CSIR

SHAREHOLDER'S COMPACT 2023/24

science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

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i. ACRONYMS

3D	Three Dimensional
4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
AMTL	Advanced Material Testing Laboratories
API	Active Pharmaceutical Ingredient
ARC	Audit and Risk Committee
B-BBEE	Broad-Based Black Economic Empowerment
BD&C	Business Development and Commercialisation
BEI	Business Excellence and Integration
BIDC	Biomanufacturing Industry Development Centre
BIDF	Biorefinery Industry Development Facility
BIFN	BRICS Institute for Future Networks
CSIR Board	Board of Directors
BRICS	Brazil, Russia, India, China, and South Africa
CeNAM	Centre for Nanostructures and Advanced Materials
CEO	Chief Executive Officer
CF	Commercialisation Fund
CFO	Chief Financial Officer
cGMP	Current Good Manufacturing Practice
CO_2	Carbon Dioxide
CoGTA	Cooperative Governance and Traditional Affairs
COVID-19	Coronavirus disease 2019
CPAM	Collaborative Programme in Additive Manufacturing
CSD	Central Supplier Database
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa
DFFE	Department of Fisheries, Forestry and the Environment
DHM	Dynamic Hydraulic Model
DoD	Department of Defence
DMRE	Department of Mineral Resources and Energy
DSAC	Department of Sport, Arts and Culture
DSI	Department of Science and Innovation
dtic	Department of Trade, Industry and Competition
EE	Employment Equity

EEP	Employment Equity Plan
ERAs	Emerging Research Areas
ERM	Enterprise Risk Management
ERMS	Enterprise Risk Management Services
ERRP	Economic Reconstruction and Recovery Plan
EPIC	Excellence, People, Integrity and Collaboration
ESG	Environmental, Social and Governance
EU	European Union
ExCo	Executive Committee
FPP	Fraud Prevention Plan
FPMP	Fraud Prevention and Management Policy
GCIS	Government Communication Information System
GDP	Gross Domestic Product
GRC	Governance, Risk Management and Compliance
HC	Human Capital
HEIs	Higher Education Institutions
HIP	Hot Isostatic Pressing
HR	Human Resources
HRSEC	Human Resource and Ethics Committee
ICASA	Independent Communications Authority of South Africa
ICT	Information and Communication Technology
IKS	Indigenous Knowledge Systems
IoT	Internet of Things
IP	Intellectual Property
IPOSS	Integrated Port Operations Support System
ISO	International Organization for Standardization
IT	Information Technology
KPIs	Key Performance Indicators
KSS	Knowledge Sharing Systems
LCBE	Legal, Compliance and Business Enablement
LF	Learning Factory
LoC	Lab-on-Chip
MDDV	Medical Devices, Diagnostics and Vaccines
MESA	Manufacturing Enterprise Solutions Association
MerSETA	Manufacturing, Engineering and Related Services Sector Education and Training Authority
MMR	Mining and Minerals Resources
MICT	Media, Information and Communication Technologies
MTEF	Medium-term Expenditure Framework
MSc	Master of Science
NACI	National Advisory Council on Innovation

NDOH	National Department of Health
NEPAD	New Partnership for Africa's Development
NHLS	National Health Laboratory Service
NICIS	National Cyberinfrastructure System
NIDF	Nanomaterials Industrial Development Facility
NMISA	National Metrology Institute of South Africa
NRF	National Research Foundation
NSI	National System of Innovation
NT	National Treasury
NWU	North-West University
OEM	Original Equipment Manufacturer
OpCo	Operations Committee
PhD	Doctor of Philosophy
PFMA	Public Finance Management Act, 1999 (Act 1 of 1999) as amended by Act 29 of 1999)
PG	Parliamentary Grant (Baseline)
PoC	Point-of-Care
PoPIA	Protection of Personal Information Act
PPE	Property, Plant and Equipment
PV	Photovoltaics
R&D	Research and Development
RD&I	Research, Development and Innovation
RIR	Recordable Incident Rate
Rm	Rand in Millions
RMP	Risk Management Plan
SaaS	Software as a Service
SADC	Southern African Development Community
SADiLAR	South African Centre for Digital Language Resources
SAHPRA	South Africa Health Products Regulatory Authority
SALGA	South African Local Government Association
SANAS	South African National Accreditation System
SANBio	Southern Africa Network for Biosciences
SANDF	South African National Defence Force
SANEDI	South African National Energy Development Institute
SAPS	South African Police Service
SET	Science, Engineering and Technology
SETAs	Sector Education and Training Authorities
SGCs	Societal Grand Challenges
SHEQ	Safety, Health, Environment and Quality
SMMEs	Small, Medium and Micro Enterprises
SOEs	State-owned Enterprises

SOs	Strategic Objectives
STI	Science, Technology and Innovation
STISA	Science, Technology and Innovation Strategy for Africa
TIA	Technology Innovation Agency
TIC	Technology Innovation Centre
TMM	Trackless Mobile Machinery
TOdB	Technical Outputs Database
TRL	Technology Readiness Level
TVET	Technical and Vocational Education and Training
UAVs	Unmanned Aerial Vehicles
UCT	University of Cape Town
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
USA	United States of America
VRE	Variable Renewable Energy
Wits	University of Witwatersrand

ii. GLOSSARY OF TERMS

Abbreviation/Term	Meaning Ascribed
Accounting Officer	A person as defined in terms of section 36 of the PFMA as CEO
Approval Framework	The CSIR policy document specifying the decision matrix and levels of maximum approval authority for different role-players within the CSIR, as approved by the Board of the CSIR and as amended from time to time.
Audit and Risk Committee (ARC)	Constituted in terms of the requirements as prescribed by the Treasury Regulations of the PFMA and sound corporate governance practices. The ARC is established to assist the Board in discharging its duties, relating to the safeguarding of assets, the operation of adequate systems, control processes and the preparation of accurate financial reporting and statements in compliance with all applicable legal requirements and accounting standards. The ARC is tasked with reviewing the control, governance and risk management practices within the CSIR and determining appropriate policies, controls and procedures to manage these, proportionate to the risk or opportunity involved.
Code	The CSIR Ethics Statement and Code of Conduct.
Combined Assurance Plan	A planned approach, based on continuous risk analysis, designed to highlight the relevant high-risk areas and the assurance to be provided by management, compliance, external audit, internal audit and other consultants or service providers, in order for the CSIR Board to be appraised of the risk management efforts undertaken to manage the risks to an acceptable level and for assessing the extent and the adequacy of assurance on key organisational risks and reporting on those risks to senior management and the ARC, and in the context of fraud prevention, to the Human Resources and Social and Ethics Committee (HRSEC).
Conditions of Service	The CSIR Conditions of Service as approved by the Board of the CSIR in terms of section 12 of the Scientific Research Council Act, 1998 (Act 46 of 1998) and as amended from time to time.
Contracted Stakeholders	Those persons or parties with whom the CSIR has formal contractual relations, such as its shareholders, employees, suppliers/service providers, collaborators and customers.
Control	A measure employed to modify risk, the existing risk processes, policy, devices, practices or other actions that act to minimise risks or to enhance positive opportunities.
Corruption	An act whereby anybody accepts any gratification (benefit) from anybody else or offers or gives any gratification to anybody else to influence the receiver to conduct herself or himself or itself in a way that amounts to the unlawful or irregular exercise of any duties.
COSO	Committee of Sponsoring Organisations of the Treadway Commission, who developed a globally accepted Internal Control—Integrated Framework, (the 'COSO Framework' or the 'Framework'), a set of guidelines designed to assist companies in evaluating the effectiveness of their internal control systems.
CSIR Board	The CSIR Board of Directors/Accounting Authority

Disciplinary Code and Procedure	A document that provides guidance when dealing with misconduct and poor work performance. It promotes regulated fairness, certainty and consistency in the application of discipline, establishes standards, principles and procedures when addressing misconduct, and encourages all employees to adhere to the appropriate standards of conduct by providing for progressive and corrective action, as approved by the Board of the CSIR and as amended from time to time.
Ethics Hotline Procedure	Provides employees with an independent mechanism to bring any unethical business practices to the attention of management via telephone, email, web-based tip-off facility, facsimile or post.
Event	An occurrence or a change of a particular set of circumstances.
Fixed Asset Policy	A document that governs the controls associated with the recognition, de-recognition, financing and transfer of assets as approved by the Board of the CSIR and as amended from time to time.
Fraud	The unlawful and intentional making of a misrepresentation, which causes actual prejudice or is potentially prejudicial to another. Additionally, the use of the term 'fraud' in this document is an expansive one and is intended to include all aspects of economic crime and acts of dishonesty that are aimed at causing economic loss to the CSIR.
Fraud Prevention Strategy	The CSIR's strategy to facilitate fraud prevention/fraud risk management and is a process that is adopted by the CSIR in putting mechanisms in place to manage the CSIR's vulnerability to fraud. Such mechanisms are designed to prevent, deter and detect fraud.
Fraud Risk	The CSIR's vulnerability to fraud, based on the adequacy of the mechanisms designed and implemented to prevent, deter and detect fraud.
HRSEC	The committee constituted in terms of Regulation 43 of the Companies Act, 2008 (Act 71 of 2008) that must monitor the company's activities regarding matters relating to: • Social and economic development, including the company's standing in terms of the goals and purposes of: - The 10 principles set out in the United Nations Global Company Principles; - The Organisation of Economic Co-operation and Development recommendations regarding corruption; - The EE Act, 1998 (Act 55 of 1998); and - The Broad-Based Black Economic Empowerment Act, 2003 (Act 53 of 2003). • Good corporate citizenship, including the company's: - Promotion of equality, prevention of unfair discrimination and measures to address corruption; - Contribution to the development of the communities in which its activities are predominantly conducted or within which its products or services are predominantly marketed; - Record of sponsorship, donations and charitable giving; - The environment, health and public safety, including the impact of the company's activities and of its products or services; - Consumer relationships, including the company's policies and records relating to advertising, public relations and compliance with consumer protection laws; and - Labour and employment matters.
ICT Policy	Provides the framework within which the CSIR's computing facilities and assets that are provided to employees and CSIR representatives, for the purpose of conducting CSIR business, are administered and managed, as approved by the Board of the CSIR and as amended from time to time.
Information Security Policy	Expresses the CSIR's position and intent to implement, maintain and improve its information security measures as approved by the Board of the CSIR and as amended from time to time.

Inherent risk	The exposure arising from risk factors in the absence of deliberate management intervention(s) to exercise control over such factors.
Institutional Review Report	The report generated periodically in terms of section 3 of the 1997 White Paper on Science and Technology requiring periodic institutional reviews to be carried out on science, engineering and technology institutions by and independent panel.
Internal Control	Is a system designed to promote efficiency, assure the implementation of a policy, safeguard assets or avoid fraud and error. These sets of rules/measures are put in place to prevent or mitigate an undesired event or condition.
ISO 31000	A family of standards relating to risk management codified by the International Organization for Standardization that provides generic guidelines for the design, implementation and maintenance of risk management processes throughout an organisation.
King IV	The King IV Report on Corporate Governance for South Africa, 2016.
National Treasury (NT) Regulations	The regulations issued by NT in support of the PFMA.
Non-contracted Stakeholders	Those persons or parties that do not have a formal contractual relationship with the CSIR, but are, nevertheless, affected by what the CSIR does or says, such as communities, the natural environment, and future generations.
Residual risk	The remaining risk exposure after management has put measures in to control the inherent risk.
Risk	An unwanted outcome, actual or potential, to the CSIR's performance objective caused by the presence of risk factors (may also present as an upside potential available for exploitation).
Risk acceptance	An informed decision by the organisation to take a particular risk.
Risk appetite	The amount of residual risk an organisation is willing to accept.
Risk assessment	An overall process by the organisation for risk identification, risk analysis and risk evaluation.
Risk culture	The values, beliefs, knowledge and understanding about risk that are shared by a group of people with a common intended purpose, in particular, the leadership and employees of the organisation.
Risk factor	Any threat or event that creates or has the potential to create risk.
Risk management	A systematic and formalised process of identifying, assessing, managing and monitoring risks.
Risk owner	The person accountable for managing a particular risk.
Risk register	The record of information about identified risks.
Risk reporting	A form of communication intended to inform internal or external stakeholders by providing information about the current state of risk and how it is being managed.
Risk tolerance	The amount of risk an organisation is capable of bearing.
Risk treatment	A process by which existing controls are improved and new controls developed or implemented.
Stakeholders	Broadly defined as those who are affected by an organisation's decisions and actions inclusive of contracted and non-contracted stakeholders – see definitions for 'contracted stakeholders' and 'non-contracted stakeholders'. Everyone who has direct and indirect interest in affairs of the organisation, persons who and entities that can affect, be affected by, or perceive themselves to be affected by a decision or an activity of the organisation.
Threats	Risks emanating from the organisation's nature of business.

1. THE SHAREHOLDER'S COMPACT OUTLINE

The Shareholder's Compact is a performance agreement between the Council for Scientific and Industrial Research (CSIR) and the Minister of Higher Education, Science and Innovation. It consists of the text of the Compact itself (Chapter 2) and a series of supporting annexures that cover the following aspects:

- Strategic planning documents:
  - Strategic Plan: 2023/24–2027/28 (Annexure A); and
  - Annual Performance Plan: 2023/24 (Annexure B).

- Documents setting out the governance structures and risk management strategies of the CSIR:
  - Governance Structure (Annexure C);
  - Risk Management Strategy (Plan) (Annexure D);
  - Fraud Prevention Plan (Annexure E); and
  - Materiality/Significance Framework (Annexure F).

- Documents setting out the CSIR Financial Plan and CSIR's compliance with the applicable financial legislation:
  - Financial Plan (Annexure G).

- Other supporting documents:
  - Annexure H: CSIR Risk Register for 2023/24.

2. SHAREHOLDER'S COMPACT AGREEMENT

FOR THE CYCLE COMMENCING 1 APRIL 2023

MADE AND ENTERED INTO BY AND BETWEEN:

THE MINISTER OF HIGHER EDUCATION, SCIENCE AND INNOVATION
Dr Blade Nzimande, in his capacity as Executive Authority, being the responsible Cabinet member (hereinafter referred to as 'the Executive Authority')

and

THE CSIR BOARD
herein represented by 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 (NSI) and establish a framework of good corporate governance;

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

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

NOW, THEREFORE, THE PARTIES HEREBY AGREE AS FOLLOWS:

GLOSSARY OF TERMS

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

Accounting Authority means the CSIR Board as established in terms of section 7 of the Scientific Research Council Act.

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 2023/24 financial year;
- Annexure C being the CSIR Governance Structure;

- Annexure D being the CSIR Risk Management Strategy (Plan);
- Annexure E being the CSIR Fraud Prevention Plan (FPP);
- Annexure F being the Materiality Framework;
- Annexure G being the Financial Plan (including the budget and cash flow for 2023/24; the Group's three-year Financial Plan and the three-year Borrowing Plan); and
- Annexure H: CSIR Risk Register 2023/24.

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

Balanced Scorecard Framework means the Executive Authority's framework for evaluating the performance of science, engineering and technology (SET) institutes described in the DSI publication entitled "Reviewing the science, engineering, technology and innovation scorecards", dated May 2003.

Basic Conditions of Employment Act means Act 75 of 1997.

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

EE Act means Act 55 of 1988.

Effective Date means the effective date of this Shareholder's Compact, which shall be 1 April 2023.

Executive Authority means the Minister of Higher Education, Science and Innovation.

KPIs means the performance measures described in the Corporate Plan, against which the performance of the CSIR shall be evaluated.

Labour Relations Act means Act 66 of 1995.

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

Parties means the Executive Authority and the Accounting Authority, respectively.

PFMA means Act 1 of 1999.

PoPIA means Act 4 of 2013.

Shareholder's Compact means this document and all annexures thereto.

Scientific Research Council Act means the CSIR's enabling legislation, namely Act 46 of 1988.

Skills Development Act means Act 97 of 1998.

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

THE SHAREHOLDER'S COMPACT

This Shareholder's Compact represents the agreement between the Executive Authority of the CSIR, being the Minister of Higher Education, Science and Innovation, and the Accounting Authority of the CSIR, being the CSIR Board, herein represented by the Chairperson of the Board. It reflects 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 2023.

This Shareholder's Compact shall operate from the Effective Date and will be reviewed by the Parties at the end of the financial year ending on 31 March 2024.

LEGAL REQUIREMENT AND PRIMARY RELATIONSHIP BETWEEN THE SIGNATORIES

Chapter 29 of the Treasury Regulations imposes 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."

FRAMEWORK OF THE SHAREHOLDER'S COMPACT

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."

The Shareholder's Compact

The CSIR's strategic objectives (SOs) are outlined in the Corporate Plan, which incorporates the CSIR Strategic Plan and the CSIR Annual Plan for the 2023/24 planning cycle; the CSIR's Risk Management Strategy; the CSIR's FPP; the Materiality Framework; the Budget and Cash Flow for 2023/24; the Group's three-year financial plan and the organisation's three-year borrowing plan. The Accounting Authority undertakes to oversee the implementation of the said elements of the Corporate Plan.

INTERNAL TRANSFORMATION

In Annexure A, the Corporate Plan of the CSIR deals with matters relating to transformation, among others. In giving effect to the Corporate Plan, the Accounting Authority will ensure that the CSIR is in full compliance with all applicable legislation, such as, but not limited to, the EE Act, the Skills Development Act, the Labour Relations Act, the Basic Conditions of Employment Act, and the B-BBEE Codes.

