework (MTSF) objectives as follows:

- Utilization of knowledge and innovation for:
 - New industrial development and economic diversification,
 - Commercialisation of ideas,
 - Improved SME competitiveness,
 - Inclusive social development.
- Expansion and transformation of research capacity through Human Capital Development (HCD) and the provision of R&D infrastructure.
- Deepening bilateral engagement with the rest of the African continent.
- Building youth support, by itself through its agencies.
- Continuous engagement with the public.

The CSIR contributes to all of the DST's strategic objectives in the following CSIR strategic objectives and key initiatives:

Conduct high-quality and relevant research and technological innovation to foster industrial and scientific development. This strategic objective is achieved through the selection and implementation of a range of R&D programmes. This strategic objectives contributes to the use of knowledge and innovation for socio-economic development and transformation. In particular the CSIR supports interventions aimed directly at improving the competitiveness of businesses (particularly [Small, Medium and Micro Enterprises \(SMMEs\)](#)) through technology interventions (see [Section A.4.1](#) for details), interventions that support government's ability to efficiently deliver services (see [Section A.4.2](#) for details), and support the growth and maintenance of our economic and social infrastructure (see [Section A.4.3](#)). These interventions will, if successful, contribute to the attainment of the following [DST](#) proxy impact indicators:

- Additional revenue of R 500 million from businesses receiving support from [DST](#)-funded instruments;
- Performance of 10,000 [SMMEs](#) improved through technology interventions;
- Decision-support that improves the service delivery of at least 10 government departments;
- Improved standard of living for at least 500,000 people and/or 12 communities.

Build and transform human capital. The CSIR's scientific and technical contributions are only possible through the skills and capabilities of our scientific staff – our [SET](#) base). The ongoing development, renewal and transformation of the [SET](#) base 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. The strategic objective of the CSIR directly addresses the [DST](#)'s second and fourth strategic objectives, focused on human capital development and transformation, and building support for youth, respectively.

The CSIR Africa Strategy The CSIR is currently revising and updating its Africa Strategy, which contributes to the [DST](#)'s strategic objective of deepening bilateral engagement in the rest of the African continent.

Public Engagement The CSIR has a robust Strategic Communications portfolio, which identifies and manages stakeholder communication issues with the aim of contributing towards the realisation and achievement of the CSIR's strategic priorities (see [Section A.6.5](#) for further details). This contributes to the [DST](#) objective of continuous engagement with the public.

A.2.3 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 outline 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 (see LC4 and ES12 in Section A.4).
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 (see EE9 in Section A.4).
3. **Advancing beneficiation or adding value to the mineral wealth.** Our interventions include activities around Titanium and Aluminum beneficiation and beneficiating polymer nanocomposites. (See EE1, EE2 and EE4 in Section A.4).
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). (See EE7 in Section A.4).
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.** No direct contribution
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 (see EE6 in Section A.4).
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. (See EE8, ESI3, ES16 and ES1 in Section A.4 for details).

- 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. (See EE13, ES15 and LC3 in Section A.4)

A.3 CSIR Strategic Objectives and Measurement Framework

A.3.1 CSIR Strategic Objectives

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

SO1 Conduct high-quality and relevant research and technological innovation to foster industrial and scientific development. This strategic objective is achieved through the selection and implementation of a range of R&D programmes. See Section A.4 for details.

SO2 Build and transform human capital. The CSIR's scientific and technical contributions are only possible through the skills and capabilities of our scientific staff (which we refer to as our SET base). The ongoing development, renewal and transformation of the SET base 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.

SO3 Maintain a sustainable and well-governed organisation. 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 sustainable manner.

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 three 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 three 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.

A.3.2 Short-Term Indicators

The detailed short-term indicators and targets are given in Section A.7.

A.3.3 Long-Term Measures

The CSIR is in the process of formalising a set of long-term measures that will assist us in determining the effects of the outcomes associated with our interventions.

SO1 Conduct high-quality and relevant research and technological innovation to foster industrial and scientific development.

The measures for this strategic objective include:

- The detailed outcome and impact indicators for our R&D programme – the current set of indicators are contained in the exposition of our R&D programme in Section A.4.
- The extent to which the strategic R&D choices made by the CSIR are aligned with, and responsive to, national developmental priorities.
- The quality of the R&D work performed by the CSIR.

SO2 Build and transform human capital.

We want to, over the longer-term measure our contribution to building and transforming human capital.

The possible measures for this strategic objective include:

- The existence, implementation and resourcing of clear strategies to support the building of human capital.
- Proportion of staff members (by demographic group and gender) who have improved their qualifications.
- Number of degrees obtained by students supported by the CSIR.

SO3 Maintain a sustainable and well-governed organisation.

The indicators for this strategic objective include the following:

- The extent to which our infrastructure is maintained at a level conducive to performing high-quality R&D?
- The extent to which our R&D services (and the business model supporting the delivery of those services) are properly positioned to ensure the long-term financial viability of the CSIR?

The longer-term measures will, in the main, be collected and analysed as part of organisational reviews conducted at two-to-three year intervals.

A.4 SO1: Research and Development

A.4.1 Economy and Employment

Achieving full employment, decent work and sustainable livelihoods is the only way to improve living standards and ensure a dignified existence for all South Africans. Rising employment, productivity and incomes are the surest long-term solution to reducing inequality. Similarly, active steps to broaden opportunities for people will make a significant impact on both the level of inequality and the efficiency of the economy. This will be achieved by expanding the economy to absorb labour and improving the ability of South Africa's people and institutions to respond to opportunities and challenges.

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 Gross Domestic Product (GDP) dropping from 24% in the early 1980s to less than 13% today.

The contribution of the manufacturing sector to overall employment fell from 14.6% in the first quarter of 2008 to 11.5% by the third quarter of 2014 and amounted to a substantial loss of some 370,000 employment opportunities.

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.

IPAP is focused on eight critical programmes, three of which directly involve industrialisation:

1. **Infrastructure-driven industrialisation** is concerned with building the public infrastructure programme, with stronger support for local manufacturing and economic infrastructure.
2. **Resource-driven industrialisation** is focused on leveraging SA's mineral resources for greater levels of downstream beneficiation and value addition.
3. **Advanced manufacturing-driven industrialisation** has a special focus on lead companies which can compete in export markets, and is characterised by strong public sector support allied to strong stakeholder engagement, particularly with global Original Equipment Manufacturers (OEMs).

Advanced manufacturing has been globally recognised as critically important to reverse de-industrialisation and to create decent, well-paying jobs. Competitive advantage is increas-

ingly 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.

It is estimated that advanced manufacturing can add R 540 billion to SA's GDP and create 1.5 million new jobs by 2030. Advanced manufacturing sectors in which SA is considered to have competitive advantage are listed as automobiles, transportation equipment, electrical equipment and parts, and chemicals. IPAP makes specific reference to the need to grow the aerospace and defence sector and aims to strengthen the sovereign local manufacturing industry with strong spill overs to related civilian sectors.

The South African photonics industry comprises a well-developed defence optronics component and some smaller medical, optronic, optic and laser display businesses. There is significant potential for diversification and expansion. Skilled and experienced expertise to exploit this potential is limited. Several universities are contributing skilled manpower and research in laser physics and some, notably the Central University of Technology (CUT), are developing capabilities in additive manufacturing.

In this context the CSIR is well-positioned to play a key role in the national effort at re-industrialization 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. The key problems that the CSIR seeks to address are outlined below, together with the proposed approaches, all aimed at achieving long-term impact as described by the related objectives specified.

EE1 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. The successful demonstration of these technologies at pilot scale is, in the short term, a critical success factor for these technologies.

EE2 Aluminum Beneficiation

There is a need for new Al product and processing technologies to improve the competitiveness of this key sector.

Our long-term aim is the development of selected Al processing technologies and new Al alloys and Al metal matrix composites (AIMMCs) to revitalise the Al industry.

EE3 Mechatronic 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. These machines include a robotic hanger for conveyor belt idlers; a concrete floor levelling machine; pedestrian detection technologies for mines; and a haul truck tyre changing robot.

EE4 Polymer nanocomposites

These materials have not been developed and produced in SA to any significant degree. The development of an industry based on polymer nanocomposites requires an in-depth understanding of the properties of such materials at the nano, micro and macro levels; the ability to engineer such material properties to meet demanding end user requirements; and the development of manufacturing processes on an industrial scale.

Our aim is to develop advanced materials targeting specific applications, together with the processing technologies that will be required to manufacture them on an industrial scale. The focus is on materials derived from local natural resources in the fields of polymer nanocomposites; clays and synthetic clays; advanced composites; natural fibre products and functional polymers. A special focus is on proving (at pilot scale) the feasibility of manufacturing such materials in industry.

EE5 Additive Manufacturing

There is a need to develop additive manufacturing platforms to create new manufacturing processes for the aerospace industry and other sectors.

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.

EE6 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.

A particular focus will be creation of enterprises in the area of photonics. The photonic sector is import dominated with poor collaboration between technology and product development stakeholders and HEIs, together with poor identification of photonics-based

SMMEs. In addition investments in South African-developed optical technologies are not being translated into new products and devices. The establishment and operation of a Photonics Prototyping Facility (PPF) will provide the necessary infrastructure, skills and expertise for the prototyping and product development of photonics technologies, which will lead to new offerings in industry and SMMEs.

EE7 Technology Localisation

There is a lack of supplier/enterprise development in support of localisation.

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 AISI the Bio-composites Centre of Competence (BCC) and the NFTN.

EE8 Digital Opportunities

We need to utilise our IT technologies and infrastructure to create economic opportunities in wireless applications and the commercialisation of software technologies.

Our aim is to develop an innovative Micro Enterprise Media Engine (MEME) platform with content ingestion, programme scheduling and timed play-out service for virtual television stations. This will create an open massively scalable mobile IPTV system that integrates public internet based media content scheduling and broadcasting capabilities without viewer stream break-up, with improved low-rate rural network performance.

EE9 Support for the National Bio-Economy Strategy

Diversification of the South African economy is an important pillar for inclusive economic growth. There is a need to convert the high-quality biosciences R&D in South Africa into commercialised products and technologies.

The CSIR will apply its unique knowledge, technologies and infrastructure in bio- and agro-manufacturing product and process development to:

- Commercialise CSIR-developed technologies from competitive expression system and natural product technology platforms through spin-out companies.
- Expand the BIDC model both nationally and regionally to support both SMEs and industry in establishing cutting edge industries in the bio-economy sector.
- Establish automated high-throughput technologies (high throughput screening, high throughput extraction, high throughput purification) to identify natural compounds and fractions from plant diversity for use in the pharmaceutical, cosmetic and food industries.
- Modify the model developed for creating sustainable Agri-parks in the Eastern Cape and roll this out to other communities across South Africa.
- Develop nutrient-dense food products using relevant food processing technologies to address food-related challenges in urban and rural communities.

EE10 Laser-based Engineering

There are a number of gaps in the South African market for laser-based engineering products:

- 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).
- Commercial laser-based engineering systems are not designed and optimised for the above processes.
- Lack of South African laser surface engineering, laser joining and laser refurbishment technologies to repair high-value components for SOEs.
- The manufacturing SMMEs are not globally competitive to support economic growth targets, as well as support job creation. AM technologies have high barriers to enter due to the capital investment and lack of expert skills to develop and provide advanced manufacturing solutions.

In response the CSIR will:

- Develop optical technologies and lasers in close cooperation with users of laser-based engineering. This will include modifying existing high-power lasers using existing CSIR know-how and patents.
- Work towards a reduction in operational costs for SOEs in the 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.
- Maintain an expertise base in advanced manufacturing by serving SMMEs through laser-based manufacturing services.

EE11 National Large Scale Engineering Capability

South Africa has a lack of large scale engineering capabilities required for participating in key complex industries such as airliner design and manufacture, electricity power plant design and building, large ship design and building, telecommunication satellite design and manufacture, and many other existing global industries and future industries, for local and export opportunities.

Our intent is to 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. This will support the development of large-scale engineering capabilities required for participating in complex industries.

EE12 Resource Efficiency – National Cleaner Production Centre-South Africa

One of the central challenges constraining South Africa's development is the resource-intensive nature of our economy.

The NCPC-SA promotes the efficient utilisation of resources through the provision of relevant training programmes for industry.

EE13 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.

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. In particular we will support efforts to establish a coherent R&D strategy and funding plan for extraction-related research in the mining sector, and contribute to co-ordinated R&D activities across the mining value chain aimed at achieving sustainable development of the sector (with reference to technological, environment, social and economic challenges).

Our work on safety in mines will include investigation into seismicity and excavation stability for current operations as well as the transition to modernised (mechanised) mining. This will be further supported by the development of geophysical tools to assist in delineating the rockmass and reserves ahead of the current mining.

EE14 ICT for Industrialisation

This area will focus 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).

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.

Our work will include:

- Development of embedded intelligence subsystems for local products/equipment to enable improved performance and competitiveness.
- Development of models, tools, analyses and technologies for product/equipment self-management, condition monitoring and tracking of products/equipment.

EE15 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. A typical example is that of decisions on how and when to develop the chains being made before a thorough value chain analysis is conducted, or local content requirements that are not informed by research.

The development of nascent industries often proves a challenge particularly in developing economies. The biggest challenge in industrial development is that its driven by the end-state in mind (e.g. 90% local content) and taking little consideration of the realities such as the need for economies of scale, the size of the local market, competitiveness and local industries that are not export driven.

The CSIR will develop analytical tools for industrial development in the Energy Sector – we will develop, customise and apply science-based tools for analysis of industrial development scenarios and policy analysis in the energy sector. These may include econometric tools such as CGE Models, Value Chain Analysis Models, Cost-Benefit analysis models, JEDA models etc.

Additional research will focus on facilitating strategic dialogue on industrialization in the Energy Sector in South Africa through development 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 and operations, identifying and analysing economic development prospects across all technologies. Collection and analysis of primary data (import and export, equipment prices, supply and demand, jobs, etc) about the South African (and global) markets will give a full-view perspective of the developments in the industry.

A.4.2 Capable State

If we are to address the twin challenges of poverty and inequality, a state is needed that is capable of playing a transformative and developmental role. This requires well run and effectively coordinated state institutions staffed by skilled public servants who are committed to the public good and capable of delivering consistently high-quality services for all South Africans, while prioritising the nation's developmental objectives. This will enable people from all sections of society to have confidence in the state, which in turn will reinforce the state's effectiveness.

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 programme 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.

Our interventions in response to these problems are as follows:

CS1 Incubation of national capabilities to support service delivery

By working with national institutions such as 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.

CS2 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 transforms 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).

CS3 The large-scale deployment of technologies that support service delivery

There are a variety of avenues through which CSIR technologies can be deployed, including licensing and the creation of start-up companies. These may not be naturally suited to the service delivery arena, and in such cases we need the dedicated capability that is able to assess the potential effectiveness of the technology and, together with other developmental agencies, identify mechanisms through which these technologies can be deployed at scale.

CS4 The large-scale deployment of technologies that support service delivery

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 will develop 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.

A.4.3 Economic and Social Infrastructure

To achieve sustainable and inclusive growth by 2030, South Africa needs to invest in a strong network of economic infrastructure designed to support the country's medium- and long-term objectives. Achieving this vision is possible if there is targeted development of transport, energy, water resources, and ICT networks. The Presidential Infrastructure Coordinating Commission (PICC) has been established to co-ordinate the long-term delivery of infrastructure. The PICC currently manages a portfolio of approximately R 800 billion and has established 18 Strategic Integrated Projects (SIPs) to support infrastructure delivery.

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.

ESI1 Water Infrastructure

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 SAICE leading to major losses and water quality problems.

Our aim is to:

- Develop coherent water resource decision-support frameworks, and address gaps in assessments, technologies, tools and techniques. These include integrated hydrogeological decision-support tools and water risk assessment measures to promote and improve the health of freshwater ecosystems.
- Develop a portfolio of solutions for water treatment and the detection of contaminants. Specific solutions 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 includes the integration of a range of technologies to enable the continuous monitoring, diagnosis, control and optimisation of the water distribution network.