THE ROLE AND POWERS OF THE ACCOUNTING AUTHORITY

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

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

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.

UNDERTAKINGS BY THE ACCOUNTING AUTHORITY OF THE PUBLIC ENTITY

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

UNDERTAKINGS BY THE EXECUTIVE AUTHORITY AS THE SHAREHOLDER

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:

- 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 Parliament requires the information and must be provided urgently;
- Not reneging on written guarantees and undertakings given;
- Providing the organisation with strategic direction and control; and
- Complying 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.

GOVERNANCE

The Accounting Authority recognises that systems of good corporate governance should be in place and reviewed continuously to ensure that they are always 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 also ensure compliance with the relevant provisions of the King IV Code on Corporate Governance (2016), and the Protocol on Corporate Governance in the Public Sector (2002) issued by the Department of Public Enterprises.

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.

KPIs LINKED TO THE BALANCED SCORECARD FRAMEWORK

The key performance indicators (KPIs) have been summarised according to the categories of the Balanced Scorecard Framework of the Department of Science and Innovation (DSI) and reflect the SOs of the CSIR. The CSIR's SOs are explained in greater detail below.

The CSIR's 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 fulfil its mandate. The KPIs are aligned to the SOs and provide a basket of measures that reflect various aspects of organisational performance. The categories and their associated SOs are:

SO1: CONDUCT RESEARCH, DEVELOPMENT AND INNOVATION (RD&I) OF TRANSFORMATIVE TECHNOLOGIES AND ACCELERATE THEIR DIFFUSION.

This SO seeks to ensure that the CSIR undertakes cutting-edge research, development and innovation in areas that will bring transformative change in the South African economy and society.

KPI 1: Publication equivalents

Research publications are a measure of the CSIR's research capabilities and outputs. The quantity and quality of peer-reviewed research publications is a measure of the quality and depth of the scientific knowledge base. Publication equivalents consist of peer-reviewed journal articles, peer-reviewed conference papers, peer-reviewed book chapters and books.

KPI 2: New priority patent applications filed

At the CSIR, priority patent filings serve as a pipeline indicator of patent families. A priority patent is the first patent application filed for the protection of a particular invention with the CSIR named as an applicant/assignee/co-applicant/co-assignee.

KPI 3: New patents granted

Patents provide a lead indicator of the potential impact to be achieved when technologies are commercialised. Patents are exclusive rights granted for inventions and are conferred by an examining patent authority with the CSIR named as an applicant/assignee/co-applicant/co-assignee.

KPI 4: New technology demonstrators

Measure an intermediate output of research, development and innovation activities with the potential to be developed further and that can be transferred to various markets for socioeconomic impacts. A prototype – a rough example of a conceivable technology (product or system) derived from existing knowledge gained from research and/or practical experience as proof of concept.

KPI 5: Number of technology licence agreements signed

This indicator is a measure of the uptake of CSIR intellectual property (IP) in the market. A licence is an agreement in terms of which the CSIR grants rights to another party to exploit IP developed by the CSIR, typically in exchange for royalty payments and/or other licence fees.

SO2: IMPROVE THE COMPETITIVENESS OF HIGH-IMPACT INDUSTRIES TO SUPPORT SOUTH AFRICA'S RE-INDUSTRIALISATION BY COLLABORATIVELY DEVELOPING, LOCALISING AND IMPLEMENTING TECHNOLOGY.

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

KPI 6: Number of localised technologies

The indicator aims to diffuse technologies commercialised or industrialised from elsewhere in the world that have demonstrated potential to positively affect the competitiveness of industry upon competent adoption by users or is a strong candidate to be an input into innovation or enhancements of other systems for the improvement of industrial activities or the capabilities of the state. A localised technology is a technology that has been invented or commercialised outside of South Africa and has been or will be introduced/adapted in South Africa for commercial or scientific benefit or a technology that has been locally developed as an import replacement.

KPI 7: Number of joint technology development agreements being implemented for industry

This indicator measures the CSIR's technology development collaborations with industry partners with the intention to commercialise and industrialise. A joint technology development initiative with an industry partner under a written agreement, where each party brings needed capability for the development and/or implementation of the technology.

KPI 8: Number of SMMEs supported

The indicator measures the CSIR's contribution to socioeconomic development and industrialisation through the support of Small, Medium and Micro Enterprises (SMMEs). Support of SMMEs (as described in Schedule 1 of the National Definition of Small Enterprise in South Africa under the National Small Enterprise Act), through the implementation of RD&I and technology interventions that contribute to SMMEs becoming more productive, efficient and sustainable.

SO3: DRIVE SOCIOECONOMIC TRANSFORMATION THROUGH RD&I THAT SUPPORTS THE DEVELOPMENT OF A CAPABLE STATE.

This SO emphasises the CSIR's role in supporting the development of a capable state and enabling the government to drive the socioeconomic transformation of South Africa through RD&I.

KPI 9: Number of reports directly contributing to national policy formulation and development

The indicator measures the CSIR's support to the government with evidence-based policy development and decision-making that can benefit from a significant science, engineering and innovation input. Evidence-based policy development support is provided to various arms of government.

KPI 10: Number of standards delivered or contributed to in support of the state

The indicator measures the CSIR's support for government policy and regulation through the development of standardised practice guidelines across economic and social sectors. New or updated standards adopted by the state and state-owned entities (SOEs) that the CSIR has developed and delivered or to which it contributed (e.g. interoperability standards, accessibility standards, products or infrastructure standards).

KPI 11: Number of projects implemented to increase the capability of the state

This indicator measures the number of projects that the CSIR implements on behalf of the state. This indicator measures the number of projects that the CSIR implements on behalf of the state. The CSIR-facilitated implementation of technologies (CSIR-created or otherwise) that improve the efficiency of government, SOEs and South African Universities.

SO4: BUILD AND TRANSFORM HUMAN CAPITAL AND INFRASTRUCTURE.

This SO seeks to build and transform the required human capital and investment in infrastructure to drive industrialisation and the advancement of society.

KPI 12: Total science, engineering and technology (SET) staff

The indicator is a measure of the CSIR's capacity to deliver on RD&I projects. The number of CSIR staff qualified in the field of SET.

KPIs 13 and 14: Percentage of South African SET staff who are black and female, respectively

These indicators measure the degree of demographic transformation within the RD&I capacity of the organisation. Percentage of staff who are black (as per B-BBEE Act definition) and percentage of SET staff who are female, respectively.

KPI 15: Percentage of SET staff with a doctoral qualification

The indicator measures the organisation's capacity to conduct and supervise quality research and to innovate. The proportion of SET staff who have doctoral-level qualifications.

KPI 16: Total Chief Researchers

The indicator is a measure of the quality of SET capacity and its potential influence in the local and international RD&I spaces (capacity to collaborate and share resources). The number of CSIR staff appointed and/or recognised as Chief Researchers through the formal Career Ladder process.

KPIs 17 and 18: Percentage of Chief Researchers who are black and female, respectively

These indicators measure the level of demographic transformation within the Chief Researcher level. The proportion of black (as per B-BBEE Act definition) South African and proportion of female South African citizens who are Chief Researchers (as per CSIR's Career Ladder process).

KPI 19: Total Principal Researchers

The indicator is a measure of the quality of SET capacity and their potential influence in the local and international RD&I spaces (capacity to collaborate and share resources). The number of CSIR staff appointed and/ or recognised as Principal Researchers through the formal Career Ladder process.

KPIs 20 and 21: Percentage of principal researchers who are black and female, respectively

These indicators measure the level of demographic transformation within the principal researcher level. The proportion of black (as per B-BBEE Act definition) South African and proportion of female South African citizens who are Principal Researchers (as per CSIR's Career Ladder process).

KPI 22: Number of staff involved in exchange programmes with industry

The indicator measures the level at which CSIR shares expertise and resources to strengthen collaborations with industry to achieve organisational growth. The exchange of staff between the CSIR and industry for a period of time to share/gain expertise for the advancement of business growth opportunities and capacity development.

KPI 23: Property, plant and equipment (PPE) investment (Rm)

This indicator provides a measure of the CSIR's investment in research infrastructure to develop and maintain world-class facilities and equipment to provide the quality of RD&I that is expected of it. PPE investment is the amount invested in CSIR and government grant-funded PPE, as well as qualifying leases (as per Accounting Standard on Leases) for a financial year.

SO5: DIVERSIFY INCOME, MAINTAIN FINANCIAL SUSTAINABILITY AND GOOD GOVERNANCE.

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

KPI 24: Total operating income (Rm)

The indicator reflects the ability of the CSIR to ensure financial sustainability. Growth in total operating income indicates growth in the outcomes and impact achieved by the CSIR. Total operating income includes revenue declared on research and development contracts (contract R&D income), income derived from licences and royalties, Parliamentary Grant received through the Science Vote, and other income.

KPI 25: Net profit (Rm)

Net profit is a key indicator of financial sustainability and the ability of the organisation to manage its expenses according to the affordability determined by income levels. 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.

KPI 26: South African public sector income (% Total income)

South African public sector income reflects the degree of government public income in the CSIR. South African public sector income is the total income earned from South African government departments (i.e. national, provincial and local), constitutional entities, and public entities (as listed in the schedules to the Public Finance Management Act "PFMA"). This includes revenue declared on R&D contracts (contract R&D income), directed/ring-fenced Parliamentary Grant (PG) received through the Science Vote and any other forms of funding received from South African public entities.

KPI 27: South African private sector income (% total income)

South African private sector income reflects the degree of private sector investment in the CSIR. South African private sector income is the total income earned from South African non-public entities (not listed as public entities in the schedules to the Public Finance Management Act and the Municipal Finance Management Act). This includes not-for-profit organisations. Licences, royalties and interest income is not included in the definition of South African private sector investment.

KPI 28: International contract income (% total Income)

International contract income reflects the global relevance of the CSIR. Growth in international investment is a key indicator of income diversification, as well as the relevance and impact of the CSIR within the global economy. International contract income is the total income earned from foreign customers (i.e. entities incorporated outside the borders of South Africa). This includes revenue declared on research and development contracts and other income received from foreign entities.

KPI 29: Broad-Based Black Economic Empowerment (B-BBEE) rating

The indicator is a measure of the CSIR's compliance to the B-BBEE Act in its contribution to support socioeconomic transformation in South Africa. A B-BBEE rating is a verification certificate issued by a South African National Accreditation System (SANAS)-approved verification agency that determines the CSIR's contribution to black (as per B-BBEE Act definition) economic empowerment.

KPI 30: Recordable incident rate (RIR)

The RIR indicates the effectiveness of the health and safety management system within the organisation in a year. The RIR is the number of recordable incidences (or cases); multiplied by 200 000; divided by the number of hours worked. A recordable incident

is a work-related injury or illness that results in one or more of the following criteria:

- *Death;*
- *Loss of consciousness;*
- *Restricted work or transfer to another job;*
- *Days away from work; and/or*
- *Medical treatment beyond first aid.*

KPI 31: Audit Opinion

The indicator is a measure of the CSIR's accountability and governance. The Auditor-General defines a 'clean audit' as achieving an unqualified audit opinion on the audits of annual financial statements and pre-determined objectives, as well as not having material findings on the audit of compliance with laws and regulations.

The target values for the set of KPIs are given in Table 1.

Table 1: CSIR KPIs for 2023/24

Key Performance Indicator		Actual 2020/21	Actual 2021/22	Target 2022/23	Target 2023/24
SO1:	**Conduct research, development and Innovation of transformative technologies and accelerate their diffusion.**				
KPI 01:	Publication equivalents	406.5	422.5	304.5	**408**
KPI 02:	New priority patent applications filed	5	7	7	**8**
KPI 03:	New patents granted	26	16	6	**8**
KPI 04:	New technology demonstrators	48	55	54	**56**
KPI 05:	Number of technology licence agreements signed	3	12	18	**18**
SO2:	**Improve the competitiveness of high-impact industries to support South Africa's re-industrialisation by collaboratively developing, localising and implementing technology.**				
KPI 06:	Number of localised technologies	5	14	11	**15**
KPI 07:	Number of joint technology development agreements being implemented for industry	25	25	27	**30**
KPI 08:	Number of SMMEs supported	96	99	72	**90**
SO3:	**Drive the socioeconomic transformation through research, development and innovation which supports the development of a capable state**				
KPI 09:	Number of reports contributing to national policy development	21	22	13	**22**
KPI 10:	Number of standards delivered or contributed in support of the state	11	8	9	**9**
KPI 11:	Number of projects implemented to increase the capability of the state	44	86	45	**60**
SO4:	**Build and transform human capital and infrastructure**				
KPI 12:	Total SET staff	1474	1551	1598	**1598**
KPI 13:	Percentage of SET staff who are black	66.5%	67.8%	67%	**67%**

Key Performance Indicator		Actual 2020/21	Actual 2021/22	Target 2022/23	Target 2023/24
KPI 14:	Percentage of SET staff who are female	36.4%	39.1%	38%	**38%**
KPI 15:	Percentage of SET staff with PhDs	20.9%	20.5%	21%	**21%**
KPI 16:	Total Chief Researchers	15	15	16	**16**
KPI 17:	Percentage of Chief Researchers who are black	20%	13.3%	19%	**19%**
KPI 18:	Percentage of Chief Researchers who are female	20%	13.3%	13%	**13%**
KPI 19:	Total Principal Researchers	179	188	189	**189**
KPI 20:	Percentage of Principal Researchers who are black	30.7%	34%	34%	**35%**
KPI 21:	Percentage of Principal Researchers who are female	19%	19%	20%	**20%**
KPI 22:	Number of staff involved in exchange programmes with industry	8	31	26	**31**
KPI 23:	PPE investment (Rm)	89.4	104	259.8	**148**
SO5: Diversify income, maintain financial sustainability and good governance					
KPI 24:	Total income (Rm)	2 569	2654	2903	**3 104**
KPI 25:	Net profit (Rm)	96	137	-5.4	**11.5**
KPI 26:	SA public sector income (% total income)	56%	56%	51%	**56%**
KPI 27:	SA private sector income (% total income)	13%	9%	12%	**11%**
KPI 28:	International contract income (% total income)	5%	8%	8%	**9%**
KPI 29:	B-BBEE rating	2	1	1	**1**
KPI 30:	Recordable incident rate	0.53	0.14	≤1	**≤0.6**
KPI 31:	Audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion	**Unqualified audit opinion**

REPORTING

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

b. 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.

c. 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.

EXTRAORDINARY 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 to from time to time during its Board meetings.

SUPPORTING DOCUMENTATION

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

- CSIR Strategic Plan as embodied in Annexure A;
- CSIR Annual Plan for 2022/23 as embodied in Annexure B;
- Risk Management Strategy (Plan) as embodied in Annexure D;
- FPP as embodied in Annexure E;
- Materiality Framework as embodied in Annexure F;
- Financial Plan as embodied in Annexure G; and
- CSIR Risk Register for 2023/24 embodied in Annexure H.

PENALTIES AND REWARDS

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, approve the payment of allowances, subsidies and benefits, including performance bonuses.

GOVERNING LAW AND DISPUTE RESOLUTION

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

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

Should the dispute, despite such mediation, remain unresolved for a further period of 30 days after being so referred, either Party may declare such dispute a formal intergovernmental dispute by notifying the other Party of such declaration in writing. In which event, the Parties will follow the procedure as outlined in section 42 of the Intergovernmental Relations Framework Act, 2005 (Act 13 of 2005).

Should the dispute remain unresolved for a period of 30 days, the said dispute or difference shall be adjudicated upon by a competent third party agreed upon by the Parties, unless otherwise agreed between the Parties by means of arbitration, mediation, or other agreement.

Should the Parties be unable to agree upon a competent third party as contemplated in clause 15.2, the dispute will be adjudicated by a competent court with jurisdiction to hear the matter.

NOTICES

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

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

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

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.

3. Any notice given by one Party to the other ('the addressee') which:
   - 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;
   - 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 fourth day after the date of posting; and/or
   - is transmitted by telefax or e-mail shall be deemed (in the absence of proof to the contrary) to have been received within one hour of transmission, where it is transmitted during normal business hours of the receiving instrument, and within two hours of the commencement of the following business day where it is transmitted outside those business hours.

WHOLE AGREEMENT

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.

All undertakings and annexures to this Shareholder's Compact are declared active on the Effective Date.

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 signed by both Parties, and such variation, modification, consent, or waiver shall be valid only for a specific case and only for the purpose and extent to which it was made or given.

AMENDMENTS TO THE SHAREHOLDER'S COMPACT

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

i. The date of the change order;
ii. The description of the proposed amendment or alteration;
iii. Previous unspecified ad hoc work to be undertaken, if applicable;
iv. The reason for making the proposed amendment or alteration;
v. When the Party requires the change to be implemented;
vi. The resources available; and
vii. The continued balance of the Parties' obligations under this Shareholder's Compact.

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

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

UNDERTAKING BY THE CHAIRPERSON OF THE CSIR BOARD

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

UNDERTAKING BY THE MINISTER OF HIGHER EDUCATION, SCIENCE AND INNOVATION

The Minister of Higher Education, Science and Innovation, Dr Blade Nzimande, approves of this approach and looks forward to the successful implementation of the undertakings embodied in this Shareholder's Compact and its annexures. The Minister accepts that, although the detail of this Shareholder's Compact may change due to variations and changes in the market and society, the spirit thereof will remain unchanged.

THE CSIR SHAREHOLDER'S COMPACT

Agreed to and signed in Pretoria, Gauteng on 27 Februrary 2023

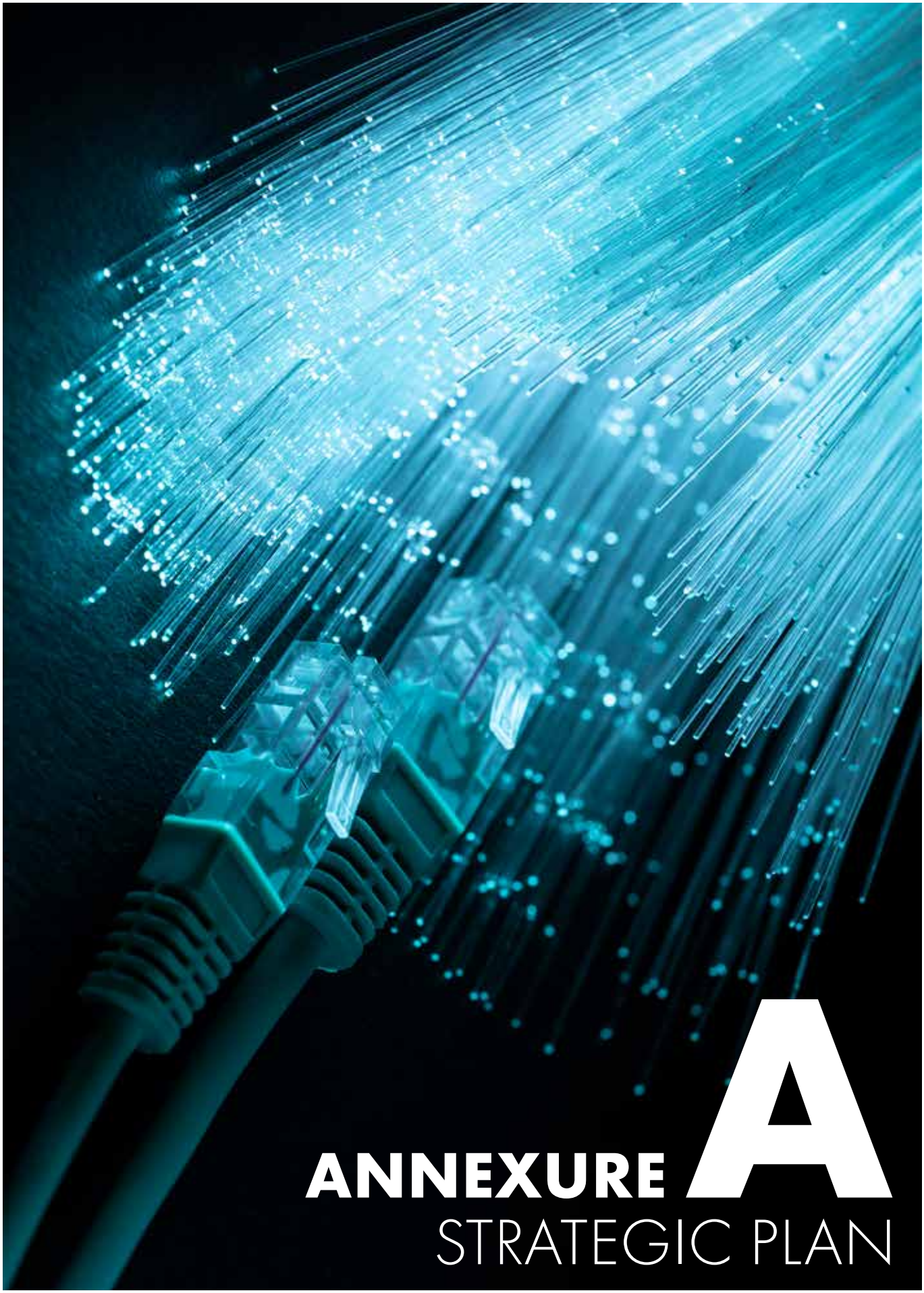
Chairman of the Board

On behalf of the Accounting Authority

Agreed to and signed in Pretoria on 28/02 2023

Dr Blade Nzimande

The Executive Authority



ANNEXURE A
STRATEGIC PLAN

OVERVIEW AND BACKGROUND

A.1.1 CSIR Mandate

The CSIR was established on 5 October 1945 by an Act of Parliament. The Act under which the CSIR now operates, the Scientific Research Council Act, 1988 (Act 46 of 1988) as amended by the Scientific Research Council Amendment Act 1990 (Act 71 of 1990), the General Law Amendment Act, 1996 (Act 49 of 1996), the Measurement Units and Measurement Standards Act, 2006 (Act 18 of 2006), the Science and Technology Laws Amendment Act, 2011 (Act 16 of 2011), the Science and Technology Laws Amendment Act, 2014 (Act 7 of 2014), and Science and Technology Laws Amendment Act 2020 (Act 9 of 2020) stipulates the following mandate:

CSIR MANDATE

"The objects of the CSIR, trough directed and particularly multi-disciplinary 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 Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

(Scientific Research Council Act 46 of 1988, amended by Act 27 of 2014)

Specifically, section 4(a)(i) of the Act dictates that the CSIR supports better utilisation of the resources of the Republic. This is achieved through the improvement of the productive capacity of its population, improvement of technical processes and methods to improve industrial production, the promotion and expansion of existing, as well as the establishment of new industries, standardisation in industry and commerce, and training of the national workforce.

A.1.2 Vision and Mission

VISION

We are accelerators of socioeconomic prosperity in South Africa through leading innovation.

MISSION

Collaboratively innovate and localise technologies, while providing knowledge solution for the inclusive and sustainable advancement of industry and society.

A.1.3. CSIR Values

EXCELLENCE

We strive for excellence and quality in everything that we do. We always strive to deliver solutions that surpass the expectations of our stakeholders. We hold each other to the highest possible standard in research, development and innovation (RD&I), as well as all other facets of CSIR business. We believe that excellence is a product of investing in the continuous, development of our people, processes and ways of doing business.

PEOPLE-CENTRED

Our business is about touching the lives of people – our employees and business partners. We care about people. We respect each other's diversity and conduct ourselves in a manner that upholds the dignity of every person. We believe in continuous personal development and encourage one another to seize opportunities for personal growth. We treat our stakeholders the way we like to be trated.

INTEGRITY

We act with integrity. We are honest and fair when dealing with one another and our business partners. We respect the trust that our colleagues and stakeholders place in us, and commit to ethical decision-making, delivery and governace.

COLLABORATION

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

A.1.3 Strategic Intent

GROWTH

Refers to inclusive and dual growth for the country and the CSIR. The CSIR will use its capabilities in, e.g., skilled human capital and infrastructure to assist in growing the economy; but will also grow to become a world-class organisation

SUSTAINABILITY

Focuses on CSIR-developed technologies that lead to the advancement and sustainability of SA enterprises and the sustainability of the organisation in a resource-constrained environment.

IMPACT

Focuses on the commercialisation of our technologies and innovations for industrial development, as well as technology and knowledge transfer that enable a capable state.

RELEVANCE

Addresses the CSIR's role in driving the relevance of innovation in inclusive sustainable industrial development and the creation of a capable state.

A.1.4 Strategic Objectives

The organisation's five SOs are derived from the prevailing strategic drivers in our operating environment. The strategic objectives provide the framework on which our strategic and operational plan is designed:

	SO1	**Conduct research, development, and innovation (RD&I) of transformative technologies and accelerate their diffusion**	This strategic objective seeks to ensure that the CSIR undertakes cutting-edge RD&I in areas that will bring transformative change in the South African economy and society
	SO2	**Improve the competitiveness of high-impact industries to support South Africa's re-industrialisation by collaboratively developing, localising and implementing technology.**	This strategic objective seeks to improve the competitiveness of South Africa's high-impact industries through research, development and technology localisation, and implementation in a collaborative manner with partners, thereby contributing to the re-industrialisation of the country
	SO3	**Drive socioeconomic transformation through RD&I that supports the development of a capable state.**	This strategic objective emphasises the CSIR's role in supporting the development of a capable state and enabling the government to drive the socioeconomic transformation of South Africa through RD&I
	SO4	**Build and transform human capital and infrastructure.**	This strategic objective seeks to build and transform the required human capital, and investment in infrastructure to drive industrialisation and the advancement of society
	SO5	**Diversity income, maintain financial sustainability and good governance.**	This strategic objective seeks to improve the CSIR's financial sustainability by diversifying revenue source, optimising the organisation's the organisation's business model and advancing good efficient and sound governance

A.2 STRATEGY 2023/24–2027/28

The CSIR Strategy for 2023/24–2027/28 is shaped by key global and regional trends, national imperatives, and priorities.

A.2.1 External Context

Global economy was on a mending path but had not yet fully recovered from the COVID-19 pandemic, with a significant divergence between the economic recoveries of advanced economies and emerging market and developing ones" .

Global growth is projected to slow from the estimated 6.1% in 2021 to 3.6% in 2022 and 2023; this is 0.8 and 0.2 percentage points lower than the IMF forecast captured in the January 2022 WEO, respectively1. Beyond 2023, global growth is forecast to decline to about 3.3% over the medium term[1]. The downgrade in the forecast is predominantly attributed to the geopolitical tension between Russia and Ukraine – its impacts felt beyond just a humanitarian crisis, leading to global spillovers which will result in slower economic growth and higher inflation[1].

Locally, the weak GDP prospects have been attributed to a weaker global environment weighing on export potential, the floods which took place in Kwa-Zulu Natal during April 2022, a tightening of the domestic monetary policy, continued and increased instances of electricity load-shedding, and the adverse impact of local and foreign factors on business supply chains[2].

Business conditions in the industries served by the CSIR, therefore, remain challenging over the planning horizon.

Disruptive trends for **the Chemicals sector** include topics of sustainability, demographics, and technology. Investments are expected to lie largely in acquisitions & sustainability[3]. Relevant to the CSIR are opportunities in Plastics Waste, towards recyclable and renewable feedstock-based polymers for a lower carbon footprint and circular economy. There's increasing pressure for transparency on Environmental, Social and Governance (ESG) factors as more and more investors and consumers put companies under pressure for environmentally sustainable solutions[4]. Strong ESG values offer a competitive advantage and attract investment [5]. Carbon Capture technology for Greenhouse Gas seems to have industry's interest with ExxonMobil and PetroChina expected to have it in their plans already[6,7].

The megatrends in **the agriculture sector** include digitisation, climate change, genetic innovation, eco-friendly plant products, food loss solutions, biodegradable packaging, AI-enables livestock monitoring systems and volarisation of natural products for food, cosmetics and pharmaceutical products (e.g. cannabis products).

The Health sector trends include, ageing populations and increased prevalence of non-communicable diseases in developed countries; inequalities in the level of healthcare because of differences in economic growth and income in developing countries, as well as the streamlining of healthcare to provide access to all. The ongoing burden of infectious diseases such as HIV/AIDS, TB, Malaria as well as non-infectious diseases such as cancer, cardiovascular diseases, diabetes etc. in South Africa and other African countries. Other trends include digitisation of the industry and the provision of personal healthcare.

Beyond these, the additional issues of medical diagnostics and vaccine development are important in the sector. The provision of critical point-of-care diagnostic devices is essential in providing effective health care, while also the development and manufacture of these devices in the country is important to replace constant imports. Vaccine Development was highlighted by the Covid-19 pandemic, demonstrating the importance of having localised manufacturing capacity. The value proposition is in the development of novel virus-like particles (VLPs) for vaccine development for diseases that are prevalent in Africa.

1 IMF (2022). World Economic Outlook: April 2022. Accessed via https://www.imf.org/en/Publications/WEO/Issues/2022/04/19/world-economic-outlook-april-2022
2 PwC (2022). South Africa Economic Outlook: Export prospects and import disruptions (May 2022). Accessed via https://www.pwc.co.za/en/assets/pdf/economic-outlook/economic-outlook-export-prospects-import-disruptions.pdf
3 PwC (2022). Innovation for a sustainable World - Practical implications for the chemical industry. Accessed from https://www.strategyand.pwc.com/gx/en/industries/chemicals/esg-driven-innovation-in-the-chemical-industry/strategyand-esg-innovation-chemicals.pdf
4 OECD (2020). ESG Investing: Practices, Progress and Challenges. Accessed from https://www.oecd.org/finance/ESG-Investing-Practices-Progress-Challenges.pdf
5 PwC (2022). Innovation for a sustainable World - Practical implications for the chemical industry. Accessed from https://www.strategyand.pwc.com/gx/en/industries/chemicals/esg-driven-innovation-in-the-chemical-industry/strategyand-esg-innovation-chemicals.pdf
6 Exxonmobil (2022). Accessed via https://corporate.exxonmobil.com/climate-solutions/carbon-capture-and-storage
7 PetroChina (2021). Environmental, Social and Governance Report. Accessed via http://www.petrochina.com.cn/ptr/xhtml/images/2021esgen.pdf

National **Defence and Security** RD&I budgets remain under pressure. The South African National Defence Force (SANDF) continues to be involved in multi-national operations including in northern Mozambique. There is growing social unrest and national infrastructure security risks (Transnet, Eskom, etc.). This leads to more operational tasking for the SANDF, and increased budget allocation away from RD&I and defence acquisition. The Defence and Aerospace Industry Masterplan implementation has been slower than hoped, even around low-hanging fruit such as improved permit processes. Many of the export barriers identified during the master plan development process remain.

Few local equipment acquisition programs are foreseen going forward and industry must therefore find export markets. The general decline of the locally owned defense industry is continuing. Denel is still in a steep decline and is now in business rescue. The result is that the CSIR is experiencing little contract RD&I business opportunity with locally owned defence industry. This industry is mostly not globally competitive, has limited exports, and struggles with access to export markets, also due to limited overseas presence. Foreign-owned defence companies in South Africa have much better prospects and for some companies, the order book is improving due to increased defence spending in the developed world. This part of the industry also lost some advanced engineering capabilities, of which a large component has been to the United Arab Emirates (UAE). There is a risk that these companies will poach talent from the organisation, and it is likely that talent losses will continue.

The local Security Industry is experiencing slow growth. It is a very labour-intensive industry, and there is a need for low-cost intelligent security products. Cyber security risks are likely to grow and will eventually impact all industries and be a key issue to be addressed as part of the digital transformation journey. In the mining Industry, key drivers include Environmental Social and Governance (ESG) risks, Social License to Mine, worker safety, decarbonisation and a move to electric mining and hydrogen (energy transition). The local industry consists of a mix of world-leading companies and dinosaur companies with very slow uptake of new technologies, leading to a diversity of technology diffusion needs.

The local manufacturing industry is slowly coming out of a phase of contraction that was worsened by the pandemic. The local market for advanced products is small, that part of the industry is dependent on exports for growth. Adoption of 4IR technology has been slow, especially amongst smaller manufacturers that do not have R&D capabilities. There is a need for renewal of the manufacturing industry, both in terms of upgrading manufacturing capabilities using modern technologies, and in terms of upgrading product ranges.

Mining industry exports during the pandemic made a significant contribution toward economic stability when many other sectors experienced severe downturns. This industry is still a strategic element of the South African economy and a major job provider. The local mining equipment industry is relatively small, with limited exports currently but the potential to grow. There is an opportunity to upgrade equipment/products using CSIR-supplied 4IR technology (e.g. equipment health and usage monitoring technology). Current trends include aligning capital allocations to ESG and enabling ESG into organisational operating models[8].

Technological breakthroughs will enable megacities to develop **smart cities** that could efficiently deal with the challenges associated with urbanisation, population growth, resource allocation and use, and the need for inclusive industrial growth:

- Unsustainable exploitation of natural resources and uncontrolled waste production, exacerbated by climate change, are threatening socio-ecological systems;
- Spatial inequality and uncoordinated urbanisation, as well as population growth constrain inclusive economic participation and equitable access to societal benefits;
- Deficient infrastructure is constraining socio-economic advancement and service delivery;
- Inadequately integrated evidence-based forward planning and ill-informed trade-off considerations are compromising effective decision-making and direction setting in socio-ecological systems;
- Resources and capability constraints are not conducive to competitive industrial development and sustainable growth.

8 Deloitte (2022). Tracking the trends 2022 - Redefining Mining

Mobility of people and goods are changing rapidly, and its future trajectory is non-deterministic. However, we know that mobility will increase as more people and goods move across cities, towns and across the globe. For example, by 2030, annual passenger traffic volumes will exceed 80 trillion passenger-kilometers – a 50 percent increase compared to 2015; global freight volumes will grow by 70 percent compared to 2015; and an additional 1.2 billion cars will be on the road – double today's total. Sustainable transport and mobility are fundamental to progress in realising the promise of the 2030 Agenda for Sustainable Development in achieving the 17 Sustainable Development Goals (SDGs).

Local Transport Industry Challenges

- Network inefficiencies and lack of critical mass of skills to manage complex mobility networks.
- Balancing of peak/off-peak demand: Peak demand for mobility outstripping infrastructure and service capacity, while off-peak demand results in gross underutilisation of infrastructure.
- Fiscal constraints leading to reduced capitalisation of industry assets. Lack of funding for transport infrastructure to meet current demand.
- Ageing and ineffective transport infrastructure.
- High cost of road crashes (3.4 % GDP per annum).
- Deregulated logistics sector creating unsustainable trade environment.
- Ensuring transport and logistic operations support environmental sustainability (reducing energy usage and carbon footprint which contribute to global warming).
- Increased consumption-led economies, including Africa, increasingly requiring smarter logistics solutions.
- Vandalism, theft of, and damage to infrastructure and security incidents impacting on safe transport of people and goods.
- Transportation and warehousing sectors are lagging in digital maturity.
- Impact of Covid-19.
- Lack of policy implementation.
- Materials scarcity and increasing costs.