ESI2 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:

- A Sulfur Hexafluoride¹ gas leak detection system for use by the power industry in SA.
- 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.
- 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.
- Natural gas – Energy technologies, processes and policies centred on natural gas as an energy source, including gas markets, gas storage and gas power generation.
- Smarter Grids – Technologies and processes for efficient markets for bidirectional power flows.
- Mobility – Technologies for applying renewables in electric and gas-driven vehicles and trains.
- Market Design and Policy-making – Develop in-house capabilities for driving market designs and policy-making.
- The CSIR will work closely with the National Hub for Postgraduate Programmes in Energy Efficiency and Demand Side Management (EEDSM Hub) housed at the University of Pretoria to develop methodologies for assessing energy demand and identifying possible energy efficiency interventions in various sectors.
- Through the Energy-Autonomous Campus Programme, the CSIR will demonstrate demand-side interventions to help balancing supply and demand at the CSIR campus in Pretoria. It will furthermore conduct analyses around the potential for dispatchable demand-side interventions in programmes along all end-use sectors together with SANEDI.
- Assess emerging energy efficiency and demand response technologies that could potentially support the integration of renewable energy in the power system
- Perform long-term forecasting of energy demand for South Africa and the region.
- Energy Planning: Long-term effects of new capacity on the power system; scenario analyses for different sets of key assumptions; IRP type modelling
- Network Planning (transmission and distribution), including real-time digital power system simulations and microgrids
- Cost-optimal design and operation of microgrids with all various dynamic energy sources The Energy-Autonomous Campus project is effectively a CSIR Campus microgrid which will provide a test-bed platform for research and industry.

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.

ESI3 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.
- Demonstrate the use of a microfiller as bitumen extender – this will double the fatigue life of asphalt materials whilst saving on cost.
- Demonstrate advanced, large block paving systems utilising waste materials for rapid construction of road surfaces.
- Develop the next generation version of the Traffic Stream Simulator (HVS) that can simulate a mixed traffic stream at high speed for road pavement testing.
- Develop performance-based specifications for smart trucks – this will allow for the design of trucks outside of the normal specification to improve road safety and increase the payload thus saving up to 15% of transport cost.
- The development and licensing of road management systems to local authorities.
- The development and implementation of pothole scanning systems.
- The field testing of a locomotive diagnostic and conditioned based monitoring system (in partnership with Transet).
- The finalisation of a field research platform for rail line defect monitoring (in partnership with Transet).

ESI4 Building Design

The over-arching problem in this domain is the sub-optimal functional performance of buildings as well as a lack of maintenance. Many buildings are currently not performing optimally both in terms of functional performance as well as in terms of resource usage. This is usually associated with poor design and low or no maintenance of such buildings. In addition, there is significant pressure to reduce the cost of, and reduce the delivery time of, new public buildings.

Our aim is to:

- Develop guidelines for the design and operation of public buildings, particularly schools and health facilities, to ensure optimal functional performance;

- Investigate new building materials that are stronger, with a lower carbon footprint; and
- Demonstrate and develop guidelines for new construction methodologies that will ensure more cost-effective and energy-efficient delivery of new buildings.

ESI5 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.
- Develop an automated system for coastal structure scanning consisting of a laser scanner that provides 3D LIDAR scanning of breakwater and port infrastructure as well as dredging levels.
- Develop tools for real time sediment movement monitoring to assess erosion of beach profiles and accretion of sediment.
- Develop models for hydrodynamic, sediment and wave modelling in coastal zones to support the efforts to improve management of coastal and marine resources.
- Deliver operational support to ports and port-city interfaces through the development of long-term conceptual model/s of interactions between social-ecological systems, the ecosystem services they generate, ecological infrastructure, human well-being, equity and poverty.
- Develop an online Oceans and Coasts Information Management System to allow for real-time accessibility of information and data for informed decision-making and planning.

ESI6 ICT Infrastructure

The national priority with respect to broadband infrastructure is 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 will:

- Develop dynamic spectrum assignment and management tools to enable automated spectrum assignment and hence increase the efficient utilisation and management of networks.

- Develop 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.
- Develop 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.

ESI7 National Integrated Cyberinfrastructure System

National Integrated Cyberinfrastructure System (NICIS) 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 (SAN-ReN); 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.

A.4.4 Transition to a Low-Carbon Economy

By 2030, South Africa's transition to a low-carbon, resilient economy and just society is well under way. Having undertaken the difficult steps to adjust, all sectors of society are actively engaged in building a competitive, resource-efficient and inclusive future, and the country is starting to reap the benefits of this transition. South Africa has reduced its dependency on carbon, natural resources and energy, while balancing this transition with its objectives of increasing employment and reducing inequality. Development initiatives, especially in rural communities, are increasingly resilient to the impact of climate change, with mutual benefits between sustainable development and low-carbon growth quickly identified and exploited. The state has significantly strengthened its capacity to manage the ongoing internalisation of environmental costs, and to respond to the increasingly severe impacts of climate change.

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.

LC1 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.

Our intent is to:

- 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.

LC2 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.
- Provide new scientific evidence and decision support tools for unlocking green economy growth from the solid waste sector.
- Develop a forest and waste biomass biorefinery R&D platform developing technologies and directed chemical engineering, chemistry, and biology capabilities enabling green economy development
- Implement the National Waste RDI Roadmap.

LC3 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 will 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.

Our intent is to:

- Develop automated landcover classification and change detection tools using novel machine learning algorithms.
- Enhance disaster management decision making and mitigation by developing multi-hazard terminal information products.
- Develop an integrated Oceans and Coasts information and awareness system based on processing of diverse satellite data.
- Develop an automated land surface deformation monitoring system.

LC4 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 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: A detailed assessment of energy consumption and demand across all end-use sectors is required to form a basis (baseline) for improving energy efficiency and demand response.
- Demand-side Technologies: There is a need to conduct technical assessments, testing and demonstration of emerging technologies. We will also investigate the development of new technologies.
- Demand Forecasting (short-term, long-term and spatially): Forecasting the total energy demand in the different end-use sectors over long time periods is important to guide investments into energy infrastructure. The research problem is to determine the energy intensity of different economic sectors, in combination with the expected structure of the economy, as well as coupling between energy sectors (e.g. fuel switch from electric to gas cooking). Spatial demand forecasting becomes an increasingly important topic in the electricity sector, as it determines the need for new grid infrastructure, especially in conjunction with spatially distributed supply options in form of solar PV, wind, biogas, small hydro and other renewables. Regional optimisation of supply and demand options can only be done if the spatial energy demand is forecasted accurately. Short-term forecasting is required to instantaneously balance supply and demand.

A.4.5 Building Safer Communities

In 2030, people living in South Africa feel safe and have no fear of crime. They are safe at home, at school, at work and they enjoy an active community life free of fear. Women can walk freely in the streets and children can play safely outside. The police service is a well resourced professional institution staffed by highly skilled officers who value their work, serve the community, safeguard lives and property without discrimination, protect the peaceful against violence and respect the rights of all to equality and justice.

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 DoD, but there has been a growth in partnerships with the SAPS and the in recent years. Strategic level partnership agreements are in place with the DoD, SAPS, and DTPS that provides a strategic framework for engagement and provides not only 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 and grown with a close working relationship existing with a number of senior managers.

The **Defence Review** of the Military Strategy of the SANDF emphasise 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.

SS1 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.

The 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 will use a “Whole-of-Society” approach for dealing with complexity – this include the creation of a shared understanding and analysis of the safety and security problem using models, stakeholder engagement and integrating multiple disciplines and organisations.

SS2 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 organizational capabilities required. Many of these capabilities require complex technology support for establishment and sustainability.

Our aim is to assist national institutions in the safety and security sector with technology and engineering systems support in order to deliver on their strategic objectives

SS3 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.

Our intent is to 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

We will 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. This will include the development of new technologies, and the evaluation of existing solutions to solve problems in the domain of inter-departmental and multi-national operations.

SS4 SANDF Air Operations capability

There is a need for continuous improvement of mission effectiveness and efficiency of SAAF Air capability.

Our intent is to support the continuous improvement of the mission effectiveness and efficiency of South African Air Force (SAAF) Air capability. This requires integration of complex systems such as aircraft, weapons, surveillance sensors and pods into a capability with high integrity, safety, and performance, and with low life cycle cost

In support of this effort we will:

- Develop a flexible, effective, cost-effective and robust simulation framework and validated models for the modelling of force and threat entities (current and future)

to advise concepts of operations, tactics, and doctrine, planning, acquisition and technology development.

- Develop of skills/experience, tools and flight test techniques to evaluate flutter, performance, flying qualities and handling.
- Develop validated simulation tools to perform the necessary thermal analysis and assessment of sub-system life in a way that is acceptable and suitable for OEM acceptance and Directorate Systems Integrity in the Air Force.
- Develop skills/experience, experimental techniques and infrastructure for the assessment of aircraft structures.
- Develop infrastructure, simulation technologies and techniques for the aerodynamic characterisation of airborne systems suitable for the purpose of aerodynamic design, aerodynamic model development and control system development.

SS5 SANDF Landwards Capability

There is a lack of technologies for supporting a specialised, highly mobile combat capability able to rapidly deploy to remote areas for specific preventative and intervention operations. This includes providing high levels of protection against threats without reducing mobility in a wide range of terrains. Deployments include Operations Other Than War that requires effective non-lethal weapons technologies. Additionally, there is a need for improved and integrated technological decision support, based on sound mathematical and scientific principles.

Our aim is to 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.

SS6 SANDF Platform Protection

There are significant engineering requirements for the design, maintenance and protection of Maritime, Airborne, and Landwards operational platforms.

Our aim is to develop engineering solutions that increase the survivability of SAAF and SA Navy platforms against optical (including infra-red) and radar-guided weapons.

Our work will include:

- Threat characterization/evaluation
- Aircraft characterisation/evaluation
- IR signature reduction.
- Counter measures characterisation/evaluation
- Training to ensure capability sustainability
- Integration of IR/RF survivability capability
- Improve survivability of aircraft against Radar guided threats

- Develop an integrated system (combining OSSIM and Sensor and EW Engagement Simulator (SEWES) functionality) for overall survivability improvement through integrated doctrine and tactics development.
- Develop rugged mid-infrared lasers in partnership with industry for commercial Directed Infra-Red Counter Measures (DIRCM) laser systems in order to address the immediate need for protection against IR guided threats.
- Develop a high-power laser shield with graduated response capabilities for protection against a variety of guided and unguided threats.

SS7 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;
- Conventional warfare;
- Combating crime; and
- Intelligence gathering – Strategic/Tactical Intelligence comprehension.

We will improve the performance of Optical surveillance sensors and networks through:

- Sensor networks characterisation
- Target of interest characterisation
- Hosting platform integration
- Scene background characterisation
- Presentation of multi-sensor information
- Sensor characterisation/evaluation

We will improve the performance of Radar surveillance sensors and networks through:

- Research into cutting-edge radar techniques and technologies to enable industry
- RF propagation prediction
- Non cooperative target recognition (NCTR)
- The development of an Airborne SAR laboratory
- New niche radar concepts for industry development

SS8 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 organizational level while under severe cyber-attack.

Our work will focus on:

- Implementation of the National Cyber Security Policy Framework: This will include the development and support for the establishment of a Cybersecurity Centre of Innovation to support the exchange of threat information, establishment of cybersecurity skills and the development of innovative cybersecurity solutions.
- SANDF cyber defence capability that can defend against current and future cyber threats, non-nation threats: This will include:
 - The hardening of SANDF systems
 - Integration of SANDF capabilities into the National Cyber Defence System
 - Development of technologies and sustainable capacity to improve DOD cyber warfare capability.
 - Development of technologies for information collection and intelligence.
 - Development of technologies and capabilities for DOD for improvement of resilience against large scale cyber threats and attacks
 - Develop technologies and capabilities to defend critical infrastructure against catastrophic cyber threats.
 - Development and support for the DOD Cyber Command intelligence Centre
- Development of a National Cybercrime Combatting Capability: This 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.
- Development of mid-infrared long-range optical communication technologies, reducing the risk of eavesdropping.
- Conduct research in ion trap quantum sensing particularly for applications of quantum feedback control.
- Develop new spectroscopic techniques for molecular fingerprinting.

SS9 Unmanned Defence Systems

There are many opportunities to use unmanned systems to avoid putting people in harm's way and to overcome human limitations in safety and security operations.

Our aim is to increase operational effectiveness and to provide military advantage through the smart acquisition/development and deployment of unmanned systems.

SS10 Special Forces Capability

We will maintain capabilities to support and maintain a Maritime, Airborne/Landwards and Combating Terrorism Special Operations Capability for Special Operations

This will include work on:

1. Developmental engineering and applied operational research projects focussed on Maritime, Airborne/Landwards and Combating Terrorism Special Operations operational capability development and maintenance
2. Command & Control. Projects optimising the current operational/tactical command and control systems for special operations
3. Communication. Projects optimising the current operational communication systems for special operations
4. Intelligence. Projects optimising the current strategic, operational and tactical intelligence systems for special operations
5. Firepower. Projects optimising the current operational/tactical firepower for special operations
6. Protection. Projects optimising the current operational/tactical protection systems for special operations
7. Manoeuvre. Projects optimising the current operational/tactical mobility systems for special operations
8. A range of Quick Reaction Task (QRT) engineering solutions in support of special operations operational deployments.

A.4.6 Improving Health

The vision is that, in 2030, South Africa has a life expectancy rate of at least 70 years for men and women. The generation of under-20s is largely free of HIV. The quadruple burden of disease has been radically reduced compared to the two previous decades, with an infant mortality rate of less than 20 deaths per thousand live births and an under-five mortality rate of less than 30 per thousand. There has been a significant shift in equity, efficiency, effectiveness and quality of health care provision. Universal coverage is available. The risks posed by the social determinants of disease and adverse ecological factors have been reduced significantly.

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.

IH1 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 will include 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 will result in a seamless, secure and trustworthy integration and exchange of health information/data across devices, systems, components and business processes.

IH2 Point-of-Care Medical Devices

Develop a portfolio of medical devices, sensors and information systems to provide 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.

IH3 Burden of Disease

The CSIR will provide 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.

The programmes supported under this initiative include:

- Develop and transfer protein expression products through novel methodologies such as biopharming.
- Establish a multidisciplinary platform that develops point-of-care (PoC) diagnostics tools for human and animal health.
- Support the Biomedical Translational Research Initiative (BTRI) to advance cutting edge gene-based therapies, treatments, diagnostics, training, education, and lead to job creation in South Africa, initially in collaboration with the University of Cape Town.

A.4.7 Transforming Human Settlements

By 2050, South Africa will no longer have: poverty traps in rural areas and urban townships; workers isolated on the periphery of cities; inner cities controlled by slumlords and crime; sterile suburbs with homes surrounded by high walls and electric fences; households spending 30 percent or more of their time, energy and money on daily commuting; decaying infrastructure with power blackouts, undrinkable water, potholes and blocked sewers; violent protests; gridlocked roads and unreliable public transport; new public housing in barren urban landscapes; new private investment creating exclusive enclaves for the rich; fearful immigrant communities living in confined spaces; or rural communities dying as local production collapses.

The CSIR is supporting metropolitan areas and municipalities in a number of areas, including spatial planning, the management of infrastructure and the long-term transition to greener and smarter economies.

Fast-growing cities are not performing optimally often due to ineffective spatial layout and management. In addition, there is a lack of capability and tools in government as well as evidence-based decision-making support, resulting in poor planning, design and management, decision making and spatial prioritisation of interventions (i.e. housing, infrastructure investment, risk mitigation, social support, economic development interventions, etc.). A major need exists to timeously plan and prioritise infrastructure investment with an understanding of impact on development priorities and long term implications. In addition, the performance of the built environment system in South Africa is suboptimal due to a number of factors including the legacy of apartheid. All sectors, as well as spheres of government, responsible for planning and decision making which result in the spatial prioritisation of interventions (i.e. housing, infrastructure investment, risk mitigation, social support, economic development interventions, etc.) need to understand the current and future spatial outcomes of the systems that drive the movement of people and economic activity in order to make informed decisions about the planning and design of regions, cities, towns and neighbourhoods.

THS1 Urban Modelling

Increasing urbanisation places strain on service provision (e.g. waste, sanitation, health-care, education, food and safety), infrastructure (e.g. transport and housing) and management of resources.

Our work will focus on:

- 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. This will include:
 - * Development of a “Smart Campus” that provides context and situational aware 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

- * 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
- * For smart cities, municipalities and regions: provide thought leadership to assist local and regional government enhancing decision based support showing the added (business) value of smart solutions; and pilot solutions in real life conditions

THS2 Spatial Prioritisation Policy

This focus area aims to contribute to the development of more sustainable human settlements by providing practical and policy guidance and access to appropriate information with respect to the planning and design of our cities, towns and neighbourhoods, involving aspects such as settlement layout, housing options and urban land. It also aims to make a contribution to the reduction of crime and the creation of safer communities utilising crime science, particularly crime prevention through environmental design.

A.5 SO2: Building and Transforming Human Capital

A.5.1 Human Capital Development

The CSIR's Human Capital Development focus remains the development of a transformed and highly skilled cadre of scientists, engineers and technologists 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 scientists, engineers and technologists, 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.

In order to develop a world class base of scientists, engineers and technologists, the CSIR broadly commits to achieve the following:

- Develop a pool of an appropriately qualified SET base to conduct research, development and technological innovation;
- Improve the qualification profile of its researchers consistent with other world-class research and technology organizations; and

- Implement a set of interventions that help ensure development of a healthy pipeline of scientists, engineers and technologists.

The CSIR is also 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 scientists, engineers and technologists and improving participation rates by designated groups across all levels. The revised strategy will, therefore, endeavour 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 development 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.
- Ensuring that transformation also addresses the development of quality CSIR scientists, engineers and technologists from designated groups. Special attention will be paid to support designated groups to grow from D1 (early 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 scientists, engineers and technologists, 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 to making CSIR a world-class research and technology organization.
- Reviving strong leadership development programmes to equip leaders in science (Project leaders, Senior Scientists, Engineers and Technologists) and leaders of science (Research Group Leaders, Competency Area Managers, Executive Directors) with critical leadership and management competencies needed to deliver on CSIR's mandate and for succession planning.

Current 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, interns and scholarships programmes. The bursary and studentship programmes have a direct and substantial impact on the CSIR because the CSIR absorbs a large proportion of graduates from these programmes either as post graduate students for further study or as staff employed as scientists, engineers and/or technologists. The bursary programme 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 studentship programme, geared towards growing intellectual capital ahead of strategic demand, has afforded the organisation an opportunity to have readily available high level skills. However, the programme also contributes highly skilled human capital to the national system of innovation whenever opportunities arise.

b. Career Ladder Frameworks, Reviews and Evaluations

The review of the Research Career Ladder and the Research, Application and Development (RAD) ladder is due to be completed early in the 2017/18 financial year, paving a way for improved career development opportunities for scientists, engineers and technologists under the new Research and Development Career Ladder. This is one of many mechanisms the CSIR is implementing to improve recognition and reward of scientists, engineers and technologists and thus improve their retention. The new ladder will be piloted and tested, then finalized for implementation in the 2018 call for assessments of scientists, engineers and technologists.

c. 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 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 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 scientists, engineers and technologists. 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 Organizations: 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. Notably, we have an established partnership on doctoral programmes with the University of Cambridge where we co-sponsor doctoral studies in mathematics and science. As part of the CSIR's Africa strategy, the CSIR is seeking to be part of a network of institutes for higher learning and research and technology organisations focusing on collaborative initiatives and human capital development.

Sector Education and Training Authorities (SETAs): The CSIR runs a number of bursary and internship programs 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 scientists, engineers and technologists. 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.6 SO3: Maintain a Sustainable and Well-Governed Organisation

A.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.

A.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 licensing and commercialisation of CSIR technologies and intellectual property. The overall strategic objective of the Licensing and Ventures (L&V) Office is to support the impact by the CSIR by strengthening and increasing technology transfer activities in the organisation.

The overall strategic objective of the 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.6.3 Strategic Partnerships

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.

The CSIR has set the following strategic goals in this area:

- Develop a deep understanding of the current and future environment;
- Develop strategic partnerships/ alliances with key actors in the identified priority sectors;
- Develop clearly articulated integrated CSIR value propositions, supported by relevant RD&I programmes for targeted stakeholders in priority sectors and clusters across the full value chain
- Make it easier to do business with the CSIR; and
- Profile the CSIR as a key institution for creating national and international impact.

The CSIR's current relationships with Government Departments, state owned companies, local and international private sector partners as well RTOs and HEIs were reviewed to reflect evolving strategic priorities to improve their effectiveness. Parallel to this process, long term programmes are being developed with HEI partners who have already shown commitment to developing joint programmes in areas of importance to the CSIR. Work has also been initiated on an Africa strategy, which will be pursued further in the coming financial year. The vision of the CSIR's Africa strategy is to make the CSIR an integral part of a vibrant network of innovation organisations solving the development challenges of the continent in line with the Science, Technology and Innovation Strategy for Africa (STISA-2024).

Strategic partnerships between the CSIR and key stakeholders in the private and public sectors, including [State Owned Corporations \(SOCs\)](#), develop structured RD&I initiatives that draw on the science and technology competences of multiple CSIR units and centres.

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 Agent (MISA) and the South African Local Government Association (SALGA). Support that will be provided to these agencies will include decision making and service delivery capacity strengthening to 27 priority 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.

[SOCs](#) in South Africa play a critical role in industrial growth, infrastructure development and job creation. Large integrated projects predicated on the CSIR's multidisciplinary value proposition are under development for and in partnership with [SOCs](#). In this regard, the CSIR is prioritising programmes with Transnet and Eskom. Notably, the CSIR is investing significantly in developing new [R&D](#) capabilities to support the collaboration with Transnet and Eskom. Key and key initiatives in support of Transnet will include High and Medium Speed Rail Research Initiative and Scoping a new TNPA Research Development and Innovation Centre. A team of CSIR and Transnet team is a semi-finalist in the global Hyperloop One competition, a next generation transportation competition to commercialize the Hyperloop for moving passengers and/or cargo at airline speeds at a fraction of the cost of air travel, a concept first by Elon Musk in 2013. The establishment of an Advanced Manufacturing facility with Non-Destructive Testing (NDT) and Non-Destructive Evaluation (NDE) at CSIR will benefit both Transnet and Eskom, and others in industry. Efforts to jointly establish a laser based refurbishing capability at an Eskom facility are at an advanced staged, potentially saving Eskom billions of rand in maintenance and infrastructure availability. These initiatives will explore the possibility to create new black industrialists as part of technology commercialisation.

The CSIR is expanding its partnerships [SOCs](#) beyond Eskom and Transnet. The CSIR has

signed a memorandum of understanding to collaborate with the University of Pretoria and the South African National Roads Agency Limited or SANRAL to establish an Integrated Education, National Certification, National Reference and Research Laboratories Facility. The integrated facility will provide a platform for academic and vocational training support in transportation infrastructure materials testing, a national transportation material reference testing platform as well as high-quality research facilities staffed by skilled personnel in road and road infrastructure. An ongoing needs assessment survey will provide insights on the research needs of the other smaller state owned entities.

The CSIR has recognised that significant scope exists to improve its efforts in serving the private sector. CSIR support to the private sector includes support to existing industries, notably multinationals and local businesses where there is potential to earn contract and royalty income from the private sector. To this end, the CSIR is ramping up its efforts to build strategic relationships with private sector entities. Notable partnerships that are at advanced stages include work with Anglo-American to create non-mining enterprises in mining towns on the basis of CSIR technologies, with Limpopo as a pilot district. The CSIR has also signed a collaboration agreement with RAW Industries, a company founded by Busmark to assist in developing an integrated bus concept and prototype. This includes use of new materials, state of the art design and production techniques, and integration of electronics, surveillance, ticketing and monitoring and diagnostics systems. A key innovation is a platform design allowing electric and hybrid drives with a view to using batteries and hydrogen fuel cells as an energy source. Ultimately the goal is to achieve full local production of the buses. The concepts can be expanded to all types of heavy vehicles. Discussions are also ongoing with General Electric, which has established an innovation centre in Johannesburg as its centre of excellence for innovation and technology transfer in Africa. Technologies under discussion include renewable energy, disease diagnostics platform and health infrastructure. The CSIR notes that there might be a lag phase between these discussions and a ramp up in private sector income.

In addition to the contribution reflected by income derived from the private sector, many government-funded initiatives to create new industries and the establishment of **SMMEs**, with a particular focus on black industrialists. Such initiatives include the Titanium Centre of Competence, The Radar and Electronic Warfare Transformative Enterprise Development (REWTEDE) programme, the Biomanufacturing Industries Development Centre, are in direct support of the private sector and have potential for substantial impact in economic development and job creation.

In the funding domain, the CSIR has put in place strategic partnerships with the 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 is reviewing and renewing its partnership with the Technology Innovation Agency, specifically to advance research from technology development through to commercialization. Internationally, the CSIR is in discussions with the Bill and Melinda Gates Foundation's Africa regional office, and areas of potential collaboration with the Foundation include primary health-

care, diagnostics and drug delivery, water and renewable energies.

In addressing national challenges, the CSIR aims to cooperate with and complement other players in the national system of innovation. The CSIR partners with Research and Technology Organisations (RTOs) and Higher Education Institutions (HEIs) to undertake research and development that contributes to economic growth and addresses the development challenges of South Africa. Through collaboration, the CSIR builds networks that contribute to the strengthening of its own science and technology base, as well as that of South Africa.

Locally the CSIR collaborates with a range of science councils on a variety of initiatives, notably in work relating to various centers of competence and centres of excellence. As an example, the CSIR is in discussion with the Human Sciences Research Councils (HSRC), specifically to complement its technical capabilities with the social science capabilities of the HSRC. Regionally, the CSIR has and will continue to build the collaboration with the Botswana Institute for Technology, Research and Innovation (BITRI), with whom we have established third party funded initiatives in ICT, TV white spaces and are now expanding the areas of focus to include health and defence. The work with BITRI could be a model through which the CSIR can improve its collaboration with innovation centres on the continent as part of its Africa strategy. Through collaboration, the CSIR builds networks that contribute to the strengthening of its own science and technology base, as well as that of South Africa.

The CSIR collaborates with most of the Universities in South Africa, and has collaborative research Initiatives (research chairs, centres of competence and joint research projects) and human capital development. Notable collaboration is ongoing with University of Cape Town, Stellenbosch University, University of the Western Cape, Wits, University of KwaZulu Natal, Tshwane University of Technology. The CSIR is ramping up its efforts to collaborate with historically disadvantaged Universities; setting up a cybersecurity with the University of Venda, and resuscitating its collaboration in food and nutrition with the University of Fort Hare (this relationship was adversely affected by student strikes which led to damages to infrastructure) and continuing work with the University of Limpopo Computational modelling of Titanium alloys, Risk and Vulnerability Atlas for climate change and the human languages technology ledger initiatives. The CSIR also signed an MoU with the new University of Mpumalanga to collaborate in research as well as human capital development.

The partnerships reflect the CSIR's mandate, which provides for research and technological innovation in collaboration with partners, and are guided by the organisation's research priorities.

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.6.4 Facilities Management

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 physical, 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 developed a Campus Master Plan for its main campus in Pretoria 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. Key features of the Plan include:

- Establishing modern public engagement areas in Pretoria, including a Visitor's Centre,
- Constructing a pilot manufacturing facility that can house various pilot projects,
- Constructing shared interdisciplinary research laboratories on the northern and southern precincts of the campus to facilitate collaboration between scientists and engineers from different disciplines to tackle socioeconomic challenges,
- Refurbishing existing buildings to modern standards in terms of interior finishes and space utilisation, and
- Developing a smart-intelligent and sustainable campus that is energy autonomous, water wise and vehicle free.

Consistent with the CSIR's goal of attracting and retaining top researchers, the Campus Master Plan also proposes short-term accommodation facilities for scientists that will provide a uniquely stimulating environment on campus.

A.6.5 Communication

A key purpose of the CSIR's communication effort is to communicate the value of the CSIR to a range of stakeholders and to facilitate a shared vision on the CSIR, the work done and why such work matters to society. Thus our strategic communication aims to raise the profile of the CSIR, create opportunities for stakeholders to engage with the CSIR, contribute to the public

understanding of science, and contribute to improved SET awareness among the youth so that they may take up careers in science, technology, engineering and mathematics (STEM).

For the CSIR to succeed in conveying the relevance and impact of its work to any audience, we need to improve our ability to communicate science – in particular we have to move from conveying information, to conveying meaning and facilitating understanding. The CSIR places emphasis on simplifying content that is produced (writing has to, where possible, be stripped of dense scientific jargon), on tailoring the message for different audiences and channels, and generating more information about the CSIR's work (to cover the many stories that are not being told), and importantly, facilitating interactive engagement with stakeholders across the country and internationally. These aspects will be prioritised in the next period. The CSIR's strategic objectives in this area are to:

- Communicate the current and future value of the CSIR through targeted messages aimed at a range of stakeholders;
- Create opportunities for the CSIR to engage with a broad of stakeholders; and
- Facilitate a shared vision and understanding of the CSIR's role among internal stakeholders.

The CSIR has enjoyed mostly positive media coverage in the past two years. The organisation works on some of the most strategic areas of national and international importance such as alternative energy generation and storage, a sustainable natural environment, and cybersecurity. Strategic partnerships with relevant media organisations will be pursued and implemented to promote the CSIR's work in the aforementioned sectors and other breakthroughs or milestones in the organisation's R&D portfolio.

Media partnerships that will receive priority include those with the South African Broadcasting Corporation (radio, television and online), eTV and eNews (television and online), CNBC Africa (television, online and print), Primedia (radio and out-of-home), regional and community media, both electronic and print. Partnerships with Brand South Africa and Proudly South African will also be strengthened.

The CSIR's multimedia awareness campaign Ideas that Work, reached more than 10 million South Africans and significantly increased the awareness of the CSIR in 2015. The CSIR will implement the next phase of the Ideas that Work campaign to sustain the CSIR brand in the public domain. The second phase of the campaign will involve the production of long-format videos showcasing the impact of the CSIR in industry development, education and community development and will be used in predominantly digital or online media such as website, YouTube and FaceBook.

The CSIR will continue to produce promotional materials that are relevant and suitable for all its stakeholders. These promotion materials (including ScienceScope) will be produced in

appropriate format and language(s) in accordance with the organisation's language policy, to facilitate easy access and understanding.

The CSIR Strategic Communications portfolio identifies and manages stakeholder communication issues with the aim of contributing towards the realisation and achievement of the CSIR's strategic priorities.