National Strategic Drivers

- Deregulation and transport network inefficiencies accelerated by urbanisation contribute disproportionately to the cost of doing business and household travel in SA.
- Extensive transport network infrastructure backlog and need to expand it even further requiring innovative use of network building materials and improved life cycle management strategies.
- Increased demand for mobility with burden to the fiscus and society in terms of disproportionately high road crashes in South Africa.
- Deteriorating infrastructure quality as a result of factors such as increasing traffic levels and "loading of roads", causing premature road failures.
- Continental desire for increased intra-Africa trade – Africa Free Trade Agreement.
- Increased complexity of transport network operations due to increased demand for just-in-time services.

A.2.1.1 Economic Recovery and Reconstruction.

To mitigate the shocks and vulnerabilities that the country continues to face because of the Covid-19 pandemic, the South African Economic Reconstruction and Recovery Plan (ERRP)[9] focuses on the following priority interventions (also see figure A1)[10]:

- Aggressive infrastructure investment;
- Strategic localization, reindustrialization and export promotion;
- Energy security;
- Support for tourism recovery and growth;
- Gender equality and economic inclusion of women and youth;
- Green economy interventions;
- Mass public employment interventions; and
- Strengthening food security.

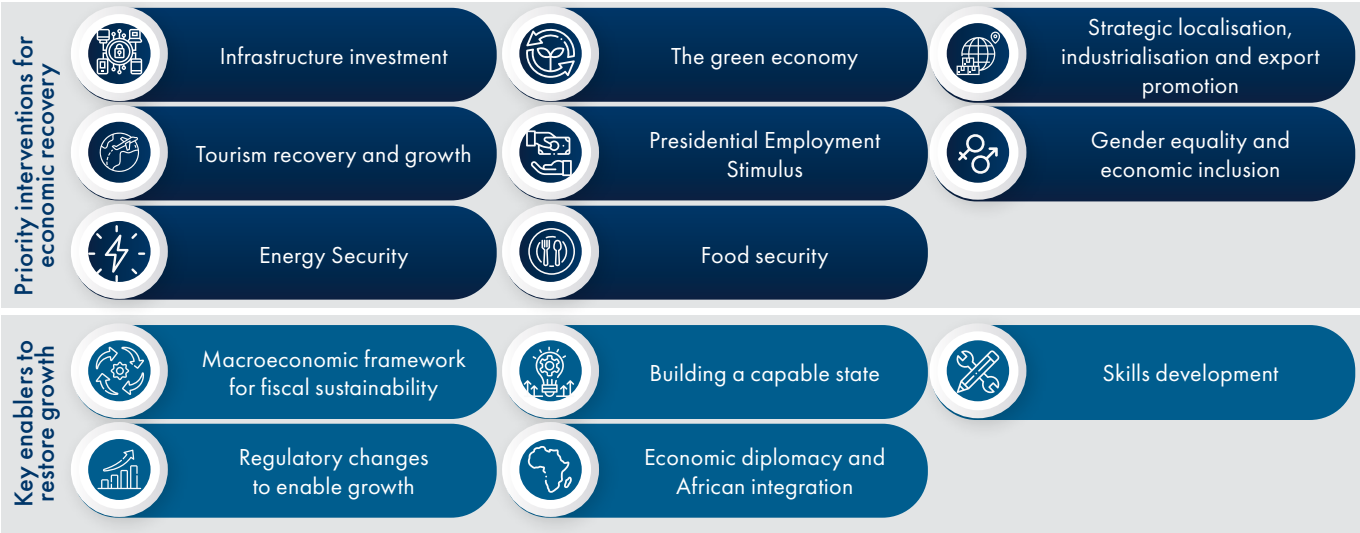


Figure A1: ERRP Priority interventions for economic recovery and key enablers to restore growth in South Africa

The CSIR's operating model and strategic interventions (please refer to Table A1) support the ERRP through scientific and industrial research in areas of energy, agriculture and food, health, chemicals mining, manufacturing, defence, and in the application of digital technologies to transport and logistics, e-government, and human settlements and spatial planning.

9 South African Government (2020). South African Economic Reconstruction and Recovery Plan. Accessed from https://www.gov.za/sites/default/files/gcis_document/202010/south-african-economic-reconstruction-and-recovery-plan.pdf

10 The Presidency Republic of South Africa (2020). Building A New Economy - Highlights of the Reconstruction and Recovery Plan. Accessed from https://www.gov.za/sites/default/files/gcis_document/202010/building-new-economy-highlights-reconstruction-and-recovery-plan.pdf

A.2.1.2 Medium Term Strategic Framework

The CSIR's Strategy supports several of the government priorities; the CSIR Strategic Objectives built around the seven (7) Medium-Term Strategic Framework (MTSF) apex priorities:

- The CSIR supports 'Economic transformation and job creation' through conducting RD&I that is geared towards localisation of technology and import replacements, support of SMMEs with technology solutions and to conduct joint technology development activities with industry partners.
- The CSIR supports the 'Building of a capable, ethical and developmental state' through conducting RD&I that informs policy development, development of standards and the implementation of various strategic projects on behalf of Government.
- In support of 'Education, skills and health', one of the pillars of the CSIR's Strategy implementation involves human capital development. The CSIR ensures continued capacity development and transformation of its science, engineering and technology (SET) base. Often, that SET base is absorbed elsewhere in the South African National System of Innovation (NSI). To demonstrate the CSIR's continued RD&I activities in the health space, the recent development of locally developed ventilators during the heat of the COVID-19 pandemic.
- In support of 'Spatial integration, human settlements and local government', the CSIR continues to conduct research in the area of 'Smart Places' and examples that demonstrate the contribution include the development of the 'Greenbook', online tool supports municipal planning with the development of climate resilient settlements. The Greenbook ultimately facilitates the mainstreaming of climate change adaptation into local government planning instruments and processes. Other examples include the 'Investmap', which is a tool for regional economic development planning that supports all spheres of government with a regional approach to planning. There are other examples.
- In support of 'A better Africa and World', the CSIR continues to forge partnerships with the rest of the African continent and the World (refer to section A.2.2.6).

A.2.1.3 National Science Policy

The CSIR strategy for 2023/24–2027/28 considers this context and is aligned with the National Science, Technology and Innovation (STI) Policy. The 2019 White Paper on STI is geared towards harnessing the power of science to deal with South Africa's socioeconomic challenges. The Decadal Plan is the implementation guide for the STI policy.

The intended long-term outcomes of the implementation initiatives proposed in the Decadal Plan are well aligned with the CSIR Strategy and are:

- A productive NSI contributing to economic growth and inclusivity, social development and environmental sustainability;
- Strong institutions; and
- A capable state.

The Decadal Plan identifies six societal grand challenges (SGCs) that capture the core domains for STI priorities and associated interventions. The six SGCs are:

- Climate change and environmental sustainability;
- Future-proof education and skills;
- A re-industrialised modern economy;
- Innovation for a healthy society;
- Innovation for energy security; and
- The future of society.

Strategies to secure financial resources for the implementation of the Decadal Plan recognise that the public component of the NSI is far wider than just the DSI and that joined-up funding from other STI-intensive government departments will be leveraged to implement the Decadal Plan initiatives. Furthermore, the public budget for STI will be coordinated through the involvement of the DSI via high-level governance structures (i.e. a Presidential STI Plenary, and an Inter-ministerial STI Committee). The STI budget allocation will be supported by analysis and evidence provided by a strengthened National Advisory Council on Innovation (NACI). Initiatives aimed at increasing investment by the private sector in South African STI are detailed in the Decadal Plan, also acknowledging that policy certainty is critical for private sector participation.

Overall, the Decadal Plan provides the CSIR with a strong basis for planning and alignment of our initiatives to the grand challenges and STI interventions.

A.2.2 Internal Context

The internal environment is characterised by the implementation of the CSIR Strategy through various mechanisms.

A.2.2.1 Pillars of CSIR Strategy Implementation

In the third year of strategy implementation, the CSIR has made significant strides toward achieving some of its strategic goals, and the current plan seeks to consolidate and build on these gains. The implementation of the CSIR Strategy is driven through five pillars as described in Figure A2 below as well as key drivers of successful strategy implementation. The Strategic Clusters are the engine of the CSIR RD&I enterprise. All the other elements are inputs to the RD&I value chain, while the drivers of successful implementation are enablers of the enterprise.

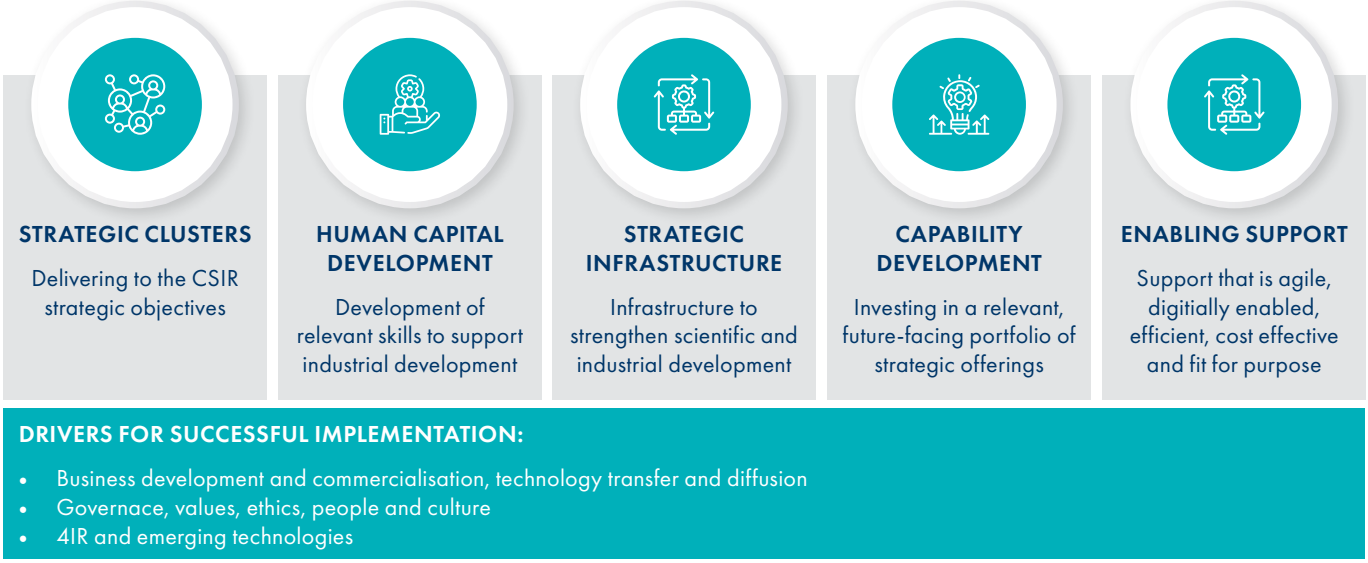


Figure A2: Pillars of CSIR Strategy Implementation

A.2.2.2 Strategic Clusters

The CSIR's operating model considered organisational design best practices applied by other research and technology organisations and service-offering firms. The CSIR strategy responds to national priorities and initiatives and, in defining the strategy, an in-depth socioeconomic and technical analysis led to the identification of the sectors that (1) have the potential to increase GDP and create jobs; (2) cold benefit from advancements in technological innovation to improve their competitiveness. We define clusters as interfaces between sectors of the economy and technology. Nine strategic clusters through which the CSIR can make the biggest impact were identified and form the backbone of the strategy and are the RD&I-performing components of the CSIR operating model.

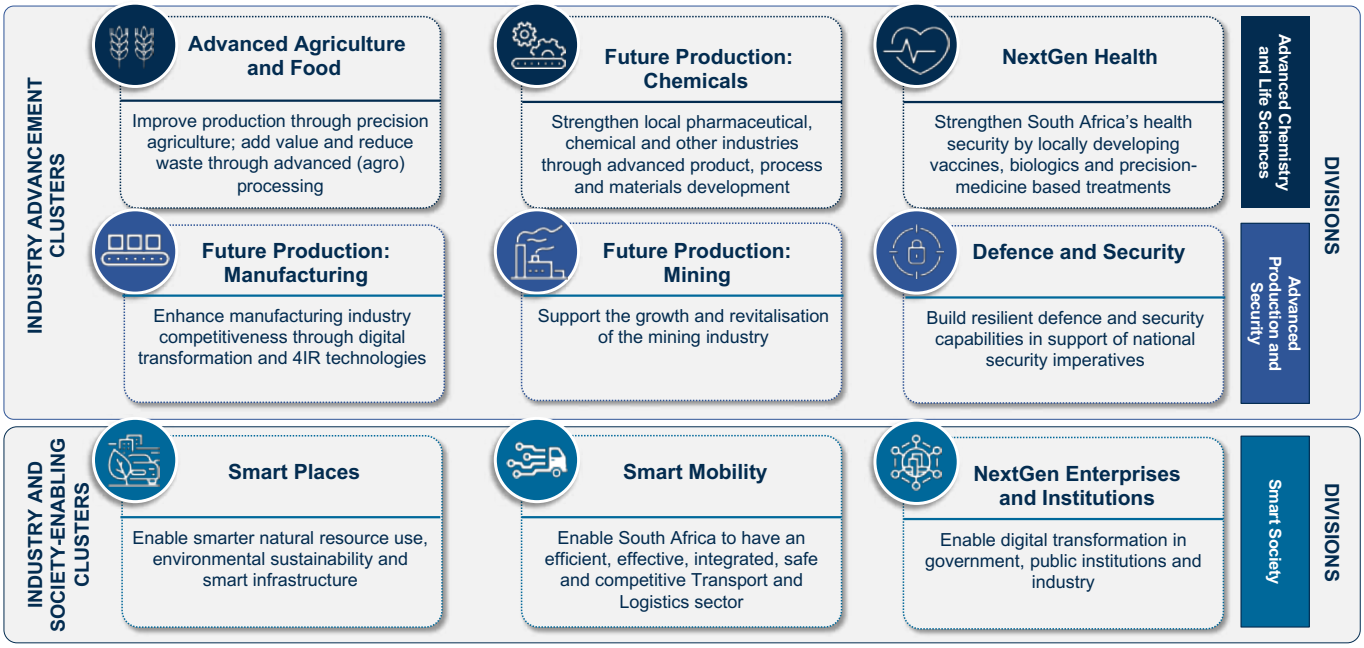


Figure A3: CSIR strategic clusters positioned to drive South Africa's industrialisation

The nine CSIR clusters are depicted in Figure A3 above and are currently operational and performing. There are six industry advancement clusters, namely Advanced Agriculture and Food; the Future Production Clusters comprising Chemicals, Manufacturing, and Mining; Next Generation Health; Defence and Security. The other three clusters (Smart Places, Smart Mobility, and Next-Generation Enterprises and Institutions) are industry and society-enabling clusters.

1. The **Chemicals Cluster** develops sustainable, state-of-the-art and innovative biological and chemical conversion technologies, materials, and products to support a vibrant and circular (South) African chemicals and pharmaceuticals industry. The cluster focuses on (i) Sustainable chemical production processes, (ii) Nanostructures and advanced materials development, and (iii) Pharmaceutical process innovation. The cluster has a Centre for Nanostructures and Advanced Materials, a Biomanufacturing Technology Impact Area, and a Pharmaceutical Technology Innovation Platform. These areas are complemented by industrial facilities and programmes (BIDC, BIDF, NIDF) together with the newly established Industrial Biocatalysis Hub, Supercritical CO_2 Encapsulation Pilot Plant, the Coega-based Fibre Hub and Nano-Micro Manufacturing Facility, which are focused on providing technical support to the benefit of local industry.

2. The **Advanced Agriculture and Food Cluster** aims to contribute to enhanced competitiveness of the agricultural industry and the agro-processing sector and to support rural development and inclusive economic growth. The cluster has three research groups and a hosted programme. The three research groups are: 1) Agro-processing, which focuses on the process and product development in the agriculture value chain. It aims to implement advanced agro-processing technologies to support the competitiveness of agro-based businesses, valorise biodiversity to support socioeconomic development and create new high-value products and support healthy lifestyles through the development of ready-to-eat and highly nutritious products. 2) Precision Agriculture, which focuses on the development of 4IR-based farming practices that can be applied in the analysis of spatial data related to crop productivity and field inputs and real-time monitoring of crop development and anomalies due to variation in soil potential, physical or climatic variables, pest and diseases, or nutrient deficiencies; and 3) Food Safety Programme, which focuses on the development of innovative methods for food safety, quality testing and extending of shelf life with envisioned

solutions from farm to folk. The cluster hosts the NEPAD Southern Africa Network for Biosciences (SANBio) programme, a DSI-funded initiative which provides the cluster and CSIR access to 12 SADC countries. SANBio is a shared biosciences research, development and innovation platform for working collaboratively to address some of southern Africa's key biosciences issues in health, nutrition and health-related intervention areas such as agriculture and the environment.