Beyond advertorials, and in line with the DST Stakeholder Engagement Framework, the CSIR has planned the following activities to engage its stakeholders;

- **The CSIR Conference:** Activities in different parts of the country will be considered as part of the CSIR Conference, a major stakeholder engagement platform in which the CSIR shares its work with its peers, and showcases its capabilities to current and potential clients in the public and private sectors. Activities such as science exhibitions at CSIR centres across the country, in Tembisa, Atteridgeville, Alice and others will run in parallel.
- **Infrastructure launches and open days:** The CSIR will invite shareholders, stakeholders in industry, (public and private) sector, research and technology organisations and universities to showcase new and existing infrastructure which can make a difference to the relevant industries.
- **The CSIR Roadshow/ScientistWork initiative:** The CSIR will visit communities/schools and give free lectures to the general public on science and engineering topics.
- **CSIR laboratories at historically disadvantaged universities:** The CSIR and universities, particularly those located in rural provinces/communities will explore possibility to use joint facilities as platforms to profile the CSIR and its collaborative work in those communities, specifically to attract youth to STEM.
- **CSIR Career Day(s):** Tailored exhibitions targeted at Grades 10-12 students from rural schools. The CSIR scientists/researchers showcase their work and share experiences with students.
- **Community Outreach Programme:** The CSIR partners with public and private organisations to visit different communities to promote science and careers in STEM, and this initiative will see the CSIR teams travel to various parts of the country to promote careers in STEM, as well as the public understanding of science.
- **Community media partnership:** Partnership with community media around the country to promote science by profiling young black scientists in vernacular languages to expand our reach to youth in remote parts of the country. Ultimately we would like to encourage community media to have regular science and technology programmes in which universities and other innovations organisations can participate.

A.6.6 Governance

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

- 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;

The CSIR has in the past achieved a Level 2 B-BBEE status but expects to achieve a Level 3 in 2016/17 due to the introduction of the new B-BBEE Codes of Practice. To improve performance, the organisation will implement its transformation and employment equity plans in line with its human capital development strategy. The CSIR will 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 organisations safety management system to ensure effectiveness and efficiency.

The CSIR has achieved a good safety and health record, and will continue to manage its occupational safety and health risks, and to maintain OHSAS 18001 certification. As part of continuous improvement, there will be more focus on enhancing a safety culture throughout the organisation by incorporating safety issues in CSIR's good laboratory practice guidelines and benchmarking the organisation's performance against similar organisations.

The CSIR endeavours to create an environment where its employees can attain their full potential. This commitment, including a commitment to employee well-being, has led to the establishment of the CSIR Employee Well-being Programme, which provides a range of support mechanisms to encourage well-being. In developing a comprehensive and holistic approach, the CSIR Employee Well-being Programme will further develop its response to needs in a variety of areas including physical, emotional, social, financial and professional.

A.6.7 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.7 KPI Targets

KPI	Target: 2016/17	Forecast: 2016/17	Target: 2017/18	Target: 2018/19	Target: 2019/20	Target: 2021/22
Publication Equivalents	490	490	500	520	540	580
	300	300	310	325	345	380
	30	40	40	42	44	48
	≥15	15	≥15	≥15	≥15	≥15
Contract R&D Income (Rm)	R 1,914 m	R 1,930 m	R 2,128 m	R 2,290 m	R 2,472 m	R 2,830 m
	R 2.9 m	R 4 m	R 5.2 m	R 6.2 m	R 7.4 m	R 11 m
Total Size of SET Base	2,100	2,050	2,100	2,152	2,206	2,318
	1,260	1,230	1,280	1,340	1,400	1,500
	60%	60%	61%	62%	63%	65%
	755	740	785	820	857	936
	37%	36%	37%	38%	39%	40%
	375	365	411	470	540	695
	18%	18%	20%	22%	24%	30%
Total Chief Researchers	-	20	22	24	26	30
	-	1	2	3	4	5
	-	10%	9%	12%	15%	17%
	-	3	4	5	5	7
	-	15%	18%	21%	19%	23%
	-	228	240	252	263	290
	-	48	53	59	65	78
Total Principal Researchers	-	21%	22%	23%	25%	27%
	-	42	45	50	55	65
	-	18%	19%	20%	21%	22%
	R 2,611 m	R 2,659 m	R 2,863 m	R 3,069 m	R 3,284 m	R 3,705 m
	R 103 m	R 117 m	R 108 m	R 117 m	R 124 m	R 155 m
	R 58 m	R 94 m	R 64 m	R 69 m	R 74 m	R 85 m
	Level 2	Level 3	Level 2	Level 2	Level 2	Level 2
DIFR	≤0.3	0.1	≤0.2	≤0.2	≤0.1	≤0.1

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

A.8 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 is calculated by assigning a value of 1 to each peer-reviewed article or book chapter, a value of 0.5 to each conference paper, and a value of n to each book (where n is the maximum of 1 and the integer part of the length of the book divided by 60). 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* and Female, 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 and Female South African citizens in SET staff.
Purpose	These measures indicate the degree of demographic transformation within the RD&I capacity of the organisation.
Desired performance	Targets are set based on projections of transformation planned in all units. The long term objective is to mirror national demographics. The CSIR aims to achieve or exceed the annual targets.
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Indicator Title	Percentage of SET staff who are Black and Female, respectively
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 and Female 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.
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.

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Indicator Title	Percentage of SET staff with Doctoral qualification
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. 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, and number of Chief Researchers who are Female
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.
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 and Female SET staff who are classified as Chief Researchers at the end of the financial year.
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Indicator Title	Number of Chief Researchers who are Black and Female, respectively
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, and percentage of Chief Researchers who are Female
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 and Female 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 and Female Chief Researcher 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 and Female 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. The number of researchers at this level is an indicator of the quality of SET capacity
Desired performance	Targets are set based on the projected growth in SET staff. The long-term aim is have at least 290 Principal Researchers within the CSIR.
Performance assessment	Promotion or appointment at these senior research levels is based on individual performance as measured through the CSIR Career Ladder process. A performance of above 95% of the target is considered acceptable. Exceeding the target is a successful result and is not the result of an inappropriate target
Data source	KPI information is extracted from the Human Resources database.
Data responsibility	CSIR Human Resources
Method of calculation	Count of the number of SET staff who are classified as Principal Researchers at the end of the financial year.
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, and number of Principal Researchers who are Female
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 Principal Researchers, and at least 65 Female 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 and Female 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, and percentage of Principal Researchers who are Female
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 and Female Principal Researchers.
Performance assessment	Promotion or appointment at these senior research levels is based on individual performance as measured through the CSIR Career Ladder process. A performance of within 3 percentage points for the proportion of Black and Female 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 and Female 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 income earned for a financial year and includes revenue declared on R&D contracts (contract R&D income), income derived from Licences and Royalties, and Parliamentary Grant received through the Science Vote.
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

Annual Plan: 2017/18

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B.1 Introduction

The CSIR Annual Plan is structured around our three strategic objectives – the delivery of our R&D programme, the growth and transformation of our human capital, and the maintenance of a well-run and sustainable organisation.

B.2 Research and Development Objectives: 2017/18

B.2.1 Economy and Employment

Long-term Objective	2017/18 Objectives
EE1 – Titanium Beneficiation	
Develop key technology building blocks for the establishment of a SA Titanium metal industry	<ul style="list-style-type: none"> – Process optimisation and qualification of the 2kg/hr Ti powder pilot plant – Design and development of the 500 tpa tech packs for Ti powder demo plant – Produce and qualify 20kg/batch of Ti CP grade powders – Optimise, produce and test high quality Ti-6Al-4V alloy powders (10kg/batch) through the metallurgical routes – Develop technology packages for Metal Injection Moulding (MIM) and Press and Sintered techniques for commercially sourced parts – Develop commercial technology demonstrator of Direct Powder Rolling (Ti Sheets) – Develop, qualify, establish and commercialise a globally competitive Titanium investment casting facility and technologies in South Africa – Superplastic forming of titanium: Modelling to reduce the development cost of superplastic manufacturing processes – Establish a TiO₂ upscaling facility for various applications
EE2 – Aluminium Beneficiation	
The development of Al processing technologies and new Al alloys and Al metal matrix composites (AIMMCs) to revitalise the Al industry.	<ul style="list-style-type: none"> – Finalise and launch of the South African Aluminium Industry roadmap – Permanent Mould Casting (Tilt Casting): Investigate new die materials and die design for improved die life and yield – Investment casting: Establish molten metal bath cooling capability and demonstrate on complex thin walled components using high strength Al alloys which are difficult to cast – Produce high pressure die cast tensile samples of Al metal matrix nano composites to establish database of tensile properties and produce prototype continuous fibre AIMMC tubes
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Long-term Objective	2017/18 Objectives
EE3 – Mechatronic Manufacturing	
Develop a suite of advanced mechatronics machines for manufacturing and mining applications, as part of an industrial automation platform	<ul style="list-style-type: none"> - Testing, validation and optimization of wheel changing system based on performance in real life conditions. Development of pre-production prototype. - Testing and validation of pedestrian detection technologies inside actual mining environment - Prototype development and testing of robotic changer for conveyor belt Idlers. - Optimization of concrete grinding prototype by adding path automation and self-correction navigation.
EE4 – Polymer nanocomposites	
Our aim is to develop advanced materials targeting specific applications, together with the processing technologies that will be required to manufacture them on an industrial scale.	<ul style="list-style-type: none"> - Develop new composites products for application in the automotive, marine and housing industry - Optimisation of production of chitosan derived products for different applications - Optimisation of production of products derived from agricultural waste, including biopolymers - Together with industry partners, develop novel encapsulated products (formulations) for application mainly in the agricultural industry - Commercialise two polymer nanocomposite based products via royalty agreements - Develop two new polymer nanocomposite products to CSIR Technology Demonstrator stage - Host at least two SMMEs for scaling-up of polymer nanocomposite production
EE5 – Additive Manufacturing	
Development of additive manufacturing platforms to create new manufacturing processes for the aerospace and other sectors	<ul style="list-style-type: none"> - Ongoing development of the Aeroswift platform. - Develop closer links with the Aerospace Industry Support Initiative.
EE6 – Enterprise Creation and Development	
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.	<ul style="list-style-type: none"> - Two sector and economic development strategies designed. - Two sector and economic development strategies implemented. - Sixteen techno-feasibility studies completed. - Twenty technology-based enterprises established. - Ten technologies transferred to industry. - Training of ten economic development practitioners.
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Long-term Objective	2017/18 Objectives
EE7 – 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 BCC and the NFTN.</p>	<ul style="list-style-type: none"> – Ongoing implementation of specific programme business plans as per agreements with the funders/stakeholders. – Fifty technology interventions to support the development of local suppliers – Twenty manufacturing systems developed to address competitiveness challenges. – Inclusion of the Supplier Development Incentive Scheme to support the development of sub-tier SMME manufacturing base through higher tier systems integrators and manufacturers in the aerospace industry.
EE8 – 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
EE9 – 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"> – Secure R15 million per annum funding for the BIDC – Provide technology incubation for 4 SMMEs – Provide RDI services to 2 established private sector companies. – Four technologies/products commercialised. – Approved Business plan and model for CapeBio and Veterinary pathogens screening. – Production and sale of food safety testing standards with value assignment for use by accredited facilities. – Develop mycotoxin production business case.
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Long-term Objective	2017/18 Objectives
EE10 – 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"> – Development of refurbishment technology packages for Transnet Engineering to effect life extension of high value components – Development of qualified laser refurbishment procedures for high value components for Eskom – Feasibility study into the use of differently shaped laser beams for surface engineering applications in order to improve process efficiency – Development of laser-shock peening for industrial applications
EE11 – 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 Product Lifecycle Management (PLM) capability and office – Field trials of robotics platforms SID and Dassie at Transnet, Mines and agriculture applications – 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 – The three main PLM systems implemented (Siemens commercial, Dassault pilot, PTC education) – PLM systems configured in such a way to demonstrate the benefits of CPLM. – Hands-on training platform established. – A PLM Centre of Excellence established to demonstrate full life cycle of product development including 3D printing, etc.
EE12 – 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
EE13 – Mining	
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Long-term Objective	2017/18 Objectives
<p>We will focus on the development of processes that will address the current challenges facing in the mining sector – increasing productivity and reducing costs whilst ensuring no harm to mine employees as well as to the surrounding environment.</p>	<ul style="list-style-type: none"> – Develop sensors for monitoring rock mass response to deformations in mines: License the Rockpulse system to an industry partner for implementation and operational support in mines – Real-time tracking, monitoring and communication system: Introduce gas monitoring at TRL 5 and underground locating technology at TRL 3 – Launch of a Mining Seismology roadmap for mining stakeholders. – Graduation of 3 post graduates with Masters in Engineering (Mining). – Finalise Borehole Radar (BHR) tool. – Undertake enhancement of GPR for face mapping. – Develop the CSIR Mining Strategy and Business Plan.
EE14 – ICT for Industrialisation	
<p>Support the long term industrialisation and industrial diversification of the economy, th specifically in 4 industrial revolution (Industry 4.0) development in South Africa.</p>	<ul style="list-style-type: none"> – Work with stakeholders (DST, DTI, MerSETA) and industry on conceptualising Industry 4.0 reference architectures and implementations, including development of reference implementation of cyber-physical systems and identify/prioritise one ICT development area required for SA to accelerate in Industry 4.0 – Introduce a framework for modelling and subsequent decisions related to intelligent condition monitoring of equipment (Capital Equipment Programme, Transnet Intelligent Crane) – Investigate health and safety technologies with contextual safety awareness, including person proximity to moving equipment (i.e. crane, forklift, or other moving equipment)

Table B.1: Economy and Employment: 2017/18 Objectives

B.2.2 Capable State

Long-term Objective	2017/18 Objectives
CS1 – Incubation of national capabilities to support service delivery	
<p>Build an appropriate capability to improve Government service delivery through the effective use of ICT, and incubate service delivery capabilities in two domains.</p>	<ul style="list-style-type: none"> – Enter into an appropriate collaboration agreement with Gauteng Provincial Government (with identified areas of collaboration with respect to ICT, with the Gauteng Department of eGovernment) – Develop prototype speech-to-speech translation system implemented in all 11 languages (restricted to phrase lookup)
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Long-term Objective	2017/18 Objectives
CS2 – 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"> – Investigate and document the needs of government in regards to national level planning, decision support and evidence based policy making through requirements analyses from government departments such as DPME, the Presidency and Planning commission. – Based on requirements design a high-level CSIR plan for National Decision Support, with clear articulation of the role of ICT, drawing on CSIR-wide capabilities in ICT and in service delivery – Using the high-level plan develop the first components for the decision support centre
CS3 – 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"> – Interventions in nine municipalities, linked to water quality infrastructure. – Develop business plan and capability requirements for expansion of this service to all municipalities.

Table B.2: Capable State: 2017/18 Objectives

B.2.3 Economic and Social Infrastructure

Long-term Objective	2017/18 Objectives
ES1 – Water Infrastructure	
<p>Develop water resource decision-support frameworks, norms and standards for water and sanitation services; and technology solutions for water treatment.</p>	<ul style="list-style-type: none"> – Report on specific gaps in hydrogeological decision-making tools and capabilities – Technical specifications and scenarios for refinement of existing integrated hydrogeological modelling platform established, taking into account surface and groundwater interfacing – Pilot to demonstrate the phycoremediation technology at large scale – Develop a modelling framework for risk profiling of existing and new (nanoscale) pollutants – A national framework with associated water assessment facilities for integrated water management reporting across various water use sectors to support socio-economic objectives and planning – Complete industry trials for removal of different contaminants using adsorbents developed – Conclude licensing agreement for the commercialization of adsorbents for water treatment – Develop adsorbents for emerging pollutants and other contaminants identified by industry partners – Work with industrial partner to test adsorption materials for water remediation – Development of new Buoy and holographic sensor for NRE to monitor climate change in the sea – Industrialisation and testing of rapid pathogen detection sensor with the objective to start commercialisation toward the end of 2017 – Full piloting of CARRS system and upgrading of the system; smart meter retrofit to the system and development of a mobile application. – Build a Dynamic Hydraulic Model testbed at the CSIR that will be used to demonstrate the efficiency of the system using the CSIR WDN. – Build the CabECO prototype plant at the CSIR. The prototype will be used to carry out Technology testing and development to inform the design of the Mobile Demonstration Plant. – Implementation of the ASWSDIII; Rural Water Supply Infrastructure. – Deployment of Basic Water Supply Infrastructure for Spring Water Harvesting, pilot studies in the Easter Cape.
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Long-term Objective	2017/18 Objectives
ESI2 – Energy Infrastructure	
<p>Develop technologies that support the maintenance of the energy infrastructure.</p>	<ul style="list-style-type: none"> - Development of prototype Gas Imaging System for SF6 (TIA relationship) - Concept and prototype development of distributed pylon sensors - Development of electronics platform and the integration into a multi-spectral inspection system to provide high definition visual channel capability. - Integration of radiometric UV functionality. - Process optimization for Mn-based cathode synthesis - Assembly of LIBs from the pouch cells using the above materials. - Production of fuel cell electrocatalysts for portable electronics applications - Synthesis/production of Anion exchange membranes for fuel cells - Completion of design and prototyping of a high pressure composite cylinder - Synthesis/ production of MOFs for hydrogen storage for automotive application - Participation in the development of the Carbon Capture and Storage (CCS) R&D strategy. - Contribute to establishment and hosting of a National Centre for Clean Coal/Energy Technology.
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Long-term Objective	2017/18 Objectives
ES13 – 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"> – Completion of field testing and commercialisation of Road Management System and Pothole Scanner – Modelling and experimental testing of defect detection in head, web and foot of railway lines (TFR relationship) – Specification of requirements for guided wave ultrasound research platform, development of prototype rail defect monitoring system for field installation / research and theoretical research into defect detection with guided wave ultrasound. – Pothole scanner licensed to Jetpatcher and further development of system to improve performance. – Investigation into the use of alternative and novel materials for use in low-volume roads – Initiate the establishment of a Road Research Centre in at least one new country – Pilot implementation of cost-effective climate adaptation options in three African countries (Ethiopia, Ghana & Mozambique) – Development of a sustainability evaluation toolkit – Vehicle-pavement interaction: Smart sensors and technologies – Green technologies and products: Alternative materials (glass as aggregate in asphalt; Bitumen-rubber extenders) – Advanced performance models for high volume roads (e.g. pavement deterioration & binder ageing) – Advanced asphalt technology (use of micro-fillers to improve asphalt performance) – Continuation with investigation into alternative materials for railway substructure and understanding of aggregate degradation and packing in ballast. – Calibration of the public transport modelling platform for multiple public transport modes within the same network. – Quantified simulated linkages between World Banks Logistics Performance Index and performance of the countrys freight logistics network. – Continued improvement of simulation parameters from on-going experimental work. – Initiate work to adopt smart truck legislation in South Africa. – Geographical expansion of RTMS to other parts of SADC region. – Formulation of alternative methods to incorporate risk in the management of road safety. – Develop alternative methods for more automated measurement of risk model.
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Long-term Objective	2017/18 Objectives
ESI4 – 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"> – Full-scale modular clinic mock up – Progress towards an architectural design microbial risk model – implementation of model in prototype clinic – Packaged weather data for building energy modelling – National UVGI guideline – Input into international UVGI guideline – Technology demonstrator for Structural Insulated Panel. This consists of panel skin as well as insulating cores. – Commercialisation of meta-kaolin cement and geo-polymer green brick. – Prototype CSIR house Mk II – Guideline for IBT use in South Africa – Business case for mainstreaming of IBTs in South Africa
ESI5 – 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 – System deployed to at least one Government Department – Identify through MVP development a third spatial information system – Further development of the underwater 3D imaging technology to increase speed of operation and functionality by identifying and trialing upgrades to the digital system embedded in the arrays. – Investigation of the 3D imaging base technologies for synthetic aperture sonar and underwater communications applications. – Continue with the ship motion and numerical modelling training. – Investigate sand bypass schemes. Possible physical model test to investigate alternatives to current method – IPOSS user interface upgrade. Modernise the front-end to the IPOSS and DMAX decision support system
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Long-term Objective	2017/18 Objectives
ES16 – 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"> – Develop models and tools to enable automated spectrum assignment – Develop technologies to harness opportunities opened by dynamic spectrum management models – Develop 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 – Develop tools to collect, store, process, design and analyse data on broadband network infrastructure and spectrum – Develop models for optimal mixes of fibre and wireless technology rollout at national and provincial levels to achieve SA connects targets
ES17 – 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 (SAN-ReN) 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"> – >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 – CHPC annual conference – 14 Postgraduate students supported by NICIS – 60 indirect peer-reviewed publications by researchers using NICIS cyberinfrastructure

Table B.3: Economic and Social Infrastructure: 2017/18 Objectives

B.2.4 Transition to a Low-Carbon Economy

Long-term Objective	2017/18 Objectives
LC1 – 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"> – Verify and improve the river routing scheme within the coupled system – Parameterise plant functional types in the terrestrial model CABLE – Develop the ocean-biochemistry coupled system – Improved parameterisation of sub-mesoscale eddies in the Southern Ocean – Improved inline coupling of the ocean and atmosphere model towards optimal parallel processing – Develop the ocean-sea-ice component model – Complete the CORDEX high-resolution projections of climate change and submission of the data set to the World Climate Research Programme–Earth System Grid Federation (WCRP-ESGF). – Complete the agroweather prediction tool based on Numerical Weather Prediction – Implement and operationalise of the Agricultural Catchments Research Unit (ACRU) based climate-agrohydrological short range forecasting system – Develop an urban heat island modelling system for eThekweni Municipality for informing strategies for mitigating the impact of urban heat islands. – Install a flux tower at Bushbuckridge and two in Middleburg Karoo. The towers are funded under ARS Africare project – Submit the pCO₂ data from the Southern Ocean (spring, summer, autumn) that has undergone rigorous quality assurance to the global CO₂ information analysis centre.
LC2 – Green Economy Solutions	
<p>Unlocking growth from the bio-economy and waste-economy sectors.</p>	<ul style="list-style-type: none"> – Publish a book and toolkit on the Design, Evaluation and Monitoring of Green Economy Projects in response to funders, policy makers and developer needs. – The launch of the City of Joburg Flagship Green Economy Project implementation on marginalised land. – Publish the toolkit “The good practice guide on implementing recycling systems in SA.” – Release of household recycling data and analysis on medium term changes in behaviour, which will inform municipal and provincial level on effectiveness of implementation strategies. – Launch of the world class Biorefinery facility in Durban – Specialised cellulose process technologies transferred to industry, – Toolkit on fractionation of sawdust into high value chemicals – deriving new industry opportunities and localisation.
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Long-term Objective	2017/18 Objectives
LC3 – Ecosystem Services	
<p>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</p>	<ul style="list-style-type: none"> – Model testing and validation for the assessment of woody biomass, cover and Leaf Area Index (LAI). Initial model runs and testing of possible interoperability with CCAM-CABLE regional climate model. – Optical/SAR algorithm developed, initial model testing and scoping of possible decision support tools in Oceans and Coasts Information Management System Platform (OCIMS). – Earth Observation maps and algorithm developed for monitoring of regional forests. – Decision support tool piloting and demonstration in partnership with private sector. – Draft frameworks for enhancing ecosystem service flows (in collaboration with EThekweni and City of Cape Town Municipalities). – Strategic R&D support to DEA Natural Resources Management program for management of invasive alien species. – Draft conservation planning tool developed and piloted with DEA NRM partners. – Marine water quality monitoring guidelines, and contribution to norms and standards for water quality monitoring in city-port interface. – Draft concept of the Marine Spatial Planning tool developed and presented to DEA, with potential development of a decision support tool for Operation Phakisa: Oceans Economy product. – Regional high resolution (5 km) model and forecasting capabilities of SA's EEZ developed through advanced numerics and data assimilation, with pilot products for Operation Phakisa: Oceans Economy.
LC4 – 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"> – Development of project implementation models for energy efficiency solutions for different end- users and industries – Development and testing of energy efficiency technical solutions – Collaboration with local and international partners to develop energy efficiency solutions – Implementation of technology demonstrators for energy efficiency, demand response, combined heat and power and waste heat recovery – Develop capabilities to conduct energy consumption and demand profiles for South African industries – Consolidate information on tested energy efficiency and demand response technologies into a Technology Readiness Guide for reference and use by energy end-users in South Africa.

Table B.4: Transition to a Low-Carbon Economy: 2017/18 Objectives

B.2.5 Building Safer Communities

Long-term Objective	2017/18 Objectives
SS1 – 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"> – Improved understanding of security risk/futures across stakeholders in the areas listed. – Risk and futures products delivered to stakeholders – Multi-organization operating concepts for Combatting Rhino Poaching – Develop one or more interventions for each of the areas with supporting models and provide strategy and policy inputs to stakeholders. – Demonstrate peacebuilding pilot intervention for communities as building block for a whole-of-society approach to security.
SS2 – 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"> – Move from an EA process focus to an established and valued organizational function understanding – Establish the EA information as an organisational asset. – Move from Stakeholder Identification to active Stakeholder Management – on all the levels of the organization affected by the strategic plan and the operational implementation. – Move from traditional Project management to include Portfolio- and Programme Management regarding the roadmap for change – High-level decision support tools definitions (concepts) – Governmental EE requirements definition documentation and analysis – Establish a standard EA deliverables templates – Establish awareness programme on EA & EE capabilities to the – CSIR enterprise and all levels of government Involvement with GOV-Tech by having workshop to Government, expanding on the previous EA, BCM, DRP, ICT Governance focus
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Long-term Objective	2017/18 Objectives
SS3 – 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 users 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.
SS4 – South African National Defence Force (SANDF) Air Operations capability	
<p>Support the continuous improvement of the mission effectiveness and efficiency of South African Air Force (SAAF) Air capability. This requires integration of complex systems such as aircraft, weapons, surveillance sensors and pods into a capability with high integrity, safety, and performance, and with low life cycle cost.</p>	<ul style="list-style-type: none"> – Necessary simulation models completed for further experimentation with scenarios and evolution of user requirements for future systems including the Beyond Visual Range Missile, the family of future supersonic stand-off-weapons and UASs. Further development and application of the simulation environment for “one on one” and “one on many” and models available. Evolution of scenarios and requirements envisaged. – Ongoing improvement in numerical and experimental tool sets for weapons development and weapons integration. Support of Gripen Integration in terms of flutter and BVR missile integration. Support of A-Darter Integration on HAWK. – Increasing Competency skills base in NDT in support of various arms of service – Improvement in modelling capabilities for turbomachinery systems on SAAF fleet
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Long-term Objective	2017/18 Objectives
SS5 – SANDF Landwards Capability	
<p>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</p>	<ul style="list-style-type: none"> - Green Platoon concept definition - First iteration model and simulation of SANDF mission – including model of light tactical incubator - Definition/Requirements for further technology incubator Update - d technology roadmaps - Terrain models - Vehicle mobility models - Unmanned systems architecture - Software algorithms and code that interfaces with commercial solvers threat-structure interaction - Digital evaluation of camouflage patterns - Model of injury mechanisms for spine and head - Empirical high strain rate materials characterisation and modelling - Improved TM&E equipment and processes - Technology review of active and reactive protection systems Development of technology roadmap for human and equipment protection Evolution of IED protection package - Re-commission the ballistics TM&E capability at DBEL - IED baseline assessment - Validated simulations of specific IEDs and other conventional and unconventional threats - Empirical database of energetic materials - Effectiveness models for current non-lethal weapons - Threat surrogates (incl. scaled surrogates) - Weapon effectiveness models - Tunable munition technology demonstrator - Identification of legal and safety risks associated with non-lethal weapons - Establish energetic materials pressing facility at DBEL - Improved Body armour technology demonstrator (SANDF & SAPS) - Dismounted rechargeable and renewable energy/power concept demonstration - Updated design of initial lightweight collaborative technology demonstrator - Initial field demonstrations/evaluations of initial lightweight collaborative technology demonstrator

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Long-term Objective	2017/18 Objectives
SS6 – SANDF Platform Protection	
<p>Increase the survivability of SAAF and SA Navy platforms against optical (including infra-red) and radar-guided weapons</p>	<ul style="list-style-type: none"> – Continue to validate aircraft and counter-measure models – Finalise prototype development for DIVCM visual band tracking – deploy DIVCM and perform flight tests. – Measurement of flares and aircraft signatures – Develop OSSIM product for external clients – Development and testing of laser jam codes – Improvements to existing FMS with HILs T&E capability – Strategy and requirements definition for integrated IR/RF capability – Development of integrated IR/RF sensor on-board a stand-off weapon system – project Thoro – Development and testing of electro-optical system integration on INUNDU pod. – Missile Exploitation and modelling and simulation skills development programme – Investigate new generation weapons – Continue R&D into new radar guided threats and countermeasures, doctrine development. – RCS Simulation: Upgraded simulation capability for RCS Simulation (SigmaHat) – Validation of additional aircraft models, including cluster controller. – SEWES: Further development and improvement of modelling and simulation capability (aircraft, countermeasure, threat), including improved user interfaces and models, including networked platforms, and cyber techniques. – Inundu: Improved performance and control of the pod based airborne electronics test and evaluation platform – including addition of jamming techniques, and simulated missile threat radar in testing countermeasures, including RAM air turbine capability. Integration on Hawk platform. – Digital radio frequency memory: Upgraded architecture to allow software based technique development, and improved wideband performance, improved spurious performance through digital spur cancellation.
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Long-term Objective	2017/18 Objectives
SS7 – 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"> – Finalise TD for new laser illuminator for KNP surveillance – Finalise TD for KNP integrated EO and radar concept – Finalisation of TD for a hemispherical panoramic dual band coverage surveillance system (XPLORE) – Develop Crowd Monitoring and Control with image processing for human tracking. – Develop IRMAW imaging and processing concept – Finalise TD on immersive OSSIM engagement visualisation using VR for training – Develop cash-in-transit WASS concept – Finalisation of DIVCM visual band tracking concept for DIRCM – Develop light-weight WASS for fire-fighting. – Fire CubeSAT satellite launch and deployment – NanoSAT TD. – Finalise TD for DataDot Handheld Machine Vision Reader – Utilisation of CalVal Open framework – Technology transfer and production of prototypes for local industry development – video auto tracker TD – Develop image processing and image enhancement toolbox TD. – Sustain Cal Val centre of excellence – Develop IRMAW Concept – Deployment of OSS surveillance TDs in the operational environment – Continued research and development towards improving surveillance and situational awareness covering: sensor network, processing, doctrine and training, fusion across land, sea, air applications. – Further development of airborne SAR payload. Development of UAV SAR payload – Further development of multi-static radar technology. Environmental asset management – Further development of Hohlwa radar system – Continued improvement to non-cooperative target recognition research, sensor and data fusion, cognitive radar further developed. – Continued tracking and surveillance radar research and development – support for industry e.g. DBRXL – Further development of bi-static SAR design – PCL network development further and multiple nodes established and processing of data sets. – Further aerostat based surveillance experimentation – Further HOSFIN technology development
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Long-term Objective	2017/18 Objectives
SS8 – National Cyber Security Capability	
<p>Contribute to the implementation of the national cyber-security policy by developing a national capability to respond to large-scale cyber threat incidents.</p>	<ul style="list-style-type: none"> – Cybersecurity evaluation laboratory for cyber product testing, cyber exercises, cyber defence concept development and analysis is established – Social awareness of cyber threats and its impact on safe use of cyber systems (reducing vulnerability introduced by lack of awareness) assessed – Support for the establishment of the Cybersecurity Hub – Cross sector networks established – Concepts and analysis of social engineering on cyber systems – Cybersecurity Centre of Innovation established – Network Emulation and simulation laboratory completed – Specialist capabilities for combatting different types of cybercrimes including cybercrime identification /investigation, intelligence, detection, evidence gathering and tamper proofing capabilities – Completion of support for Cybersecurity Hub Support for the SAPS for the establishment of Cyber Intelligence – Capability to secure critical information Infrastructure systems. – Improved robustness against attacks – Capability and protocols that will ensure that all the security operations centres respond in a coordinated manner to major cyber-attacks exist – Collaboration agreements with other institutions on mass education and training of cyber security professionals. – Development of tools that can assist with the identification of Organised Crime Network/Social Structures – Implementation of secure crime combatting systems (crime combatting systems that cannot be tampered with, e.g. by criminals) for use of SAPS – Establishment of Cybercrime and cyber intelligence centres.
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Long-term Objective	2017/18 Objectives
SS9 – Unmanned Defence Systems	
<p>Support the strategic, operational and tactical potential of unmanned systems.</p>	<ul style="list-style-type: none"> – Necessary simulation models completed for further experimentation with scenarios and evolution of user requirements for future systems including the Beyond Visual Range Missile, the family of future supersonic stand-off-weapons and UASs – Further development and application of the simulation environment for “one on one” and “one on many” and models available. Evolution of scenarios and requirements envisaged. – Use of open source tools during flight trials and border experiments. – Further development of Hardware-in-the-loop system for UASs. – Further development of sub-system test rigs. – Ongoing development of Synthetic aperture radar. Ongoing theoretical work on bi-static synthetic aperture radar. – Ongoing development for Hardware-in-the-loop system for UASs. – Ongoing development of control algorithm for novel supersonic stand-off weapon. – Development of Autonomous 2m hand-launched UAS completed. – Ongoing support for border experiments. – ADM version of the subsonic 6m wing span completed. Ongoing support for border experiments – pursuit of necessary certification in the United States. – Integration of UAS simulator with optical scene simulation. Further development of simulator to increase fidelity of models. – Turbine and compressor bench tests completed. Manufacturing technologies and sub-system integration being explored. Stand-Off – Weapon Air Intake design and integration initiated. – Detailed system design in progress. – Ongoing design and development of the family of futuristic supersonic stand-off weapons co-developed between CSIR and Denel Dynamics in progress. – Ongoing development of the family of rocket systems based on the 102 mm rocket including a 102 mm artillery system, 102 mm UAS based system and 70 mm variant for Rooivalk. – Identification of other future system opportunities – Investigation and identification of opportunities to develop new propulsion system technologies including but not limited to ramjet, scramjet, detonation engines, etc. Identification of relevant research questions.
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Long-term Objective	2017/18 Objectives
SS10 – Special Forces Capability	
<p>We will maintain capabilities to support and maintain a Maritime, Airborne/Landwards and Combating Terrorism Special Operations Capability for Special Operations</p>	<ul style="list-style-type: none"> – Developmental engineering projects focussed on Maritime and Airborne/Landwards Special Operations operational capability development and maintenance (Project VERBENA - command and control, communication, intelligence, firepower, protection, manoeuver and sustainment) – Applied operational research projects focussed on Maritime and Airborne/Landwards Special Operations operational capability development and maintenance (Project CROSSBOW - command and control, communication, intelligence, firepower, protection, manoeuver and sustainment) – A range of Quick Reaction Task (QRT) engineering solutions in support of special operations operational deployments – A range of futures studies and/or strategic security related risk analysis projects for various industries (ESCOM & EAM Stakeholders) – A range of specialised EAP projects for the optimisation of specialised EAP capabilities in the public and private sector (eg secure communication and information networks, research on wildlife crime, EAP doctrine development, etc) – Direct manufacturing industry, stakeholder, business and training program development – Establishment of the behavioural sciences research group