3. The **Next-Generation Health Cluster** focuses on the improvement of access to healthcare and incorporates synthetic biology and state-of-the-art diagnostic and treatment technology with advances in artificial intelligence to provide integrated digital health solutions. The cluster has an impact area in Medical Devices, Diagnostics and Vaccines (MDDV), which focuses on the Human Diagnostics and Omics, and Veterinary Molecular Diagnostics and Vaccines research areas. The MDDV impact area includes a Diagnostics Lab Testing facility. The cluster has a research centre, the Synthetic Biology and Precision Medicine Centre (SynBio Centre) which focuses on the Bioengineering and Integrative Genomics, Array Technology and Companion Diagnostics, and Synthetic Nanobiotechnology and Bio-machines Group research areas.

4. The **Defence and Security Cluster** aims to drive scientific and technological excellence to secure South Africa, the region and the continent, and advance its industrial and human capital base through the development of strategic defence technologies and capabilities for air, land, sea and cyber defence. The Cluster has six impact areas, namely Aeronautic Systems; Optronics Sensor Systems; Command, Control and Integrative Systems; Radar and Electronic Warfare; Landward Sciences; and Technology for Special Operations; and one research centre, namely the Information and Cybersecurity Centre. The cluster conceptualises and develops novel, innovative, and integrated solutions designed and scaled to meet the safety and security needs of civil society and the public sector. Moreover, the cluster provides strategic, world-class cybersecurity research, development, and innovation leadership.

5. The **Manufacturing Cluster** supports re-industrialisation of South African industry and is centred around the localisation of key aspects of advanced manufacturing value chains, specifically metal additive manufacturing, injection moulding and casting; product localisation of designated and high-value components, products and equipment; facilitation of access to unique and capital-intensive infrastructure, equipment and tools for SMMEs; and digital transformation. Strengths are in the areas of photonics for additive manufacturing, medical point-of-care devices, laser engineering services, advanced manufacturing processes and equipment for casting, metal injection and other powder metallurgy processes, sonar, UV and thermal sensor development for various industrial and health applications as well as for underwater communications, digital twin development of industrial and production processes for the purposes of optimisation, robotics and automation implementation and data analytics using machine intelligence and artificial intelligence techniques. Impact areas include Metals, Machinery and Mining Equipment; Automotive; Health (Medical Devices); and Aerospace and Defence.

6. The **Mining Cluster** currently has two impact areas, namely Mining Testing and Training and Mining and Minerals Resources (MMR). Mining testing supports the zero-harm objective by providing quality, independent testing, and verification services to the mining industry. While the MMR impact area offers technical expertise in the areas of rock engineering, geotechnical solutions, and bespoke mining-related studies. The cluster has carved out a new developmental path that will expand its impact areas into three technology areas, namely Mine Digitalisation and Automation (including but not limited to digitisation and automation of the mining value chain through design and deployment of Internet of Things [IoT] sensors, mine automation, digital integration, and application of big data analytics to enable better decision support); Extraction Mining Process (includes but not limited to the application of advanced geophysics tools, sensors to support structural mapping of resources to improve mining, extraction of resources, improve safe conditions, e.g. remote early entry examination, preventing fall of ground); and Optimised Energy and Decarbonisation (supporting the mining industry with its decarbonisation drive involves supporting mine electrification, improving energy efficiency and grid stability).

7. The **Next-Generation Enterprises and Institutions Cluster** aims to enable digital transformation in government, public institutions and industry. This aim is accomplished through focused initiatives in impact areas and centres. The cluster has three impact areas, namely e-Government, Networked Systems and Applications, and Operational Intelligence. Moreover, the cluster also contains the Emerging Digital Technologies for 4IR research centre and the National Cyberinfrastructure System (NICIS), which is ringfenced and funded by the DSI. Due to the cross-cutting nature of digitalisation, ICTs and 4IR technologies, the cluster plays an enabling role in a wide range of application domains in public and private sectors. The impact areas and research centre of this cluster provide solutions in domains such as Government Service Delivery, Digital Health, Energy, Telecommunications, Education, Disaster Management, Agriculture, Mining and Financial Services, among others.

8. The **Smart Places Cluster** aims to effect smarter resource use, optimisation of hard and soft infrastructure, and efficient and effective service developments directed towards enabling competitive socioeconomic environments, sustainable ecosystems and economic growth. The cluster has four impact areas, namely Inclusive Smart Settlements and Regions, Functional Building Infrastructure, Sustainable Ecosystems, and Holistic Climate Change. The cluster has two research centres, namely the Water Centre and the Energy Centre. Moreover, the cluster also contains a hosted programme which consists of two sub-programmes that are managed on behalf of the Department of Trade, Industry and Competition (the dtic). The cluster's impact covers inter alia the following sectors: Transportation and Logistics; Utilities (Electricity and Gas, Water); ICT; Business and Financial Services; Education; Health; Agriculture; Metals, Mining and Quarrying; Manufacturing (Petroleum Products, Chemicals, Rubbers and Plastics; Metals, Metal Products, Machinery and Equipment; Food, Beverage, and Tobacco), Human Settlements, Safety and Security, and Construction.

9. The **Smart Mobility Cluster** responds to the challenges and opportunities in society and the economy associated with the mobility of goods and people, and its enabling infrastructure, systems, and operations. The cluster has two impact areas, namely Transport Systems (service-oriented), and Transport Infrastructure Engineering (technology-focused). There are new areas of specialisation under development within the cluster, including smart logistics management, transport safety, and 4IR solutions in transport and mobility. The cluster represents the confluence of various key elements including technology, mobility infrastructure, mobility systems and solutions and people to create demand-responsive, integrated, safe and cost-effective transport and mobility networks. The outcomes of the interventions will be measured in terms of increased network efficiencies, improved safety, and the reduction of the generalised life-cycle cost of transport systems and infrastructure.

Strategic clusters will deliver on several RD&I initiatives for the 2023/24–2027/28 planning horizon (Table A1). The RD&I initiatives support the South African Economic Reconstruction and Recovery Plan (ERRP), post-Covid-19 and they also respond to the Societal Grand Challenges of the Decadal Plan.

Cluster Internal Contexts

1. The **Chemicals Cluster** remains a strongly-performing cluster which meets the majority of its targets annually and has shown a firm profit margin for the last 3 years. The key issues with the cluster remain that of not reaching its headline income target and the SET staff levels as per our annual plans. This shows a lack of growth against an otherwise well-performing cluster. The future growth needs to come from international as well as private sector funding, which are difficult areas to secure funding, and require collaborative work with BD&C.

   The performance of the cluster is underpinned by strong research platforms in the Biomanufacturing Technology area as well as in the Centre for Nanostructures and Advanced Materials, with a growth area in Pharmaceutical Technology, which is starting to demonstrate its development through output targets. These platforms are underpinned by a number of Chief Researchers spread between the areas as well as a complement of principal researchers that assist in directing the research across the cluster.

   There are still a few areas that are struggling to reach their targets and have been supported in moving forward over the last year. The Gqeberha site will be resolved in 2022/23, while the breath analyser technology should also be licensed in the same year, bringing some industry support to the sensor group. In addition, we are aiming to ensure that the industry-facing facilities will have attracted significant funding by 2023/24 to continue with the SMME support work.

   Significant opportunities are open to the cluster through some of the newly supported facilities. The Fibre Hub based at Coega will be fully operational and will be focused on attracting industry and SMME work to stimulate the hemp-based industry in the country. The Biodegradability test facility as sponsored by UNIDO, will be fully operational in 2023/24 and this should attract testing income. In addition, the Nano Micro Manufacturing Facility should start to realise some of its capex installations by 2023/24 in order to allow it to support internal and external customers in prototyping. The NT funded FuturePharma facility will finalise construction in 2023/24 and should thereafter be operational.

   Going forward, the lack of growth of the SET staff will have to be addressed, particularly against the current situation where senior staff feel overburdened with continuous demands on their time. The appropriate Human Capital strategy has been developed and will continue to focus on the appropriate recruitment and transformation goals, with efforts being placed on our pipeline programmes to identify and train critical staff for ourselves and industry. Transformation will be considered and pursued in light of all new vacant posts.

2. The **AAF Cluster** is associated with the Biomanufacturing Industry Development Centre (BIDC) which provides facilities to respond to SMME and industry needs:
   - Misalignment of existing capability and offerings with industry (especially private sector) to drive large multi-year programs (cutting edge research currently only exists in precision agriculture group).
   - Skills mismatch to new innovative solutions required by the industry.
   - Lack of 4IR integration in agro-processing to facilitate innovation for industry development.
   - Under capacitated (lack of critical mass) research areas, e.g., Food Safety, making it challenging for the research areas to deliver on some contracts.

   Key interventions identified to turn around the cluster and provide growth include:
   - Developing internal collaborations with other CSIR clusters to strengthen value propositions, e.g., food safety programme leveraging capabilities in Smart Society (blockchain technologies, ICT capabilities NGEI) and Advanced Production and Security (biometric system) and Precision nutrition with NGH.
   - Collaboration with the industry for co-development of solutions to industry pain points.

Exploring formal collaboration opportunities with international and local stakeholders to broaden networking opportunities and for technology localisation.

The next 5 years will focus on growing the cluster. This entails the following:

- *Enhancing its capabilities*

The cluster's offerings are critical for the agriculture value chain, from primary production to the final agriculture products, i.e., food, pharmaceuticals, and cosmetics. Therefore, the cluster will focus on building capacity in key strategic areas, i.e., precision agriculture, agro-processing (including cannabis value chain and transition protein), and food safety.

The cluster has recently acquired state of the art equipment to support its innovation efforts, e.g., the Unmanned Arial Vehicle (Drone) to support small scale farmers with precision agriculture efforts, Supercritical Extraction equipment to support cannabis extraction. It will focus on equipping the food safety laboratory and acquiring new HPLC and getting the lab accredited.

- *Increase SET base size and expertise*

The Cluster will focus on growing its SET base from the current size of 34 to 45 over the next 5 years. The cluster will tread cautiously between increasing SET base and maintain a sustainable fixed cost base. There will be focus on increasing the profile SET base. This will include developing Principal researcher and Chief Researcher and more researchers in the IKS space to growth this area into an independent research group. Principal researchers are required to support the agro-processing area and the food safety area. Critically, the cluster requires a Chief Research to drive the food safety area growth.

- *Increase and diversify the income streams*

The Cluster aims to increase its income from R60M to R80M over the next 5 year. This will be enabled by:

1. Maintaining the public sector income high. The public sector contributed 59% of the cluster's total income. The cluster aims to continue responding to the national strategic areas.
2. Develop offerings that respond to private sector players. Recent conducted in the cluster highlighted gaps between the Cluster's offering and market needs.
3. Develop key regional and international collaborations to attract funding from international players.

3. The **NGH Cluster** has an established expertise in vaccines development, diagnostic methods development (VLP/CLP vaccines, molecular diagnostics, isothermal technologies, bioinformatics & comparative genomics, veterinary diseases, epidemiology, phylogenetics, proteomics, structural biology, and bio-separation).

- Under capacitated research groups e.g., Synthetic Nanobiotechnology and Bio-machines Group
- Ageing infrastructure and equipment, e.g., Human Molecular Diagnostics
- Lack of digital and data analytics capability which limits the cluster's growth in digital health
- Lack of large multi-year programmes to sustain the group's contract R&D needs
- Limited linkages with public sector initiatives, e.g., with DOH (Department of Health) and DSI (Department of Science and Innovation) for strategic funding opportunities.

Research focus in next 5 years will be on growing the NGH Cluster RD&I capability, contract R&D (public and private sectors), human capital and finance position as follows:

- *Enhancing its capabilities*

The majority of the cluster's offerings are at preliminary stages of development. Therefore, it will focus on building capacity in key strategic areas, i.e., Digital health, Biofoundry hub, vaccine development and Lab-on -Chip Point of Care diagnostics for both human and veterinary applications. The cluster will seek to acquire state of the art equipment to support its innovation efforts.

- *Increase SET base size and expertise*

The Cluster will focus on growing its SET base from the current size of 42 to 55 over the next five years. The cluster will tread

cautiously between increasing SET base and maintain a sustainable fixed cost base. There will be focus on increasing the profile SET base towards senior Entreprenurial skills. This will include developing Principal researcher and Chief Researcher. Addition of key skills will also be the focus of the cluster, e.g., data scientists who are required to drive the digital efforts of the cluster.

- *Increase and diversify the income streams*
  The Cluster aims to increase its income by 45% over the next 5 year, i.e., from R70M to R100M. This will be enabled by diversifying income streams from predominantly internal income towards the private and public sector.
  It will leverage existing platform and technologies to attract private sector funding and international funding.
  It will look to position its growth platform with key government departments to attract public sector funding.

4. The **CSIR's Defence and Security Cluster** has also suffered tremendously from the budget cuts, as it lost the Defence Evaluation Research Institute (DERI) funding for the first time in decades. The loss of the DERI has put the cluster in a very challenging position in terms of ensuring financial sustainability, as it constitutes more than 30% of the total cluster income. The COVID-19 pandemic also slowed down the cluster's critical international business market, as many countries reprioritised budgets from defence towards combating the pandemic. The cluster's private sector portfolio is also growing at a very slow pace.

   Over the years the cluster has built world class capabilities, which has resulted in technologies and products that have attracted attention from many clients around the world. The cluster has also produced many amazing and innovative capability demonstrators. Not all these technology demonstrators have led to product systems that have gone to market, mainly due to the lack of product development skills and process within the cluster. The cluster has put significant effort to ensure that it realises its potential when it comes to commercialisation. The commercialisation drive has not taken off at the expected pace due to the need for major change management within the cluster to align the staff in terms of understanding the processes around commercialisation. The loss of critical skills is still a huge problem for the cluster as it continues to lose a lot of its skilled staff to the international and private sector markets. The main reason for the loss of skills is that the cluster struggles to compete with the large salaries offered by the international and private sector markets. The cluster has mainly struggled to retain its Software development capabilities, as these skills are in high demand globally. To ensure that it achieves its key strategic objectives and positively changes its outlook, the cluster will focus on (1) Innovative and Impactful capabilities, (2) Business Development, Marketing and Commercialisation, (3) Income Diversification, (4) Collaborative Stakeholder Engagement, and (5) Human Capital Development.

5. The **Manufacturing Cluster** strategy is centered around applying our capabilities towards the masterplans localisation priorities and increasing the scope of our training and development content plus making this more accessible to a wider audience. Implementation of this strategy will be through the application of digital transformation and other 4IR capabilities that the cluster will continue to develop through its three strategic interventions of Digital Transformation, Manufacturing as a Service (MaaS) and Product Development.

   The cluster's strengths lie in the areas of photonics for additive manufacturing, medical point-ofcare devices and other laser engineering services; advanced manufacturing processes and equipment for casting, metal injection and other powder metallurgy processes; sonar, UV and thermal sensor development for various industrial and health applications as well as for underwater communications; digital twin development of industrial and production processes for the purposes of optimisation, robotics and automation implementation and data analytics using machine intelligence and AI techniques. This enables the cluster to deliver value in the areas of: • manufacturing processes and equipment, • end-to-end digital engineering and logistics, • industrial services, and • product development.

   Critical areas of distress are the cluster's loss of skilled team members over the past few years that for whom replacements are scarce and ageing equipment and infrastructure that have not been maintained. Part of the mitigation action is to increase the

pipeline through studentships and less experienced staff that we can develop, but this is a longer-term strategy and we need to find alternative interventions for the short/immediate term. The intention is secure maintenance funding in the medium to long term through industry partnerships and better costing of contract work that will allow the establishment of an internal repair and maintenance fund. In the short term, the cluster is funding critical repairs from its margin.

6. The **CSIR's Mining RDI** capability has experienced a regressive period over the past two decades characterised, which has necessitated that the cluster undertakes a process of developing a fit for purpose innovation roadmap. The roadmap was the result of extensive stakeholder engagement that was facilitated both internally within the organisation and externally with mining industry stakeholders. The cluster has developed a business model, that focuses on creating higher value by establishing relevant capabilities and competencies inhouse to enable the cluster to offer value adding services and innovative solutions to the mining industry.

   The cluster is in process of building niche capabilities in specific areas, which supports development of bespoke solutions for the mining industry. These innovative technological solutions are developed in collaboration with industry stakeholders such a mining companies, original equipment manufacturers (OEMs) and original technology supplies (OTMs). The development of these capabilities supports growth of the cluster through value added solutions to the industry. The cluster derives its income from contract R&D from both public and private sectors customers, with compounded annual growth of 2%, and royalty income. The development of these capabilities will support the cluster's plan to grow its contract research for both the public and private sectors. The R&D activities will be supported by sufficient pipeline of projects to ensure that the cluster meets its strategic objectives.

7. **NGEI's** overarching intent is to harness the benefits of digitalisation to build a capable state and to support the growing importance of digitalisation, 4IR technologies, leveraging of cross-cutting evidence-based analysis and broadband access in the private sector. According to the SWOT analysis in Table 3 below, the two main challenges that the Cluster faces center around the attraction and retention of skilled staff, and the availability of R&D funding. Challenges in the attraction and retention of staff are influenced by the national skills shortage in the ICT sector and areas such as data science and 4IR innovation. The Cluster competes with private companies that have more flexibility to pay higher salaries for highly sought-after skills.