Table B.5: Building Safer Communities: 2017/18 Objectives

B.2.6 Improving Health

Long-term Objective	2017/18 Objectives
IH1 – E-Health	
Develop a standards framework for interoperability of eHealth systems, and establish a national regime for implementation of interoperability standards.	<ul style="list-style-type: none"> – Enhance the Health Patient Registration System (v2.1) – Deployment of Version 1 of a National Health Information Exchange to facilitate interoperability between national-level health systems – Establishment of an eHealth Lab for testing conformance of health information systems to the Health Normative Standards Framework
IH2 – Health Technology	
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	<ul style="list-style-type: none"> – Close off of Tshwane Umbiflow study, write final clinical report and publish as journal article Implement Umbiflow in 5-10 further SA districts as per agreement with NDOH Implement Umbiflow in India (BMGF relationship) Clinical testing of Cardioflow prototype system – The development and implementation of the Cloudnostics platform that will provide connectivity, lifecycle management and data analytics capabilities to any medical device - solution will be provided as a SaaS application in the cloud for both private and public healthcare – Development of automated pharmacies for dispensing of medicine in shopping centres and remote areas – Development of capabilities in the manufacturing of printed biosensors and lateral flow devices – New prototype breath analyser developed for diabetes sensing with industrial partner – Complete clinical trials for the MA based diagnostic device – Together with industry partners, identify specific needs for drug formulations and start to develop these
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Long-term Objective	2017/18 Objectives
IH3 – 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"> – Prototype biomarkers identified and further annotation of our compound libraries. – Utilise the Array printing technology for additional Health applications in partnership with Persomics. – Contribute to the identification a focused library against Malaria and screen more compounds. – Expand the High-Throughput Screening and bioassays groups to focus on bioassay development, validation and providing routine bioassays for natural based compounds. – Establish a multidisciplinary platform that develops bio-analytical tools for point-of-care (PoC) diagnostics for human and animal related disease detection. – Operationalise the BTRI: Infrastructure established at UCT. All projects defined and progressing. Industry Partnerships formed and commercialisation model defined and in place. Long term strategic plan developed and approved. – Precision medicine cancer intervention: start collecting patient organoids, apply genome sequencing, expression profiling and sensitivity to known drugs. Establish a database linking genetic and transcriptional information to drug responsiveness and identify at least one commercial opportunity for technology transfer. – Generation of induced Pluripotent Stem Cells (iPSCs) lines that are specifically engineered with genetic backgrounds. Established lines that can be used in drug screening, cell banking, disease-in-a-dish models and development of novel therapeutics as part of a platform for stem cells closely linked to the medical centre.

Table B.6: Improving Health: 2017/18 Objectives

B.2.7 Transforming Human Settlements

Long-term Objective	2017/18 Objectives
THS1 – 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"> – Application of the new UrbanSim model to one further metro – Finalise framework to be able to dinter-settlement people movement modelling – Develop at least 2 systems for external clients (DRDLR and PICC) – Development of evidence based planning guidelines as it relates to urban and regional planning practice – Continue to grow the spatio- temporal data management and analysis capability (underpins all the other objectives) – Development of the first “Smart Campus” pilot within a localised scale over a set of offices, infrastructure, and number of available multi-domain datasets (e.g. energy utilisation, solar farm, water distribution). This first pilot will provide initial context and situational aware assistance to decision makers (building and campus managers) and showcase the first version of technologies for automatic control and optimisation of infrastructure (solar farm) and resources (water). – Develop initial interactive business cases via simulation models using the method and metrics for quantifying the value of better decision making, i.e. for Transnet and CoJ. This will build towards proving the business value (cost vs savings and revenue generation) of actual implementation of these technologies in cities and regions, vs the current situation where cities and provinces are dependent on vendor specifications and lock-in.
THS2 – 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.7: Transforming Human Settlements: 2017/18 Objectives

B.3 Building and Transforming Human Capital

The CSIR's Human Capital Development focus remains the development of a transformed and highly skilled cadre of scientists, engineers and technologists 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 scientists, engineers and technologists, 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 2017/18 financial year the organisation will focus on the following objectives:

- Growth of the SET base: Our key measurement is the number of SET Staff, and in support of this objective we will:
 - through our bursary and scholarship programme, support graduate and undergraduate students in critical scientific areas;
 - continue to develop and implement effective retention and recruitment strategies.
- Improving the qualification profile of our SET base: Our key measurement here is 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.
- Improving the transformation profile of the SET base: Our focus is particularly on 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).

Detailed targets for the KPIs in this are are contained in Table B.11

B.4 Financial Sustainability and Governance

The financial budget indicates that the CSIR will remain financially sustainable and continue as a going concern. All financial resources are invested in line with the CSIR's mandate.

The budget is prepared taking into account the current economic climate in South African and the growth projections issued by the South African Reserve Bank. The international macroeconomic environment does influence the CSIR since a large percentage of international income is secured from countries with oil-dependant economies.

Conservative balance sheet practices, including working capital and cashflow management, will continue to allow CSIR to leverage its investment in scientific equipment and infrastructure. The continued growth of income streams and securing of strategic business partnerships with key clients remain important in the forthcoming financial year. The growth in international income is important to retain the Rand hedge this affords the CSIR.

B.4.1 Growth

The CSIR has budgeted for an increase in total operating revenue of 7.6% (see Table G.7). Contract R&D income and baseline grant funding increase on a comparative basis by 10.3% and 5.0% respectively.

Income from the South African public sector, South African private sector and international contract income is budgeted to increase by 9.4%, 16.4% and 19.0% respectively.

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

B.4.2 Expenditure

Total expenditure is budgeted to increase by 7.4%, with employee remuneration costs, operating expenses and depreciation budgeted to increase/(decrease) by 8.6%, 6.3% and (2.2)% respectively.

The CSIR has implemented cost containment measures as per the applicable National Treasury Instructions and the measures address expenditure on:

- consultants and professional services;
- travel and accommodation;
- catering, social events, entertainment, corporate branded items, advertising and hiring of venues; and
- attendance of events, conferences, consultations and meetings.

The increase in employee related costs is due to the annual salary increase, career ladder adjustments and the planned increase in research capacity.

Operating expenditure is budgeted to increase by slightly more than projected inflation. This is in part due to: the increase in variable costs related to the budgeted 10.3% increase in contract income; increased foreign currency denominated costs due to the weak Rand; and energy price increases. These will be ameliorated by ongoing cost containment measures and reducing the amount of electricity purchased from Tshwane with the continued roll-out of the energy autonomous campus project.

The reduction in depreciation is due to reduced grant funding being allocated to PPE investments and utilisation of CSIR reserves. The carrying value of PPE will therefore be depreciated over the useful life of the asset as opposed to the carrying value of the asset being reduced by the grant funding utilised.

B.4.3 Royalty income and other income

Royalty income is budgeted at R5.2 million and includes an anticipated royalty flow from Per-somics AB. Included in the 2016/17 forecast is other income of R31 million – this relates to foreign exchange losses incurred and the profit on the disposal of the Port Elizabeth site to NMMU. 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.4.4 Financial sustainability

The 2017/18 budget indicates a net profit of R64 million. The prior year comparative of R95 million includes the R38 million profit from the disposal of the Port Elizabeth site. On a comparative basis the budgeted net profit is a 14% increase from 2016/17. Investment income is expected to amount to R41.1 million.

Table G.7 provides the high-level CSIR statement of comprehensive income reflecting the forecast for 2016/17 and the budget for 2017/18. A statement of comprehensive income for the Medium Term Expenditure Framework (MTEF) period is provided in Appendix G.1.

	Forecast 2016/17 (R'000)	Budget 2017/18 (R'000)
Total Operating Revenue	2,659,918	2,862,908
Contract R&D Income	1,930,362	2,128,379
Public – South Africa*	1,530,229	1,673,644
Private – South Africa	168,119	195,709
International	155,642	185,188
Parliamentary Grant – Ring-fenced*	76,372	73,838
Parliamentary Grant	694,827	729,359
Royalty income	4,009	5,170
Other income / (expenditure)	30,720	–
Total Expenditure	2,594,632	2,785,409
Employees' remuneration	1,488,491	1,616,730
Operating expenses	1,019,698	1,084,100
Depreciation	86,443	84,579
Operating Profit before Investment Income	65,286	77,499
Investment Income	46,318	41,090
Net profit before non-guaranteed employees' remuneration (Performance bonus)	111,604	118,589
Non-guaranteed employees' remuneration (Performance bonus)	16,691	54,833
Net profit	94,913⁺	64 006

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

⁺ Includes the R38 million profit on the disposal of the Port Elizabeth site to NMMU.

Table B.8: Statement of Comprehensive Income

Category	2017/18 R'000	2018/19 R'000	2019/20 R'000
Baseline Parliamentary Grant	729,359	771,661	814,875
Parliamentary Grant	701,464	742,149	783,710
National Laser Centre	27 895	29,512	31,165
Ring fenced allocation	269,692	285,436	303,272
Laser Loan Programme	8 189	8,664	9,149
African Laser Centre	4,474	4,733	4,998
Implementation: ICT R&D Strategy	61,175	64,724	68,348
Cyber Infrastructure	195,854	207,315	220,777
Total	999,051	1,057,097	1,118,147

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

B.4.5 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 R 792 million in conjunction with the current liabilities of R 1 billion. The current ratio (current assets/current liabilities) is expected to remain slightly greater than 1.1.

	Forecast 2016/17 (R'000)	Budget 2017/18 (R'000)
ASSETS		
Non-Current assets	807,367	869,198
Property, plant and equipment	779,853	841,248
Interest in Joint Ventures and Associates	21,101	22,704
Interest in subsidiaries	5,246	5,246
Trade and other receivables	1,167	583
Current Assets	1,242,734	1,179,906
Trade and other receivables	259,376	280,151
Inventory and contracts in progress	108,789	107,896
Cash and cash equivalents	874,569	791,859
TOTAL ASSETS	2,050,101	2,049,104
EQUITY AND LIABILITIES		
Reserves	1,023,545	1,087,551
Retained earnings	1,023,545	1,087,551
Non-current liabilities	12,800	13,793
Post-retirement medical benefits	12,800	13,793
Current liabilities	1,013,756	947,760
Advances received	758,962	537,460
Trade and other payables	254,794	410,300
TOTAL EQUITY AND LIABILITIES	2,050,101	2,049,104

Table B.10: Projected CSIR statement of financial position

B.4.6 Investment in property, plant and equipment

The level of investment in property, plant and equipment for the 2017/18 financial year is budgeted to be R 108.7 million.

Notwithstanding the fact that an item is included in 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.4.7 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.4.8 Governance

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

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

- Improve its performance on employment equity in line with its employment equity goals,
- Review 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.5 Annual and Quarterly Targets: 2017/18

	Indicator	Q1	Q2	Q3	Q4
Scientific & Technical	Publication Equivalents	75	150	280	500
	Journal Articles	60	120	150	310
	New Technology Demonstrators	0	0	0	40
	New Patents	2	6	9	≥ 15
	Contract R&D Income (Rm)	R 328 m	R 883 m	R 1,334 m	R 2,128 m
	Royalty and License Income (Rm)	R 1 m	R 2 m	R 2 m	R 5.2 m
Learning & Growth	Total Size of SET Base	1,995	2,048	2,068	2,100
	– Number of SET Base who are Black	1,190	1,229	1,261	1,280
	– Percentage of SET Base who are Black	60%	60%	61%	61%
	– Number of SET Base who are Female	730	754	773	785
	– Percentage of SET Base who are Female	37%	37%	37%	37%
	– Number of SET Base with a PhD	390	401	405	411
	– Percentage of SET Base with a PhD	20%	20%	20%	20%
	Total Chief Researchers	20	20	20	22
	– Number of Chief Researchers who are Black	1	1	1	2
	– Percentage of Chief Researchers who are Black	5%	5%	5%	9%
	– Number of Chief Researchers who are Female	3	3	3	4
	– Percentage of Chief Researchers who are Female	15%	15%	15%	18%
	Total Principal Researchers	228	228	228	240
	– Number of Principal Researchers who are Black	48	48	48	53
	– Percentage of Principal Researchers who are Black	21%	21%	21%	22%
	– Number of Principal Researchers who are Female	42	42	42	45
	– Percentage of Principal Researchers who are Female	18%	18%	18%	19%
	Fin. & Gov.	Total Income (Rm)	R 441 m	R 1,188 m	R 1,795 m
PPE Investment (Rm)		R 27 m	R 54 m	R 81 m	R 108 m
Net Profit (Rm)		- R 17 m	- R 6 m	- R 13 m	R 64 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: 2017/18

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. Majazi (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
- Prof M. Phakeng

- Mr A. Mabunda (Board Secretary)

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

- Prof M. Phakeng (Chair)
- Dr P. Goyns
- 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

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

C.2 Executive Management

The members of the CSIR Executive Management Team are:

- Dr. T Dlamini (CEO)
- Mr C. Sturdy (Chief Financial Officer)
- Mr R. Zondo (Group Executive: Shared Services)
- Dr R. Chikwamba (Group Executive: Strategic Alliances and Communication)
- Dr M. Motuku (Group Executive: Research and Development & Human Capital Development)
- Mr L. Cloete (Group Executive: Operations)

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
Prof T. Majazi (Chairperson)					
44	Male	Black	<p><i>University of Manchester Institute of Science and Technology</i> PhD (Process Integration)</p> <p><i>University of Natal</i> M.Sc (Engineering) B.Sc (Chemical Engineering)</p>	2	<p><i>Director</i> A1 Consulting Engineers CC Zyblue Pty Ltd</p>
Dr. T Dlamini (Chief Executive Officer)					
47	Male	Black	<p><i>University of Witwatersrand</i> B.Sc Chemistry B.Sc (Hons) Chemistry PhD Chemistry, Catalysis</p> <p><i>University of South Africa</i> Masters in Business Leadership</p>	0	<p><i>Council Member:</i> University of KwaZulu Natal Council</p> <p><i>Advisory Board Member:</i> University of Stellenbosch, Centre for Renewable and Sustainable Energy Studies</p> <p><i>Advisory Committee Member:</i> National Nanotechnology SHE Advisory Committee</p> <p><i>Panel Member:</i> DST Ministerial STI Landscape Review Committee</p>
Dr R Masango					
42	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>	2	<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>
Prof M. Phakeng					
51	Female	Black	<p><i>University of the Witwatersrand</i> PhD (Mathematics Education) M.Ed (Mathematics Education) B.Ed (Mathematics Education)</p> <p><i>University of Bophuthatswana</i> B.A (Ed) (Mathematics)</p>	2	<p><i>Trustee</i> FirstRand Foundation</p>
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Age	Sex	Race	Qualification	Years	Position on other Boards
Ms A Noah					
50	Female	Black	<i>University of Cape Town</i> B.Sc (Electrical Engineering) <i>International Management Centre</i> MBA <i>University of the Witwatersrand</i> Executive Development Programme <i>Harvard Business School</i> Advanced Management Program	2	<i>Chairperson</i> Energy Access Partnership <i>Board Member</i> The SA National Energy Association Eskom Rotek Industries (ERI)
Dr PH Goyns					
43	Male	White	<i>University of the Witwatersrand</i> PhD (Energy Studies) M.Sc (Mechanical Engineering) B.Sc (Mechanical Engineering)	6	None
Dr A Llobell					
62	Male	White	<i>University of Sevilla</i> PhD (Biology) M. Sc (Biological Sciences)	2	<i>Chief Executive Officer</i> BioGold International <i>Managing Director</i> Biogold Network EM, SA <i>Director</i> Bio Innovation (Pty) Ltd:
Ms P Baleni					
50	Female	Black	<i>University of the Witwatersrand</i> B.Proc LLB	2	<i>Chairperson</i> MERSETA <i>Council Member</i> Wits University Council <i>Board Member</i> IIASA NMO (RSA)
Ms M Maseko					
41	Female	Black	<i>University of South Africa</i> B Compt (Hons) CA (SA)	2	<i>Director</i> Leruo Corporate Consulting <i>Member</i> Independent Regulatory Board of Auditors SA Institute of Chartered Accountants <i>Partner</i> PSTM CAs
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Age	Sex	Race	Qualification	Years	Position on other Boards
Adv G Badela					
59	Male	Black	<p><i>Leningrad Polytechnic Institute</i> M.Sc (Electromechanical Engineering)</p> <p><i>University of Johannesburg</i> M.Sc (Engineering Management)</p> <p><i>Brunel University</i> M.Sc (Packaging Technology)</p> <p><i>University of South Africa</i> LLB</p> <p><i>Gordon Institute of Business Science</i> MBA</p>	6	<p><i>Director</i> Metrobus (Johannesburg) Denel Amagcisa Integrated Solutions AMAGCISA Holdings Badela Brothers ENRICO</p>
Mr J Netshitenzhe					
61	Male	Black	<p><i>University of London</i> M.Sc (Financial Economics) Post-graduate Diploma (Economic Principles)</p> <p><i>Institute of Social Sciences, Moscow</i> Diploma (Political Science)</p>	2	<p><i>Executive Director</i> Mapungubwe Institute for Strategic Reflection</p> <p><i>Director</i> Nedbank Group Nedbank Life Healthcare Group</p> <p><i>Member</i> African National Congress NEC Centre for Education in Economics and Finance Africa</p>
Mr A Mabunda (Board Secretary)					
47	Male	Black	<p><i>University of Witwatersrand</i> B.A. Law LLB LLM</p> <p><i>De Montfort University</i> Post Graduate Diploma in Business Management</p> <p>Attorney of the High Court of South Africa</p>	0	

Table C.1: CSIR Board

Age	Sex	Race	Qualification	Years	Position on other Boards
Mr R Zondo, Group Executive: Shared Services					
48	Male	Black	<i>University of South Africa</i> BCom Law <i>University of Pretoria</i> MSc (Project Management) <i>Durban University of Technology</i> M.Tech (Biotechnology) NHD (Quality Assurance) <i>University of Zululand</i> B.Sc (Hons) (Biochemistry)	14	None
Dr R Chikwamba, Group Executive: Strategic Alliances & Strategic Communication					
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	12	<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 and Development					
51	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	5	<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
Mr L Cloete, Group Executive: Operations					
50	Male	White	<i>University of Pretoria</i> M.Eng (Electronics) B.Eng (Electronics)	26	<i>Member</i> University of Pretoria Computer Science Advisory Board <i>Chairperson</i> The mLab SA Board

Table C.2: CSIR Executive Management

Risk Management Plan 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. 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 macro-economic and national challenges affecting the National System of Innovation and 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.

Operational risks include financial, legal and compliance risks and are those risks affecting the systems, people and processes through which the CSIR operates.

This document is intended to provide a risk management framework to the organisation. It describes CSIR's risk management:

- Objectives;
- Benefits;
- Principles;

- Responsibilities; and
- Guidelines.

D.2 Background to Enterprise Risk Management

It is acknowledged that the new style of risk management in the King III Code of Corporate Governance (King III) 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.

This document is based on current recognised business practices and standards and corporate governance principles.

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 III Report and the PFMA. It is expected that all operating units and centres, operations and processes are subject to the Risk Management Plan.

The CSIR is a diverse and multidisciplinary entity. There are several operating units and centres working at managing risk exposures.

Different risk related or assurance provider functions will align their various goals and reporting processes into one cohesive and structured framework. All of CSIR's business, financial, technological, legal and operational risk exposures, whether they are insurable or not, will be identified, assessed, and appropriately managed.

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

Effective risk management is imperative to the CSIR. The realisation of CSIR's business plan 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, as well as take 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 principles contained in this plan are applied at all levels within the CSIR.

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 aims to protect and enhance the reputation and standing of the organisation.

Risk analysis forms part of organisational strategic planning, business 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 to gain 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. Strategic and operational 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 by 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.

A risk management strategy, which must include a Fraud Prevention Plan must be used to direct the internal audit effort and priority and to determine the skills of managers and staff to improve controls and to manage these risks.

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

Impact of Risk	Controls & Measures in Place	Additional Controls & Measures
S03: Finance and Governance Risks		
1. Macro-economic environment		
<p>The South African economy is dictated by global markets which in turn may influence research work being done at CSIR. CSIR has international clients and such instability in global markets could potentially affect the levels of contract income from these clients as well as increase the cost of importing equipment. The current environment also results in added operational cost pressures due to high inflation.</p>	<ul style="list-style-type: none"> • Foresighting and opportunity identification are part of business planning process. • Focus is on securing long term relationships with strategic clients. • Business development strategy is in place to ensure communication of CSIR offerings. • Foreign currency cover. • Regular review of markets for new opportunities. 	<p>Greater collaboration with the private sector and State Owned companies.</p>
2. Cyber Security		
<p>CSIR is very dependent on its information and communication technology (ICT) network and infrastructure. Cyber security threats include Spam, Malware Attacks, Denial of Network Service attacks and hacking. Unavailability and/or breach to CSIRs ICT infrastructure and network will have a significant impact on the operations of the organization and result in loss of critical intellectual property.</p>	<ul style="list-style-type: none"> • CSIR IT Governance structures • Information Security Office • Access and authentication controls • Disaster Recovery Plan • Daily data back-up • Secondary/Back-up Data Centre. 	<ul style="list-style-type: none"> • Regular and ongoing vulnerability assessments and intrusion detection tests. • Security assessment to identify any potential gaps in our ICT ecosystem.
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Impact of Risk	Controls & Measures in Place	Additional Controls & Measures
3. Legislative and regulatory environment		
<p>There have been numerous reviews of national legislation, especially within the supply chain management sector, which potentially have an impact on CSIR operations. The creation of the Office of the Chief Procurement Officer in National Treasury has resulted in the release of new Instruction Notes on a regular basis which affects CSIR operations. This has resulted in higher organisational compliance costs and administrative burden. Non-compliance could result in reputational damage, potentially high liability costs and perception of poor governance.</p>	<ul style="list-style-type: none"> • Regular monitoring of compliance by the Enterprise Risk Management Office, Legal Services and Internal Audit Services. • Procurement Forum oversees procurement activities within the organization. 	<p>Increase resources to ensure compliance.</p>
4. Environment, health and safety risks		
<p>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.</p>	<ul style="list-style-type: none"> • Feasibility and environmental impact assessments. • Emphasis on good laboratory practices. • Safety inspections and audits (OHSAS 18001). • Deployment of safety managers. • Incident Management and Emergency plans. 	<p>Campus Master Plan incorporates EHS requirements.</p>
SO1: Scientific and Technical Risks		
1. Research Infrastructure		
<p>CSIR has had significant infrastructure and property investment over the past number of years. There remains a shortfall in funding to address all the equipment and infrastructure needs across the CSIR. This results in CSIR having obsolete and outdated infrastructure which in turn can result in poor quality of R&D outputs, outcomes and impact as well as the increased risk of projects not being delivered on brief and on time.</p>	<ul style="list-style-type: none"> • Planning and budgeting process. • Motivations to National Treasury as part of the MTEF process. • Sharing of expensive research infrastructure amongst research entities and universities. • Continued evaluation of research facilities. 	<p>Sourcing of funds from National Treasury and other partners to implement CSIR Campus Master Plan.</p>
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Impact of Risk	Controls & Measures in Place	Additional Controls & Measures
2. Research management and governance		
<p>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.</p>	<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. 	<p>None</p>
SO2: Learning and Growth Risks		
1. Transformation		
<p>The CSIR underwent rapid demographic and gender transformation since 1994. However, more work remains in building on the foundation which has been set, especially following the adoption of the Beyond60 Strategic Framework. The rate of transformation remains relatively slow and this causes discontent among stakeholders from time to time and also increases the potential for employee dissatisfaction.</p>	<ul style="list-style-type: none"> ● Employment Equity Plan and ongoing monitoring thereof. ● Effective Transformation and Employment Equity Committee. ● Transformation and Employment Equity Policy ● Greater investment on HDC initiatives. ● 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"> ● Formal Transformation Strategy. ● Executive management is considering transformation dialogues as a means of engaging in focused and constructive conversations on transformation.
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Impact of Risk	Controls & Measures in Place	Additional Controls & Measures
2. Critical and skilled human capital		
<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"> • Investment in bursars and studentships to develop SET base pipeline. • Succession planning for both SET base and SET management and leadership. • Competitive remuneration structure and performance bonus scheme. • 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. • Ongoing benchmarking of CSIR remuneration and rewards with the market.

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 focuses on the timeous identification and prevention of fraud, corruption and theft.

The CSIR's planning for fraud prevention includes the development, implementation and monitoring of appropriate policies, processes and procedures, and ensuring appropriate allocation of responsibilities. This plan also makes provision for a communication and education programme aimed at encouraging employees and other stakeholders to report instances of fraud, corruption and theft. Planning is aligned with applicable legislation such as the [PFMA](#).

The elements of fraud prevention are:

- Defining the required control environment;
- Assessment of the effectiveness of controls;
- Ongoing risk assessment;
- Risk response;
- Communication; and
- Consequence management.

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 Management, Risk Assurance Office, Internal Audit Services, Finance and Legal Services teams.

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

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 Prevention

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 Approach to Fraud Prevention

The approach to fraud prevention in CSIR entails the following:

- Defining the control environment
 - Audit and Risk Committee oversight;
 - Code of conduct/ research ethics/ disciplinary code; and
 - Prevention and response plan.
- Information sharing and ongoing communication

E.5.2 Fraud Risk identification and Response

Ongoing risk assessment

CSIR acknowledges that it faces diverse fraud risks from both internal and external sources. In order to comply with the requirements of the PFMA and Treasury Regulations, CSIR conducts risk assessments on an ongoing basis. Fraud awareness forms part of the prevention strategy. The Audit and Risk Committee, in performing its duties, ensures that adequate controls are in place to prevent and detect fraud.

Consideration of fraud schemes and scenarios

The identification of fraud risks include consideration of typical fraud schemes and scenarios that CSIR may be exposed to; and CSIR continually monitors and takes stock of fraud schemes to which it is exposed and develops mitigating actions to deter and prevent such schemes.

Ongoing identification of fraud risk controls

The CSIR continually develops specific anti-fraud controls and action plans for risks identified. The ongoing rationale for controlling fraud encompasses:

- Identifying and taking preventative measures to reduce exposure to specific fraud schemes;
- Identifying key individuals and participants;
- Eliminating the opportunity to commit fraud emanating from internal control weaknesses;
- Evaluating the design and operating effectiveness and efficiency of controls during the course of audits;

- Implementing basic internal controls that assist in the mitigation of identified fraud risks, including, though not limited to:
- Adequate approval of transactions as prescribed in the approval framework;
- Implementation of security measures designed to ensure that access to assets and information is restricted to authorised employees;
- Arithmetic and accounting controls, which include checking arithmetical accuracy of records, the maintenance and checking of totals, monthly reconciliation of control accounts, and accounting for whereabouts of documents;
- Supervision of day-to-day transactions and checking these; and
- Adequate segregation of duties.

Evaluate operational effectiveness and efficiency

The effectiveness and efficiency of controls are evaluated through the monitoring of fraud risk factors and indicators, and fraud auditing.

E.5.3 Timely Detection and Response

Incident reporting

Employees and/or external parties may be faced with the dilemma of not knowing what they should do or where to report suspected fraud. The first step is for the employee to approach their immediate manager. Should the report feel uncomfortable to report to their immediate manager for whatever reason, it should be raised in confidence, by contacting the CSIR Whistleblowing Facility. If a member of management is the subject of the complaint, the HRM, Legal and/or CSIR Internal Audit Services should be informed. The external parties may approach the CSIR Whistleblowing Facility.

How will allegations of fraud be dealt with?

For issues raised by employees or members of the public, the action taken will depend on the nature of the concern. The matters raised are screened and evaluated and may subsequently:

- Be investigated internally by CSIR Internal Audit Services;
- Be investigated by an independent forensic service provider (where necessary);
- Be referred to a law enforcement agency;
- Any fraud committed by an employee or any other person is pursued by way of an investigation. Appropriate action will be taken, which may include:
 - In the case of employees, taking disciplinary action within a reasonable period of time after the incident has been investigated;

- Instituting civil action to recover losses; and
- Initiating criminal prosecution by reporting the matter to the South African Police Service (SAPS).
- When fraud is reported, the first response is to conduct a high-level assessment of the information that is provided and involves the following steps:
 - Seriousness of the allegation;
 - Authentication of the allegation;
 - Consideration of the source of information;
 - Preliminary investigation and consulting with appropriate managers within CSIR regarding the allegation;
 - Ensuring that the investigation is conducted within a reasonable time period;
 - Detailed investigation, if necessary, based on the outcomes of the preliminary investigation;
 - If the allegation is found to be valid, disciplinary proceedings are instituted, investigated, heard and disposed of, in accordance with the disciplinary code and the PFMA;
 - Ensuring that disciplinary proceedings are carried out in accordance with the CoS;
 - Reporting to the Auditor-General, National Treasury and the Executive Authority in terms of the PFMA. The report is to include a schedule of:
 - * The manner, form and circumstances of the allegation;
 - * The particulars of the misconduct and the nature of the disciplinary steps and/or criminal charges laid;
 - * Matters relating to the investigation; and
 - * The circumstances and outcomes of any disciplinary hearing and/or criminal charges.
- During the detailed investigation, simultaneous loss and risk mitigation steps are implemented. This includes:
 - Suspending the perpetrator to limit further financial losses, prevent destruction of evidence and interference with witnesses;
 - Removal of the asset at hand/ subject to vulnerability from custodian;
 - Suspension of access to information systems (where necessary);
 - Withdrawal of approval rights (where applicable); and
 - Addressing the control weakness to prevent the fraud from continuing or recurring.