   The Cluster has also experienced a higher level of competition for R&D funding, due to competing priorities in government, the establishment of R&D capabilities in private companies and government departments, and the availability of affordable resources for R&D work at universities (such as postgraduate students). The following interventions aim to strengthen the Cluster's capacity to deliver on the CSIR strategy: • Focused recruitment to improve depth of skills in critical areas, capacity and transformation within the Cluster. • Leveraging the Foundational Digital Capabilities Research (FDCR) programme of the DSI to build critical capabilities. • Targeted retention interventions that respond to the results of the CSIR Culture Survey. • A concerted effort to increase private sector business over the next 5 years.

8. The **Impact Areas and Centres within the SPC** are at different levels of maturity, in terms of coherence of Research Groups (RGs). Some RGs are well positioned in terms of having a strong portfolio of programmes and projects, state-of-the-art infrastructure, and a diverse client base, while other RGs are emergent in terms of being able to respond to the 4th Industrial Revolution (4IR), and/or to contribute to sustainable industrial development. The strategic objective of the SPC is to harness the opportunities afforded by transformative technologies to support resource trade-off modelling, develop smarter infrastructure, and service developments directed towards enabling competitive industrial environments, sustainable ecosystems, and economic growth.

   The Team has strived to develop an agile and resilient plan that extracts maximum value from the current and planned internal capacity, anticipated investment funds and available infrastructure. We have adopted transformed work practices, empowered

by rapid modernisation and deployment of ICT tools, that have leveraged our ability to work more collaboratively and whilst remote from our offices/labs.

Currently, the Cluster is embarked on an accommodation rationalisation and optimisation programme that will lead to cost savings on the footprint of the unit and free up space for external clients. This process will also investigate the current asset base and seek opportunities to rationalise and optimise CAPEX equipment and assets under its control. In the HR domain, the Cluster remains committed to maintaining transformation in the SET Base despite an increase in staff turnover the Cluster has maintained transformation ratios. The high attrition rate of SET Base is cause for concern and a specific Retention Plan (page 31) is included to mitigate the effects and stem the tide. The CSIR has implemented significant ICT upgrades in response to the demand to Work from Home (WFH), however, the SET Base and administrative staff who can perform their roles remotely must be capacitiated with more suitable hardware support and encouraged to invest in minimum connectivity and safety levels from their home office. Critically, back-up systems must be in place for remote working that support WFH employees in order to be fully productive during power outages (load shedding).

9. The **Smart Mobility Cluster** represents the confluence of various key elements, being technology, mobility infrastructure, mobility systems and solutions and people to create demand responsive, integrated, safe and cost-effective transport and mobility networks. The establishment of the CSIR/NRF Smart Mobility Research Chair in the Cluster will stimulate collaborative work with southern African universities.

   The focus of the cluster for the new year is on: (1) Implementing the 2023/24 strategy and have it embedded in our work programmes. (2) Undertaking collaborative projects with other CSIR divisions and clusters to enhance the value proposition to the Smart Mobility client base. (3) Developing joint technology development programmes, within the CSIR and with key industry partners, as well as establishing strategic associations with the private sector. This will support "leapfrogging" via technology localisation with industrial partners. (4) Broadening and enhancing regional and continental collaboration, in the fields of transport infrastructure engineering research, knowledge transfer, technological development, dissemination of information and innovations. (5) Diversification from single client base reliance within South Africa, through strengthening our "Africa footprint" and vigorously exploiting opportunities across the continent and internationally. (6) Capacitating the identified areas of growth in support of an income diversification strategy, namely Smart Logistic Management and the Transport Safety Laboratory in the Transport Systems and Operations Impact Area, and the Technology Innovation Centre in the Transport Infrastructure Engineering Impact Area.

Table A1: Strategic Research, Development and Innovation Initiatives (2023/24–2027/28)

No.	Strategic Initiative Description	Envisaged Impacts	[a]ERRP Priority Interventions	[b]Decadal Plan's Societal Grand Challenge(s) and [c]Key Economy Sectors addressed
1. Chemicals Cluster				
1.1	Develop and/or localise biological and chemical conversion technologies and products using sustainable feedstocks to support commercially competitive green chemical production	Support industry in re-industrialisation through developing new products as part of the green economy	[a]Infrastructure investment and delivery; [a]Industrialisation through localisation	[c]Health innovation; [b]The future of society; [b]Climate change and environmental; sustainability
1.2	Develop sustainable polymer (composite) and nanostructures production processes and materials to support the polymer, plastics, and chemical industries	Supporting the development of novel and polymer composite materials for product development, reindustrialisation and localisation	Green economy interventions; Industrialisation through localisation.	[c]Circular economy, [b]The future of society, [c]Modernising manufacturing
1.3	Support the local production of drugs through the provision of fully automated integrated hybrid processing technologies, as well as biopharmaceutical processes, enabling clinical sample production, including the development of the associated technologies and capabilities	Developing technologies and capabilities for local production of modern drugs for reindustrialisation and localisation, to provide a key stimulus to developing this industry in the country	[a]Infrastructure investment and delivery; [a]Industrialisation through localisation	[b]The future of society; [c]Health innovation
2. Advanced Agri and Food Cluster				
2.1	Development of extraction technologies to demonstrate local applicability and formulation of innovative product types (e.g. cannabis products) with SMMEs and big companies.	Establish two distinct value chains for cannabis Industrialisation (e.g. hemp and medicinal cannabis industries)	[a]Industrialisation through localisation; aGender equality and economic inclusion of women and youth	[c]Health innovation
2.2	Development of complementary medicines, cosmetics and food products and assist companies to navigate the Indigenous Knowledge Systems (IKS) regulatory framework	Introducing IKS-based products into the market and the development of the rural economy	[a]Strengthening agriculture and food security; [a]Gender equality and economic inclusion of women	[c]Health innovation

No.	Strategic Initiative Description	Envisaged Impacts	[a]ERRP Priority Interventions	[b]Decadal Plan's Societal Grand Challenge(s) and [c]Key Economy Sectors addressed
2.3	Support the digitisation of the Agri sector (food crop, livestock, forestry) through innovative and adaptive earth observation technologies, Climate Services, TV Whitespace, Artificial Intelligence, Augmented Reality, Internet of Things, and Distributed Ledger Technologies	Increase the efficiency of production and increase the involvement of small-to-medium scale growers	[a]Strengthening agriculture and food security;	[b]Climate change and environmental sustainability
3. Next-Generation Health Cluster				
3.1	Cell lines for pharmacovigilance application through the bioengineered stem cell platform	Contribution to regulatory approval framework development	[a]Industrialisation through localisation	[c]Health innovation
3.2	Development of Lab-on-Chip Point of Care (LoC PoC) molecular diagnostics biomarker platforms, aquaculture diagnostics and isothermal diagnostics biomarker for SARS-CoV-2 variant identification and PoC screening	SMME support and new industry development	[a]Industrialisation through localisation	[c]Health innovation
3.3	Next Generation (mRNA) Vaccines and Therapeutics (veterinary and zoonotic disease)	Revolutionise the South African vaccine industry for independency with key focus on SMME support	[a]Industrialisation through localisation	[c]Health innovation
4. Defence and Security Cluster				
4.1	Research and innovate homegrown identity management, cyber and information security solutions, and approaches to securely identify and protect people (cradle to grave) and systems (physical and digital) against vulnerabilities, threats, and risks.	• Better protection of state and private ICT infrastructure • Better protection of citizen's information • Link all identity systems within the integrated justice system • Decrease identity theft and criminal activities • Effective forensics investigations	[a]Industrialisation through localisation	[c]Innovation-enabled capable state
4.2	Enhance the market competitiveness of the industries and operation effectiveness of user through collaborative technological innovations on forensic of energetic materials, protections, firepower, vehicle mobility and dismounted systems.	• Development of vehicles with enhanced mobility, protection, and firepower for battlespace and border protection • Enhance the soldier's capability to better survive and navigate the battle space • Advanced non lethal weapons to combat unrest	[a]Industrialisation through localisation	[c]Innovation-enabled capable state

No.	Strategic Initiative Description	Envisaged Impacts	[a]ERRP Priority Interventions	[b]Decadal Plan's Societal Grand Challenge(s) and [c]Key Economy Sectors addressed
4.3	Develop a hydrogen fuel cell powered UAV propulsion unit ground based test, and develop UAV exploiting hydrogen fuel cell propulsion	• Increased flying range on UAVs • Lees noise on reconnaissance missions	[a]Industrialisation through localisation	[c]Innovation-enabled capable state
5. Manufacturing Cluster				
5.1	Support and enhance the localisation of products within South African industry through the development and implementation of a through-lifecycle product development framework	• Contribute towards technology and product localisation in support of the dtic's masterplans. • Stimulate reindustrialisation through local innovation and manufacturing	[a]Industrialisation through localisation	[c]Modernising manufacturing
5.2	Assisting local manufacturing industry and the CSIR leverage the opportunities of 4IR and digital transformation of processes and value offerings.	• New industry business models and revenue streams • Re-industrialisation of local industry and access to global value chains • Resource efficiency and service delivery improvements and optimisation.	[a]Industrialisation through localisation	[c]Modernising manufacturing
5.3	Facilitating access by local industry to advanced manufacturing infrastructure and equipment to increase localisation of products and services. On-demand manufacturing (incl. manufacturing services) for prototype, complex or low volume requirements.	• Access to unique infrastructure for improved competitiveness and value offerings by SMMEs. • Development of a model for incubating and commercialising viable services. • Provide reduced meantime to repair (MTTR) of robust components and replacement parts at low costs while enhancing their lifespan. This will promote the localisation & competitiveness of OEMs.	[a]Industrialisation through localisation	[c]Modernising manufacturing

No.	Strategic Initiative Description	Envisaged Impacts	[a]ERRP Priority Interventions	[b]Decadal Plan's Societal Grand Challenge(s) and [c]Key Economy Sectors addressed
6. Mining Cluster				
6.1	Development of a decarbonisation programme for mining houses, which focuses on hydrogen and battery technologies.	• Contribute to the decarbonisation of the mining industry • Supporting local SMMEs to participate in the decarbonisation economy	[a]Green economy interventions, Energy security	[b]Climate change and environmental sustainability; [c]Energy innovation, [c]Modernising mining
6.2	Develop significant capability in system integration and digital platforms to support the integration of systems used by various original equipment manufacturers (OEMs) in the mining industry.	• Drive value for the mining houses, reduce systems in use where information and data are duplicated; Contribute towards simplifying systems and digital platforms; Reduce system costs; Develop system integration platform.	[a]Infrastructure investment and delivery	[c]Modernising mining
6.3	Develop high impact decision-support tools to assist in decision-making for mining operators and management.	• Develop a suite of high impact decision support tools; support zero harm, efficiency improvements; Cause and effect between various mining processes (known and unknown).	[a]Infrastructure investment and delivery	[c]Modernising mining
7. Next-Generation Enterprises and Institutions Cluster				
7.1	Digital enablement of Government and Public Institutions to build a capable state	• Facilitate efficient and effective service delivery • Lower access barriers to government information and services • Improve planning and monitoring of government programmes for socio-economic impact • Contribute to improved policy formulation • Provide operational decision support	[a]Infrastructure Investment and delivery	[c]Digital Economy [c]Innovation-enabled capable state

No.	Strategic Initiative Description	Envisaged Impacts	[a]ERRP Priority Interventions	[b]Decadal Plan's Societal Grand Challenge(s) and [c]Key Economy Sectors addressed
7.2	Digital enablement of Industry to facilitate inclusive economic growth	• Improve operational efficiencies and safety • Minimise digital and socio-economic divide • Policy/regulatory certainty for local business enablement • Transfer high-impact technologies • Foster technology localisation • Facilitate business growth	[a]Infrastructure Investment and delivery [a]Industrialisation through localisation [b]Reduced cost and increased quality of digital communication[5]	[b]Future-proof education and skills; [c]Digital Economy
7.3	National Cyber Infrastructure System to support digitalisation	• Provide high-performance computing & cloud infrastructure to improve the Nation's competitiveness • Foster improved data management, storage and governance • Provide high-speed connectivity to research and higher education institutions	[a]Infrastructure Investment and delivery; aIndustrialisation through localisation	[c]Digital Economy
8. Smart Places Cluster				
8.1	Planning support to cities on climate change adaptation and disaster risk reduction.	More resilient cities in the face of climate change	[a]Green economy interventions	[b]Climate change and environmental sustainability
8.2	The Southern Ocean Carbon & Climate Observatory (SOCCO) contributes to the improvement of national and international understanding of the impact of Southern Oceans to regional climate trends.	Inform public policy	[a]Green economy interventions	[b]Climate change and environmental sustainability

No.	Strategic Initiative Description	Envisaged Impacts	[a]ERRP Priority Interventions	[b]Decadal Plan's Societal Grand Challenge(s) and [c]Key Economy Sectors addressed
8.3	Provide modelling data and decision support on sustainable energy futures, just energy transition, variable renewable energy (VRE) grid integration, energy efficiency and demand response while developing battery materials and solar PV projects, energy storage test beds and other renewable energy resources.	Just transition of the South African Energy sector	[a]Green economy interventions	[b]Climate change and environmental sustainability
9. Smart Mobility Cluster				
9.1	Creation of solutions to improve the performance of transport network operations and associated management systems and provision of infrastructure management systems and public transport systems designs	A safe and efficient transport network	Competitive and efficient freight transport	[c]Innovation-enabled Capable State
9.2	Developing engineering solutions for design, construction, maintenance and management of transport infrastructure while ensuring climate resilience, through innovation in materials and systems to strengthen the ability of public and private sector stakeholders to deliver fit-for-purpose transport infrastructure as an enabler for socioeconomic development.	Improved safety and efficiency of ports and protected coastal zones. Smart road infrastructure	[a]Green economy interventions; aIndustrialisation through localisation; aInfrastructure Investment and delivery	[c]Innovation-enabled Capable State; [b]Climate change and environmental sustainability, [c]Circular economy

a *ERRP Priority Interventions – Infrastructure investment and delivery; energy security; gender equality and economic inclusion of women and youth; industrialisation through localisation; support for the recovery and growth of the tourism, cultural and creative industries; green economy interventions; mass public employment interventions; strengthening agriculture and food security; macro-economic policy interventions.*

b *Decadal Plan's Societal Grand Challenges – Climate change and environmental sustainability; future-proof education and skills; a reindustrialised modern economy; innovation for a healthy society; innovation for energy security; the future of society.*

c *Decadal Plan's Key Economic Sectors Addressed - Modernising Manufacturing, Modernising Agriculture, Modernising Mining, Digital Economy, Circular Economy, Health Innovation, Energy Innovation, Innovation-enabled Capable State*

A.2.2.3 Capability Development

At the core of delivering the CSIR's mandate to improve the quality of lives of the people of the Republic lies in maintaining, developing and advancing a portfolio of relevant, cutting-edge, world-class capabilities that can be leveraged to enable competitiveness of industries, create new industries and enable a capable state in present-day and in the future.

The CSIR recently adopted a Capability Development Framework that will frame systemic development of existing and new capabilities relevant to the implementation of the CSIR Strategy. In addition to advancing the extensive capability base currently within the nine clusters described in A.2.2.2, since 2019/20, the CSIR has also invested in new capability development initiatives in new areas of growth. Such investments include developing capabilities and technologies for precision agriculture, local manufacture of pharmaceuticals, biological and chemical conversions, and end-to-end logistics. Implementing these initiatives directly supports the CSIR's strategic objective to improve the competitiveness of high-impact industries to support South Africa's re-industrialisation.

Precision agriculture aims to develop a unique precision agriculture information system (PAIS) for maize. The PAIS seeks to provide regular farm-level, information-actionable data on the spatial variability of crop growth conditions to foster precision farming and supply chain management decisions at all levels of the agriculture value chain from farm to fork. Thus, the main product that will be commercialised is precision agriculture data or information accessed via the IoT on desktop and mobile platforms.

Biopharmaceutical technologies will create a cost-competitive platform and improved processes for the synthesis of small molecule and biopharmaceutical active pharmaceutical ingredients (APIs) of African relevance that can be scaled up for commercial production. The utilisation of new biocatalytic, flow, and immobilised catalyst technologies that encompass green principles, such as incorporating fewer toxic materials, waste reduction, and increased efficiency, will be employed to synthesise small molecule APIs using a hybrid batch-flow-biocatalytic approach. In parallel, researchers will demonstrate the production of biopharmaceuticals using plant-based expression systems and localise mature technologies available internationally for expedited adoption. The key differentiator and competitive advantage is aimed to be the integration of state-of-the-art chemistry and novel bioproduction systems, emerging green and disruptive continuous production, and smart technology for monitoring and intelligent optimisation to develop fully scalable automated end-to-end green production processes.

The biochemical conversions initiative aims to establish a bio-chemical-conversions platform to develop disruptive bio-based technologies and products for adoption in South African industries or to develop new industry sectors that will directly impact the bioeconomy. Using an industrially integrated approach, the overall aim of the bio-conversions platform is to establish disruptive bio-based technologies and products for adoption by South African industries and globally. In terms of internal alignment, the platform's value proposition to the CSIR is to bridge the gap between the bio-refinery, bioconversion, and bioplastics platforms, which are currently firmly established at the organisation. Currently, in South Africa, the manufacture of bio-based platform chemicals is non-existent. However, we have become the largest consumers of green chemicals on the African continent, which creates a unique opportunity for technology development that moves away from petroleum-based chemicals and services a local market currently using internationally sourced green chemicals.

Going forward, these initiatives provide an opportunity to contribute to the implementation of the strategy. The value of the strategy can only be created and delivered when the CSIR has the appropriate capabilities. The capability development initiatives will not deliver value immediately, thus requiring the CSIR to be invested in the programme for longer than the Medium-term Expenditure Framework (MTEF). The CSIR will ensure that these initiatives articulate and develop technologies and solutions aligned with their value offering. The strategic alignment and linkages of strategic initiatives, while investing in all nine clusters of the organisation, will inform initiatives supported as capability development. This investment support to capability development initiatives has continued in the current financial year – 2022/23, with an expanded CSIR portfolio that includes new investments in digital precision medicine, mining, smart mobility through the support of a research chair, mining, and the circular economy.

Mining capability development initiatives are mine digitalisation and automation pursuits which include but are not limited to digitisation and automation of the mining value chain through design and deployment of IoT sensors, mine automation, digital integration, and application of big data analytics to enable better decision support. Extraction mining processes include but are not limited to application of advanced geophysics tools, sensors to support structural mapping of resources to improve mining, extraction of resources, improving safe conditions, e.g. remote early entry examination, preventing fall of ground. This also includes supporting building a circular economy ecosystem. Optimised energy and decarbonisation supporting the mining industry with its decarbonisation drive involves supporting mine electrification, improving energy efficiency and grid stability.

For the first time in 2020/21, the CSIR supported new research centres, and this includes the Information and Cybersecurity Research Centre of which the strategic thrusts are 1) building human capital and skills in the areas of information and cybersecurity; 2) research, development and innovation of home-grown cyber and information security technologies; and 3) industry support through commercialisation and technology transfer to enable and advance internal and external stakeholders including contributing towards building a capable and secured state in the digital space. The Emerging Digital Technologies for the Fourth Industrial Revolution Research Centre will establish a deep and wide 4IR capability to innovate and address large-scale 4IR systems to transform industry, resulting in many products and services for commercialisation with common open-source platforms that will support the building of a local innovation ecosystem and local service providers.

The Water Research Centre focuses on big water data management (quality and quantity) and use, technologies for data acquisition, smart water management systems, and modular technologies for water and wastewater treatment, as well as supply networks, and control optimisation. Fit-for-purpose solutions and enhancement of circular economies concerning the water-energy-food nexus sustainability and wastewater re-use, are the main drivers for the outputs and products from the center.

The Centres for Synthetic Biology and Precision Medicine, Nanostructures and Advanced Material, and Robotics and Future Production are renewed investment built on previous investments in the now discontinued Emerging Research Areas (ERAs) programme initiated as part of the Beyond 60 strategy. This investment focus was also motivated by the fact that the CSIR Executive Committee has invested resources into three ERAs in the past 10 years to develop capabilities in the then-emerging areas of research in nanotechnology, synthetic biology, and autonomous robotics systems. The capability developed in these emerging areas has since been incorporated into new research centres in terms of the new CSIR Operating Model.

The Centres for Synthetic Biology and Precision Medicine focuses on improvement of access to healthcare services and products, incorporates synthetic biology and state-of-the-art diagnostic and treatment technology, with advances in artificial intelligence to provide integrated digital health solutions. It thus aims to ensure that appropriate treatments are delivered for the optimal treatment outcome for the patient.

The main strategic focus of the Centre for Nanostructures and Advanced Material (CeNAM) is in stimulating the development of the advanced materials sector in South Africa to contribute to the socioeconomic development of the country. CeNAM focuses on five strategic capability platforms, namely Advanced Functional Materials, Advanced Polymer Composites, Nanostructured Materials for Sensing Applications, Advanced Metals Processing, and Carbon dioxide (CO_2) capturing and utilisation through green hydrogen.

The strategic focus of the Centre for Robotics and Future Production is to foster technology uptake to enable the local manufacturing industry to be globally competitive. This aligns with the Manufacturing Cluster's strategic intent to help drive the 4IR for the industry in South Africa to achieve growth and modernisation. Three specific areas that enable the achievement of this goal are production optimisation, technology localisation and value chain development, and customised robotic and automation solutions.

A.2.2.4 Human Capital Development

The continued investment in the development of skilled human capital remains critical in enabling the various CSIR capability development initiatives and technology platforms in support of national imperatives. The CSIR's SO4 – Build and transform human capital and infrastructure – enables the organisation to provide a sustainable supply of human capital to meet internal capacity demands equipped with relevant skills and capabilities for the achievement of the organisational strategic objectives. A conducive workplace, cohesive organisational culture, embedded value system and engaged workforce are some of the prerequisites that the organisation believes should exist to achieve organisational effectiveness, improved productivity, enhanced performance and excellence.

The CSIR ascribes to the call to build and strengthen SET human capabilities as outlined in the Sustainable Development Goals; the National Development Plan: A Vision for 2030; the Human Resource Development Strategy for South Africa 2010–2030; the DSI's Human Capital Development Strategy for Research, Innovation and Scholarship of 2016. To optimise on the above, the CSIR participated and contributed to the Decadal Plan objectives in November 2021, which is the implementation plan for South Africa's new paper on STI. The CSIR strategy for 2023/24–2027/28 considers this context and is aligned with the national policy on Science, Technology and Innovation (STI). The 2019 White Paper on STI is geared towards harnessing the power of science to deal with South Africa's socio-economic challenges. The Decadal Plan approved by Cabinet in 2022 is the implementation guide for the STI policy.

The CSIR has commenced to implement relevant human capital development initiatives over the short, medium, and long term so that the organisation can develop its capacity to deliver on the mandate. These initiatives are multi-faceted and encompass improvements to the pipeline development programmes; a strong focus on leadership development; succession planning; performance management; and creating prospects for the long-term growth of CSIR staff. The CSIR has concluded and approved its new employee value proposition while also repositioning its rewards and recognition aspects to include tangible and intangible benefits that reinforce a culture of high performance across all functions, portfolios, clusters and divisions.

The human capital strategic pillars and key initiatives to deliver on the SO4 objectives include:

Building A Diverse Talent Ecosystem and A Sustainable Future Supply

The establishment of a diverse talent ecosystem to capacitate the CSIR with highly skilled human capital is essential to achieve organisational growth and ensure long-term sustainability in delivering on the strategic objectives and mandate and enhance the importance of the CSIR's role and contribution toward socioeconomic development and technological advancement of the country and its people.

The aim is to grow the CSIR talent ecosystem and provide a sustainable supply of human resources aligned to capacity and skills demands to achieve the business objectives of the CSIR. Targeted talent acquisition and management, workforce planning, pipeline development and organisational learning, corporate social investment, an Alumni Programme, and strengthening of external partnerships will be key focus areas in achieving this objective.

Strengthening Leadership and Deepening Professionalism

Our strategy for building a motivated, high-performing, and diverse workforce is multi-faceted and it includes a strong focus on leadership development and creating prospects for the long-term growth of our people. Leadership and management capabilities are strengthened through the initiated leadership and management development programmes as part of our commitment to the development of leaders and high-potential staff. In the quest to deepen professionalism, focusing on strengthening the behavioural competencies of our staff aligned to our EPIC values, the CSIR has targeted development programmes and collaborations with industry professionals to foster the development and transfer of skills.

Improving Individual and Organisational Performance

This objective aims to elevate individual performance and organisational performance towards the achievement of excellence and high-performance culture in a systematic and staged approach and address key areas of improvement. The key to the achievement of this objective is the implementation of human capital initiatives required as imperative for the improvement of our capabilities to drive operational efficiency and increase organisational performance. Initiatives in this regard include implementing a compelling Employee Value Proposition aimed at improving attraction and retention of talent, improvement of performance management, and employee engagement, and implementing performance-based reward practices.

Increased Efficiency and Effectiveness of HC Systems and Processes

The CSIR continues to strive for efficiency and effectiveness by leveraging its systems to allow for increased productivity and impact on its clients. As such, human capital-related systems and processes remains a focus to realise the achievement of objectives and initiatives geared to support the organisation. Standardised and automated processes as well as increased utilisation of systems are therefore key to the success of the Human Capital function for increased levels of service delivery, effectiveness and efficiency.

Advancing Women, Youth and People with Disabilities

Engagement activities are key to the CSIR and several initiatives, such as the women's forum and the youth forum, have been introduced into the organisation. The forum emphasises the importance of empowering women in some male-dominated industries and aims to find solutions with women themselves leading from the front and championing the women's development agenda. In addition, the advancement of women is prioritised through recruitment planning aligned to the Employment Equity Plan (EEP) of the CSIR. The Youth Forum initiatives further emphasise the role the youth play in contributing to and influencing the strategic future of the CSIR. The forum creates space for networking and collaboration among young professionals while also contributing to building a vibrant and inclusive organisational culture within the CSIR. The CSIR advances the employment of people with disabilities and currently employs 1.8% with a target of 2%. The emphasis is on the employment of unemployed youth with disabilities in SET through the YES programme.

A.2.2.5 Infrastructure Investment Strategy/Plan

Research infrastructure is a key component of achieving the strategic objectives of the CSIR. Therefore, there is a need to renew the CSIR's infrastructure, as shown in Figure A4, to achieve the strategic objectives of the CSIR.

Figure A4: Key needs to renew CSIR infrastructure

National Treasury (NT) through the DSI has recently approved funding for the establishment of strategic research infrastructure at the CSIR, by means of performing upgrade and or enhancement of capability to existing infrastructure.

In implementing the project, the four strategic research infrastructure projects are grouped into a programme, in order to develop research infrastructure capability that will allow the CSIR to support the growth and sustainability of various economic sectors in South Africa. These four projects include:

Future Pharma (FP)

In order to drive technology development and commercialisation of API manufacturing in South Africa, the establishment of the FP "open innovation facility integrating molecular engineering and continuous pharmaceutical manufacturing for Africa" is proposed. The facility will focus on the production of both small molecule and biologic APIs using modern manufacturing technology that blurs the lines between the physical and the digital worlds, solving complex real-world problems for the local pharmaceutical industry, and making production more automated, modular, cost-effective and responsive.

Learning Factory (LF)

The LF will focus on the manufacturing technologies, skills and processes required to address industrialisation, economic transformation and skills and education in alignment with the strategic objectives of the CSIR. In addition, the LF will also support industry, government bodies, academia and entrepreneurs, who need to adopt a digital transformation intervention or improvement. The key objectives of the LF are to perform 4IR readiness benchmarking, new product development, process innovation, as well as support the outcomes of the 4IR LF being developed in collaboration with the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA). The CSIR will explore further opportunities to support Post-School Education and Training Institutions such as the Imbali Education and Innovation Precinct and others.

Advanced Material Testing Laboratories (AMTL)

The Road Materials Testing Research Group provides specialist testing services, develops innovative kits and customised equipment, creates new technologies and testing procedures in support of the SET needs of the pavement engineering sectors in South Africa and internationally. The research group contains two sub-groups with unique facilities – the AMTL and the Technology Innovation Centre (TIC).

The AMTL facility is modelled around the two types of road pavement designs, and hence it consists of the following:

- A granular (soils, gravel and aggregates) and cementitious materials laboratory;
- An asphalt laboratory;
- A dynamic testing laboratory; and
- A bituminous binders laboratory.

The TIC will consist of the following:

- A mechanical workshop; and
- Smart technology and prototyping area.

Model Hall

The laboratory was constructed in the late 1960s and is 11 000 m^2 in size. Two pump buildings, one adjacent to the laboratory, the other on the opposite corner of the campus along with underwater storage tanks with a total capacity of three million litres, form part of the integrated infrastructure. The main function of the laboratory is to test scale layouts of ports, test the stability of port breakwaters, test ship motion alongside a quay, and test ship navigation (port entry and departure). A Programme Management Group was appointed to assist in the integration, alignment, standardisation, execution, monitoring, evaluation and control with oversight to the governance and implementation of these four projects.

Capital Projects across CSIR campuses

Facilities Management and Security Services requires several investments to the value of approximately R86.3 million for various capital projects across the CSIR campuses, including transformer replacements, lift replacements, main low-voltage board replacements, low-voltage sub-distribution board replacements, and ablution upgrades, amongst others.

A.2.2.6 Drivers of Successful Strategy Implementation

Business Development and Commercialisation, Strategic Partnerships and Marketing

The Business Development and Commercialisation (BD&C) function's primary focus is to undertake business development and lead the commercialisation of CSIR intellectual property and know-how, to achieve CSIR strategic objectives. In particular, the BD&C function is leading in the improvement of the CSIR's financial sustainability by diversifying revenue sources and optimising the business model to achieve competitiveness, supported by efficient and sound governance. The function has accountability for securing contract R&D from the private sector and international markets and derives income from commercialising IP and know-how through licensing, spin-offs, joint ventures, equity deals and other structures that maximise returns from CSIR investments.

Guided by sectoral and business strategies at divisional and cluster levels, the function leads and maintains high-level stakeholder engagements and develops commercial partnerships in the public sector, private sector, non-governmental sector, and internationally as appropriate. In an endeavour to optimally structure and systematically guide engagement with the vast array of potential partners envisaged by the mandate, the organisation has developed a Stakeholder Engagement Framework, a Strategic Partnerships Framework, and a Strategic Partnerships Policy.

In pursuit of the strategic partnerships to fulfil the CSIR mandate and strategy, there have been several significant partnerships and related developments in the last two years, including:

Africa

- AUDA-NEPAD – a partnership with AUDA-NEPAD was concluded in 2020. A new AUDA-NEPAD Centre of Excellence in STI (CoE-STI) was launched as a jointly hosted centre by the CSIR, Stellenbosch University and AUDA-NEPAD. The CoE-STI is physically hosted at the CSIR Stellenbosch campus, and AUD-NEPAD staff are in the process of occupying offices there.
- UNDP – the CSIR and UNDP launched this partnership in August 2021, and the two organisations are in the process of implementing governance structures and some projects under this agreement.
- Science Diplomacy Capital for Africa – The launch took place on the 08th of July 2022 at the CSIR ICC, and was led by the Higher Education, Science and Innovation Minister Dr Blade Nzimande, and the CSIR CEO Dr Thulani Dlamini, and was attended by diplomatic missions, government departments and various agencies, science councils, universities, regional and global agencies, the private sector and civil society.
- Science Diplomacy Capital for Africa Initiative launch – On Friday 8 July 2022, the Department of Science and Innovation (DSI) together with CSIR launched the Science Diplomacy Capital for Africa initiative which promotes science collaboration across Africa and beyond, towards leveraging and connecting technology innovation with humanity.
- DSI-CSIR Africa Industrial Development Support Programme – the CSIR is working with the DSI to develop a DSI-CSIR Africa Industrial Development Support Programme, whose objective are (a) to establish a strategic response to industrial RDI development needs on the continent by establishing an Africa Industrialisation RDI programme of cooperation between South Africa and other African partners; (b) to support Africa's industrial RDI development goals by identifying and supporting key economic development sectors that are strategic to industrialisation research, development and innovation in the continent; (c) to maximize economic development opportunities offered by the African continent while contributing to the growth of the national and continental economies; and (d) to identify and contribute to the development of technology-intensive industries for African countries' economies. It is intended that the programme will be operational in the coming financial year.
- CSIR- Uganda Industrial Research Institution (UIRI) – the CSIR is working with UIRI to develop an essential oils industry sector in Uganda through a pilot (demonstration agronomy) project consisting of selected essential oil plant varieties. Uganda is well-positioned to contribute to this sector as the country is richly blessed with fertile land, a tropical climate, basic infrastructure and a strong tradition in agriculture, with an extensive emerging farmer portfolio. Preliminary results from the pilot project seem promising with a potential to develop an essential oils sector in Uganda. A memorandum of understanding is currently under development, which will cover among other things collaboration on essential oils.

- Ghana Ministry of Environment, Science, Technology, and Innovation (MESTI) – On Thursday, 1st of September 2022, the CSIR hosted a delegation from Ghana MESTI led by MESTI Chief Director. The purpose of the visit was to strengthen and deepen the bilateral cooperation between the two countries through the sharing of knowledge and best practices.
- WAITRO Africa Special Interest Group (SIG) – the CSIR and North West University led efforts aimed at creating a platform for a coordinated approach to addressing the challenges faced by African RTOs, which resulted in the launch of the WAITRO Africa Special Interest Group at the WAITRO Global Innovation Summit held in Cape Town in mid-November 2022. The SIG will be an important vehicle that the CSIR will use in engaging with other African RTOs on challenges of common interest in the continent.

Rest of the World

- Handover of the Biodegradation Testing Laboratory Equipment by Japan to South Africa – On Tuesday, 23 August 2022, the Minister of Forestry Fisheries and the Environment, Barbara Creecy and Deputy Minister Buti Manamela officiated over the hand-over of the biodegradation assessment laboratory equipment to the CSIR by the Embassy of Japan in South Africa. The event was attended by a high-level delegation, which consisted of the Ambassador of Japan, His Excellency Mr Norio Maruyama, a senior member from the United Nations Industrial Development Organization (UNIDO), as well as the CSIR CEO, Dr Thulani Dlamini.
- A Consortium of Erith Technologies and Jendamark – An interesting business formation has developed between C4IR South Africa, Jendamark Automation and Erith Technologies. Jendamark Automation and Erith Technologies proposed business models for supporting the "Accelerated Adoption of IoT by SMMEs" project. Jendarmark Automation pledged to provide the SMMEs with their hardware called ODIN Raven Sensors and Erith Technologies pledged their Intelligence system.
- Fraunhofer-Gesellschaft – The CSIR CEO, Dr Thulani Dlamini, hosted Prof. Reimund Neugebauer, President of Fraunhofer-Gesellschaft, Germany's national research and technology organization (RTO), for discussions on potential collaboration opportunities in energy, water, smart agriculture, hydrogen, and artificial intelligence.
- World Science Forum 2022 – the CSIR took part in the World Science Forum (WSF) 2022, which was held in Cape Town on 5-9 December 2022 under the theme "Science for Social Justice". The event, opened by President Cyril Rampahosa, was being held for the first time on African soil. The WSF is a platform for the scientific community, public policy makers and communities to exchange ideas on the growing interdependence of science and society, and how science can help to address global challenges facing humanity.
- World Association of Industrial and Technological Research Organizations (WAITRO) – the CSIR continues to be an active member of WAITRO and has completed yet another term serving on the Executive Board of the organization. WAITRO is currently undertaking a major international study of benchmarking research and technology organizations (RTOs) on best practices in RTO management. The CSIR is taking part in this study.
- The CSIR is currently exploring a number of opportunities for collaboration with BRICS member countries in a range of research areas.