Recovery of losses

Managers are required to ensure that losses or damages suffered by the CSIR, as a result of reported acts committed or omitted by an employee, management or any other person, are recovered from such person if found liable for the same.

Feedback to reporters of fraud

Upon receiving an allegation of fraud the following actions will be taken by CSIR Internal Audit Services in collaboration with Legal Services/ HRMs:

- Acknowledge receipt of the allegation;
- Indicate how the matter will be dealt with;
- Give an estimate of how long it will take to provide a final response; and
- Give feedback on the outcome of the investigation.

Confidentiality

All information relating to fraud that is received and investigated is treated confidentially. The progress of investigations is handled in a confidential manner and is not disclosed or discussed with any person(s) other than those who have a legitimate right to such information on a *“need to know basis”*. This is important in order to avoid harming the reputation of a suspected person who may subsequently be found innocent of fraudulent conduct.

Protection of the Whistleblower

Whistle blowing is encouraged. This can be done directly through the CSIR Whistleblowing Facility or an employee's immediate manager.

Whistle blowers are protected in terms of the applicable legislation (Protected Disclosure Act).

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 practises, 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 HRM, 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.

E.5.5 Information and Communication**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.

Change management

Creating awareness

This is the cornerstone of the Plan and comprises two areas, namely:

- Education; and
- Communication.

A Fraud Prevention Plan Awareness Programme approved by CSIR Executive Management is in place. The main principles that form the basis of the awareness program are:

- Facilitating a culture which takes pride in a high standard of ethics; and
- Training and education regarding ethics, and CSIR's stance on prevention, combating, detection and investigation of fraud and corruption.

Education

- Formal awareness presentations are conducted for employees of CSIR through the [PFMA](#) roadshow.

Communication

- The objective of communication is to further create awareness amongst employees, the public and other stakeholders of the Fraud Prevention Plan, in order to inculcate a culture where all stakeholders strive to contribute towards the eradication of corruption and fraud;
- To ensure that there is no uncertainty amongst employees, suppliers and clients about the policies and procedures that shape CSIR's approach to fraud as being one of 'zero tolerance'. This includes making appropriate attachments to offers of employment and the inclusion of appropriate items in induction and training programmes;
- Signing of declarations of commitment by all employees to the CoS and applicable policies and procedures;
- Publishing the transgressions and the consequences thereof in the Annual Report when these exceed the set materiality levels; and
- Communication will use a variety of mediums, including but not limited to:
 - Email communiques and circulars;
 - Posters;
 - Pamphlets and flyers; and
 - Publishing the Fraud Prevention Plan on the CSIR website

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 whistle blowers 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 predetermined 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 19 500 000.</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>

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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 2017/18

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

	Forecast 2016/17 (R'000)	Budget 2017/18 (R'000)	Budget 2018/19 (R'000)	Budget 20119/20 (R'000)
Total Operating Revenue	2,659,918	2,862,908	3,068,727	3,284,576
Contract R&D Income	1,930,362	2,128,379	2,290,862	2,472,256
Public – South Africa	1,530,229	1,673,644	1,802,515	1,946,716
Private – South Africa	168,119	195,709	210,779	227,641
International	155,642	185,188	199,447	215,403
Parliamentary Grant – Ring-fenced	76,372	73,838	78,121	82,493
Parliamentary Grant	694,827	729,359	771,661	804,875
Royalty income	4,009	5,170	6,204	7,445
Other income	30,720	–	–	–
Total Expenditure	2,594,632	2,785,409	2,985,958	3,194,975
Employees' remuneration	1,488,491	1,616,730	1,733,134	1,854,454
Operating expenses	1,019,698	1,084,100	1,162,155	1,243,506
Depreciation	86,443	84,579	90,669	97,016
Operating Profit before Investment Income	65,286	77,499	82,769	89,601
Investment Income	46,318	41,090	39,898	41,396
Net profit before non-guaranteed employees' remuneration (Performance bonus)	111,604	118,589	122,667	130,997
Non-guaranteed employees remuneration (Performance bonus)	16,691	54,833	54,028	56,793
Net profit	94,913*	64,006	68,639	74,204

*Includes the R38 million profit on the disposal of the Port Elizabeth site to NMMU.

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

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

	Forecast March 2017 (R'000)	Budget March 2018 (R'000)	Budget March 2019 (R'000)	Budget March 2020 (R'000)
ASSETS				
Non-Current Assets	807,367	869,781	903,877	941,718
Property, Plant and Equipment	779,853	841,248	873,845	907,892
Interest in Joint Ventures and Associates	21,101	22,704	24,786	28,580
Interest in Subsidiaries	5,246	5,246	5,246	5,246
Trade and other receivables	1,167	583	-	-
Current Assets	1,242,734	1,179,323	1,221,043	1,267,211
Trade and other receivables	259,378	279,568	299,762	320,745
Inventory and contracts in progress	108,789	107,896	118,698	126,879
Cash and cash equivalents	874,569	791,859	802,583	819,587
TOTAL ASSETS	2,050,101	2,049,104	2,124,920	2,208,929
EQUITY AND LIABILITIES				
Reserves	1,023,545	1,087,551	1,156,190	1,230,393
Retained Earnings	1,023,545	1,087,551	1,156,190	1,230,393
Non-current liabilities	12,800	13,793	14,759	13,215
Post-retirement medical benefits	12,800	13,793	14,759	13,215
Current liabilities	1,013,756	947,760	953,971	965,321
Advances received	758,962	537,460	529,232	532,698
Trade and other payables	254,794	410,300	424,739	432,623
TOTAL EQUITY AND LIABILITIES	2,050,101	2,049,104	2,124,920	2,208,929

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

G.1.3 CSIR Cash Flow Statement

	March 2018 R'000
Cashflow from operating activities	
Cash receipts from external customers	2,114,250
Parliamentary Grant income	729,359
Cash paid to suppliers and employees	(2,857,705)
Cash utilised from operating activities	14,096
Net finance income	41,090
Net cash from operating activities	27,578
Cashflow from investing activities	
Increase in investments	(1,603)
Decrease in long term receivables	584
Acquisition of property, plant and equipment	(108,685)
Net cash utilised in investing activities	(110,288)
Cashflow from financing activities	
Increase in long-term liabilities	–
Net cash generated from financing activities	–
Net decrease in cash and cash equivalents	(82,710)
Cash and cash equivalents at beginning of the year	874,569
Cash and cash equivalents at end of the year	791,859

Table G.3: CSIR Cash-Flow Statement**G.1.4 Twelve Month Cash Flow Projection for Parliamentary Grant: 2017/18 (including VAT)**

R'000	Total	April	July	Oct	Jan
	1,138,918	284,730	284,730	284,730	284,730
Baseline	799,669				
National laser Centre	31,800				
Laser Loan Programme	9,336				
African Laser Centre	5,100				
Implementation: ICT R&D Roadmap	69,740				
Cyber Infrastructure	223,273				

Table G.4: Cash-Flow For Parliamentary Grant

G.1.5 PPE Budget Summary

Category	2017/18 (R'000)
Buildings	20,468
R&D equipment	46,852
Computer, Information Technology (IT) and office equipment	36,985
Furniture and fittings	4,080
Vehicles	300
Total	108,685

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.2 CSIR Group 3 Year Financial Plan

G.2.1 Subsidiaries and Associate Companies

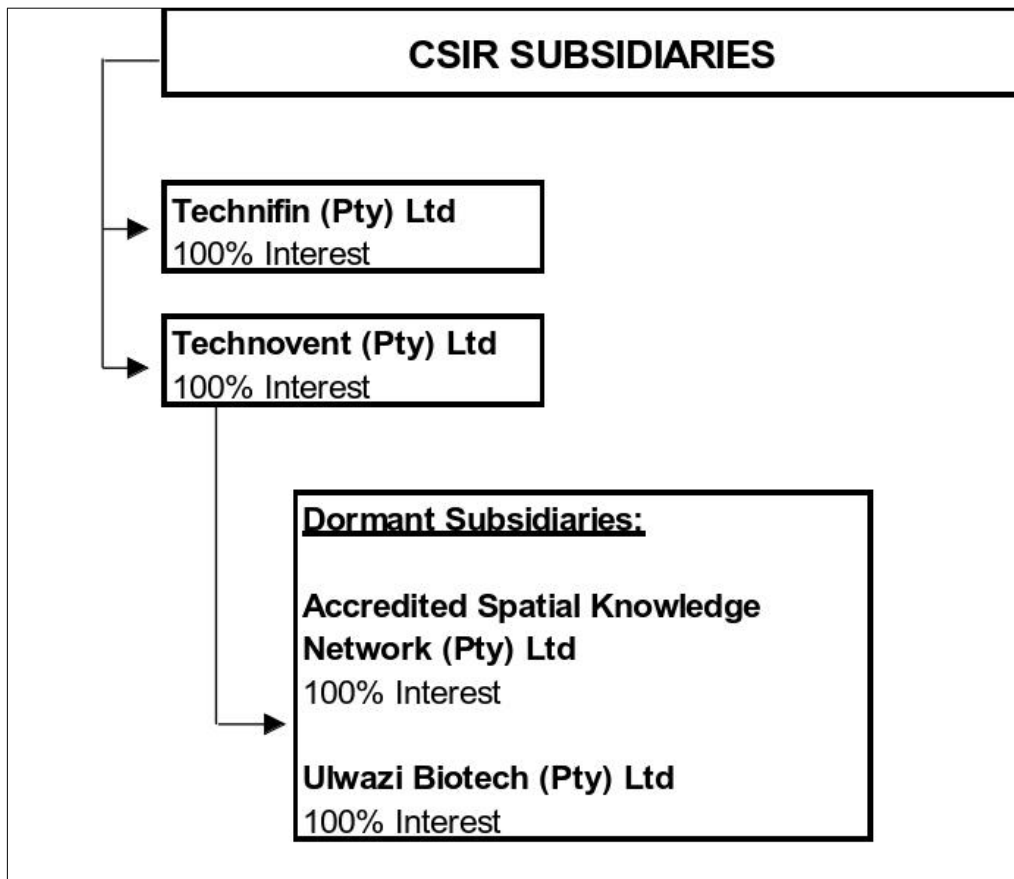
	Total	Technifin	Technovent	SERA	Ellipsoid	Persomics AB
Incorporated		SA	SA	SA	SA	Sweden
% Holding		100%	100%	100%	100%	24.87%
	Annual Budget R'000					
Total Income	400	400	–	–	–	–
Contract R&D income	–	–	–	–	–	–
Finance Income	400	400	–	–	–	–
Other Income	–	–	–	–	–	–
Expenses	213	213	–	–	–	–
Operating Expenses	213	213	–	–	–	–
Employees Remuneration	–	–	–	–	–	–
Share of profit/(loss) of joint ventures & associates	(2,015)	–	–	97	–	(2,112)
Net Profit	(1,828)	187	–	97	–	(2,112)

Table G.6: CSIR Subsidiaries and Associated Companies: Income and Expenditure 2017/18

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 2016/17 (R'000)	Budget 2017/18 (R'000)	Budget 2018/19 (R'000)	Budget 2019/20 (R'000)
Total Operating Revenue	2,659,982	2,862,908	3,068,727	3,284,576
Contract R&D Income	1,930,362	2,128,379	2,290,862	2,462,256
Public – South Africa	1,530,229	1,673,644	1,802,515	1,936,716
Private – South Africa	168,119	195,709	210,779	227,641
International	155,642	185,188	199,447	215,403
Parliamentary Grant – Ring-fenced	76,372	73,838	78,121	82,496
Parliamentary Grant	694,827	729,359	771,661	814,875
Royalty income	4,009	5,170	6,204	7,445
Other income	30,784	–	–	–
Total Expenditure	2,595,126	2,785,622	2,986,184	3,195,215
Employees' remuneration	1,488,491	1,616,730	1,733,134	1,854,454
Operating expenses	1,020,192	1,084,313	1,162,381	1,243,745
Depreciation	86,443	84,579	90,669	97,016
Operating Profit before Investment Income	64,856	77,286	82,543	89,361
Investment Income	46,854	41,490	40,322	41,845
Share of profit/(loss) of joint ventures and associates	(1,123)	(2,015)	358	766
Net profit before non-guaranteed employees' remuneration (Performance bonus)	110,587	116,761	123,223	131,972
Non-guaranteed employees remuneration (Performance bonus)	16,691	54,583	54,028	56,793
Net profit	93,896	62,178	69,195	75,179

Table G.7: Group Statement of Comprehensive Income – MTEF Period

G.2.4 CSIR Group Statements of Financial Position

	Forecast March 2017 (R'000)	Budget March 2018 (R'000)	Budget March 2019 (R'000)	Budget March 2020 (R'000)
ASSETS				
Non-Current Assets	801,000	862,522	898,991	937,240
Property, Plant and Equipment	779,855	841,250	873,847	907,894
Interest in Joint Ventures and Associates	19,978	20,689	25,144	29,346
Interest in Subsidiaries	–	–	–	–
Trade and other receivables	1,167	583	–	–
Current Assets	1,249,784	1,185,437	1,225,340	1,272,077
Trade and other receivables	259,386	279,578	299,772	320,755
Inventory and contracts in progress	108,789	107,896	118,698	126,879
Cash and cash equivalents	881,609	797,963	806,870	824,443
TOTAL ASSETS	2,050,784	2,047,959	2,124,331	2,209,317
EQUITY AND LIABILITIES				
Reserves	1,024,403	1,086,581	1,155,776	1,230,955
Retained Earnings	1,024,403	1,086,581	1,155,776	1,230,955
Non-current liabilities	12,800	13,793	14,759	13,215
Post-retirement medical benefits	12,800	13,793	14,759	13,215
Current liabilities	1,013,581	997,585	953,796	965,147
Advances received	758,962	537,460	529,232	532,698
Trade and other payables	254,619	410,125	424,564	432,449
TOTAL EQUITY AND LIABILITIES	2,050,784	2,047,959	2,124,331	2,209,317

Table G.8: Group Statement of Financial Position over the MTEF Period

G.2.5 CSIR Group Cash Flow

	March 2018 R'000
Cashflow from operating activities	
Cash receipts from external customers	2,114,250
Parliamentary Grant income	729,359
Cash paid to suppliers and employees	(2,859,041)
Cash generated from operating activities	14,096
Net finance income	41,090
Net cash from operating activities	26,058
Cashflow from investing activities	
Increase in interest in joint ventures and associates	(1,603)
Decrease in long term receivables	584
Acquisition of property, plant and equipment	(108,685)
Net cash utilised in investing activities	(109,704)
Cashflow from financing activities	
Increase in long-term liabilities	–
Net cash generated from financing activities	–
Net increase in cash and cash equivalents	83,646
Cash and cash equivalents at beginning of the year	881,609
Cash and cash equivalents at end of the year	797,963

Table G.9: CSIR Group Cash-Flow Statement

G.3 5 Year Borrowing Plan



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Prof Thokozani Majazi
Chairperson
Council for Scientific and Industrial Research
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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

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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

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

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



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