There is a five-year commercialisation income growth strategy that shifts from the current licence portfolio of predominantly local SMME/start-up deals to a diversified commercialisation portfolio with equity deals and licence deals from national and international large corporates for scalable technologies, toll manufacturing and service models, and sale of IP rights of patents with less than five years' life span.

For the CSIR to succeed in improving the competitiveness of high-impact industries, localising transformative technologies and driving socioeconomic transformation, it needs to raise its profile among key target audiences/stakeholders. To this end, the CSIR Communication and Marketing Strategy outlines how the organisation must communicate with its stakeholders in support of the activities undertaken by the BD&C function. The aim is to influence new clients to buy the services and innovations while retaining existing ones and forging new partnerships for medium to long-term relations. The focus is to employ innovative, creative and effective communication solutions and support business development objectives; buttressed by a sound understanding of the organisation's work and role within the NSI, as well as the organisation's evolving RD&I strategy. The CSIR Strategic Communication and Marketing Strategy was adopted by the CSIR Board during 2020/21. The CSIR Strategic Communication and Marketing Strategy has five objectives as illustrated in Figure A5 below.

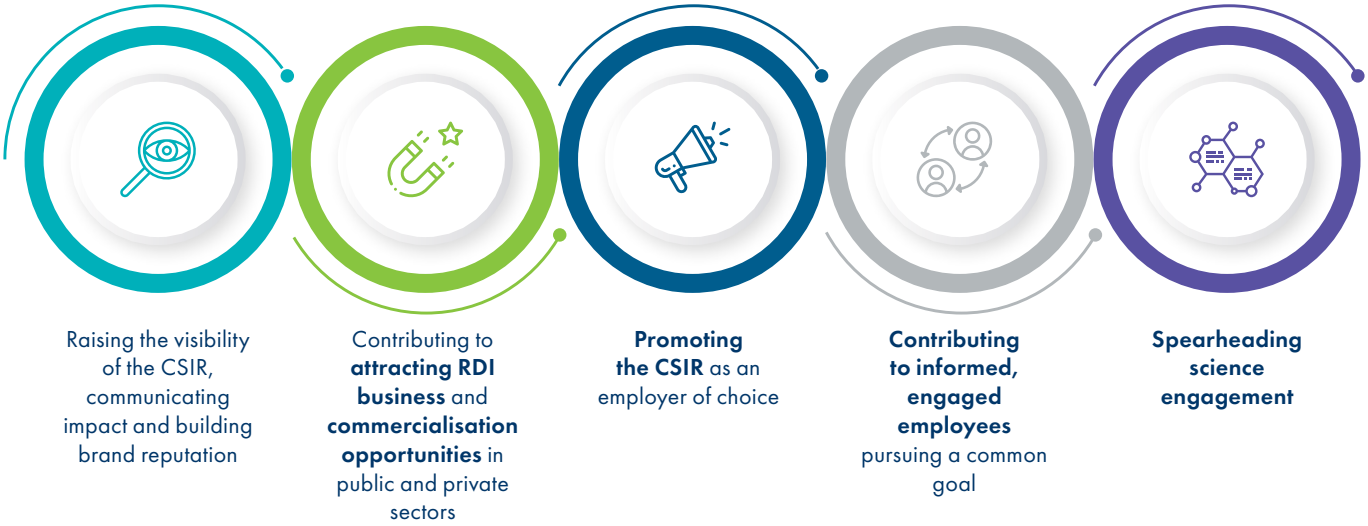


Figure A5: New CSIR Communications and Marketing Strategy

The biggest effort towards SO5 has been the increased industry engagement and private sector income towards achieving a benchmark distribution of income of 55–60% public sector, 15–20% contribution of private and international income by 2025. Trends from the past two years have highlighted challenges in growing private sector income, especially in the defence and security-related industries. Significant commercialisation income is expected to be realised from 2024/25 from equity deals and technologies licences. One key weakness of current licences issued is that some licensees are either start-ups or SMMEs with limited resources, distribution channels and/or market reach.

Intellectual Property Management and Technology Transfer

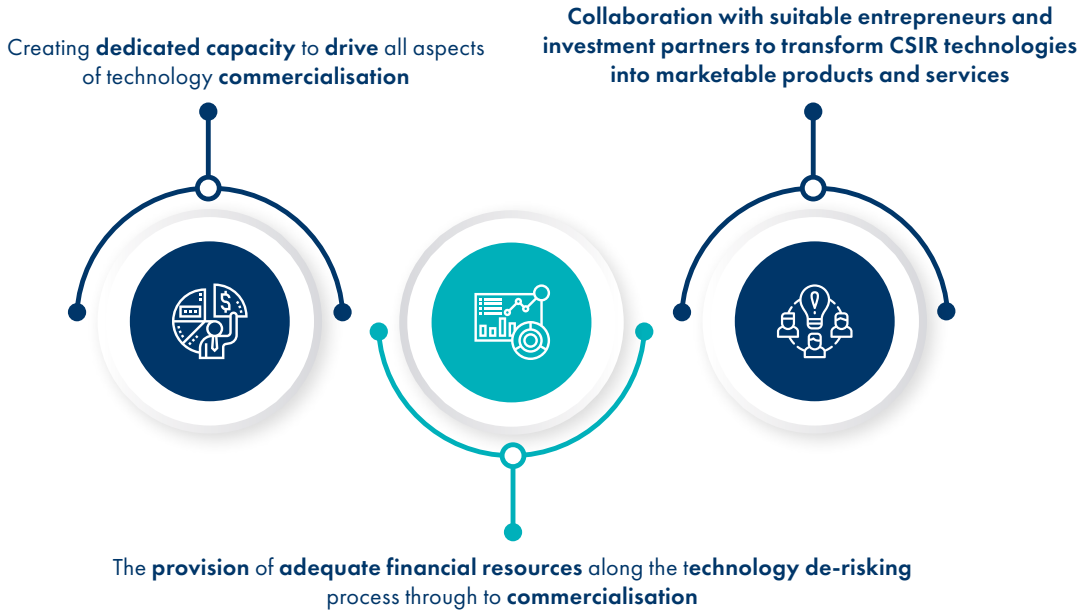
CSIR Technology Commercialisation Enterprise

The CSIR is in the 4th year of implementation of its industrial development strategy, which has seen us elevating our contribution to industrial development in line with our mandate. Our contribution to industrial development happens through:

- Improving the performance and competitiveness of existing industrial products, processes and services;
- Introducing new products, processes and services to existing firms; and
- The creation of enterprises that produce new products or provide new services.

The latter presents a number of new opportunities for the CSIR, and over the years the CSIR has commercialised technologies through creation of new enterprises with varying degrees of success. The CSIR undertook an evaluation of lessons from this history and a rigorous best practice and bench marking assessment with leading research and technology organisations (RTOs) with a track record in technology commercialisation. Some key lessons from history are the market readiness of technologies is critical for success and to this end technology de-risking is essential for successful market entry, adequate and patient capital that does not demand immediate returns and a capable entrepreneurial team are critical success factors. We also noted that the licensing route is a limited way to get value/return on investment form intellectual property, and the equity route must be explored. Notable observations from the global bench marking exercise are that the leading RTOs that were included in the benchmark study all have special purpose vehicles for commercialisation, and some have incubation capabilities. In all of them, seed funding is invested from the RTO and government funds, and some tend to raise follow on funding to avoid being diluted in subsequent rounds of investment in high value opportunities.

Against this background, the CSIR has embarked on a systematic process to develop a structured and managed to improve our approaches to the commercialisation of CSIR IP through the creation of new enterprises. This includes ensuring that we converge the relevant business understanding and acumen, capital in addition to the IP itself in a suitable business model. In this regard, the CSIR has rigorously explored the possibility of creating a standalone special purpose technology commercialisation enterprise that will hold all CSIR IP and act as an incubator for the commercialisation of start-up enterprises underpinned by strong technical financial and non-financial support. The CSIR aims to accelerate the pace and expand the scale at which the intellectual property assets generated by the organisation are commercialised by:



To this end the CSIR will establish a technology commercialisation enterprise with a mandate to house and trade in all CSIR. The enterprise will transact on behalf of the CSIR (technology de-risking, business models, deal structuring and financing through market entry), maintain market networks/insights, portfolio of investors, focused, expedited approach to continuous resource mobilisation. The CSIR for its part will maintains evergreen pipeline of intellectual property and support the enterprise in resource mobilisation, access to diverse highly technical, multi-disciplinary skills and infrastructure, and an environment in which we can successfully incubate and accelerate innovative businesses. The CSIR will ensure the special purpose vehicle is immersed in a vibrant ecosystem of start-ups, corporates, innovators, financiers, entrepreneurs, government departments among others. The CSIR has explored the legal and regulatory landscape, and there are no obstacles to the establishment of the enterprise. The CSIR has evaluated and prioritised its rich portfolio of knowledge assets and has built a prospectus that will be launched along with the technology commercialisation enterprise. The CSIR already has a rich pipeline of intellectual property in addition to the prioritised assets, it will continuously innovate and set the stage for rapid innovation.

To this end, the CSIR has raise R100m as an initial investment into the vehicle to de-risk our technologies to improve their market readiness. The CSIR will consolidate this, and other funding directed towards technology commercialisation to raise more funding to incubate and accelerate technologies towards the market from public sector and other institutions. In 2021, we launched the CSIR Commercialisation Fund (CF) comprising the Appex and Accelerator sub funds. The Apex Fund is a sub-fund of the CF that supports high-impact projects (high returns on an investment expressed through solid financial models) to address a gap or need in the market by developing innovations that will ideally be ready for uptake by industry or may form the basis of a start-up in two to three years. The Accelerator Fund supports projects from TRL 4–6 that require technology development and pre-commercialisation support with the intention to scope and develop the commercialisation case for technologies towards making them licensable or investor-fundable opportunities. These funds will be directed towards the successful commercialisation of or prioritised assets.

The intended outcomes of this approach include:

- A portfolio of enterprises (existing firms and startups) commercialising CSIR IP;
- Greater private sector investment (angel investors, venture capital funds, banks, private individuals etc.) in the commercialisation of CSIR IP;
- Financial returns to the CSIR through equity appreciation and release, licensing/royalty income and contract R&D;
- Financial returns to CSIR partners through equity appreciation and release, dividend payments etc.;
- A culture of innovation and technology commercialisation at the CSIR; and
- Job creation, industrial development and economic growth.

The CSIR will launch the enterprise early in the 2023/24 financial year. The intended outcomes include:

- A portfolio of enterprises (existing firms and startups) commercialising CSIR IP;
- Greater private sector investment (angel investors, venture capital funds, banks, private individuals etc.) in the commercialisation of CSIR IP;
- Financial returns to the CSIR through equity appreciation and release, licensing/royalty income and contract R&D;
- Financial returns to CSIR partners through equity appreciation and release, dividend payments etc.;
- A culture of innovation and technology commercialisation at the CSIR; and
- Job creation, industrial development and economic growth.

Over the 2022 financial year, the progress made by the CSIR towards the establishment of the technology commercialisation enterprise can be summarized as follows;

- Completed the explorations of the enterprise feasibility as had been mandated by the Board in August 2021
- Examined the possible models for the vehicle as a follow-on exercise after the benchmark study
- Explored models of funding, and other possible funders to invest into the vehicle and/or the new start-up companies
- Went through the rigorous process of identifying top technologies for the launch prospectus
- Progress on the development of the technology commercialisation prospectus
- Got formal Board approval to;
    - Establish the vehicle, along with the proposed ownership model, including incubation and acceleration approaches as well as establishment of a seed fund to de-risk technologies
    - Ringfence R100m from the CSIR balance sheet to initiate the establishment of the seed fund, and future investments into the enterprise
    - Capacitate the CV with the requisite human resources in line with the CSIR recruitment plan and delegation of authority framework
    - Establish the governance structures - proposal for enterprise Board composition to be approved by the CSIR Board
    - Formally engage the relevant stakeholders, including the Minister of Science and Innovation on the establishment of the vehicle.

A.2.3 Financial Strategy

Income diversification remains a key objective for the CSIR. The aim is to reduce financial risk by complementing public sector income with the private sector and international income. Income diversification is also expected to improve the CSIR's profitability. The goal is to grow private sector income to 15% in three years and international sector income to 12% in three years by 2025/26. The long-term sustainable target is 30% for both private sector and international income combined. The potential growth in the international sector is supported by the guarantees that are already in place.

Focus on cost containment remains in place to ensure that costs are reasonably controlled with opportunities for further optimisation.

The commercialisation of opportunities to be implemented by engaging with the relevant stakeholders to obtain the necessary funding to implement three key commercialisation opportunities.

The CSIR receives PG Baseline Allocation from the DSI, in line with Vote 35 on Science and Innovation of the Estimates of National Expenditure presented to Parliament by the Minister of Finance during the Budget Speech. On an annual basis, the DSI confirms an MTEF PG allocation to the CSIR in a letter to the Chairperson of the Board. The allocation has two components – a PG Baseline Allocation portion and a ring-fenced portion for the specified programmes or projects that the CSIR implements on behalf of the DSI. The PG represents the largest funding to the CSIR from one source.

A key initiative underlying the organisation's ability to strengthen its RD&I capabilities was the adoption of a PG Investment Policy. The CSIR Board approved the policy in 2019/20. The policy advocates for a shift from an allocation approach with regard to the PG to an investment approach. To improve alignment with key industry sectors, a PG Investment Committee consisting of external and internal members has been established to advise the CSIR CSIR Executive Committee on strategic investment of PG, including on annual PG investment planning. The formula for allocating PG investment proportionally (Table A2) across clusters, capability development and commercialisation activities ensures that the investment (70%) is largely towards core RD&I activities of the CSIR.

Table A2: PG Investment Framework

PG Investment/Allocation Categories	PG Investment sub-categories
PG Baseline Investment in Divisions/Clusters	Division 1: Advanced Chemistry and Life Sciences
	Division 2: Advanced Production and Security
	Division 3: Smart Society
PG Baseline Allocation to Portfolios/Support Functions	Business Excellence and Integration (BEI)
	Legal Compliance and Business Enablement
	Finance and ICT
	Human Capital and Strategic Communications
Capability Development Initiatives	Research Centres
	New Capability Development Strategic Initiatives
	Research Infrastructure
	Human Capital and Skills Development

PG Investment/Allocation Categories	PG Investment sub-categories
Commercialisation and Technology Transfer	Accelerator Fund
	Apex Fund
	Commercialisation Vehicle
Strategic/Discretionary Fund	Legal (provision for legal services as required)
	Covid-19 risk mitigation – current context-specific
	Health and well-being
CSIR Board and CSIR Governance Structures	CSIR Board and other CSIR Governance Committees

More details on income diversification and financial sustainability can be found in section B.6.

A.2.4 Good Governance

Inherent in the CSIR mission is to pursue the inclusive and sustainable advancement of industry and society. Beyond leading innovation and providing unique solutions to address South Africa's challenges, the impact we seek is to improve lives and this translates to the wider obligation of the CSIR to operate as a responsible corporate citizen. The CSIR must duly comply with all legal imperatives, whether constitutional, national or common law, with due regard for the governance implications for CSIR business. South Africa is also a signatory to several international treaties and, as such, several international strategies inform the work of the CSIR.

Corporate social responsibility is entrenched within our EPIC (excellence, people-centered, integrity and collaboration) value system. It is our obligation to carefully consider the interests of all our stakeholders and the environment within which we operate to ensure that we appreciate the social and environmental consequences of our business activities. In support of the CSIR's corporate citizenship strategy, critical emphasis will continue to be placed on the following initiatives:

- Enhanced implementation of the compliance function as part of our combined assurance model to more effectively manage risks associated with compliance, business ethics and fraud prevention;
- The enhancement of safety, health and environmental practices through integrated collaboration with all internal and external stakeholders to pursue zero harm;
- The active pursuit of strategies to improve the CSIR's carbon footprint against a trajectory of continuous improvement; and
- Contributions to B-BBEE, based on the dtic codes of good practice, with a specific focus on the critical role that the youth of South Africa must play in shaping our economy.

A.3 KPI TARGETS

Table A3: Five-year KPI Targets

Indicator		Target 2022/23	**Target 2023/24**	Target 2024/25	Target 2025/26	Target 2026/27	Target 2027/28
SO1:	**Conduct RD&I of transformative technologies and accelerate their diffusion**						
KPI 01:	Publication equivalents	304.5	**408**	375	385	393	407
KPI 02:	New priority patent applications filed	7	**8**	10	12	14	14
KPI 03:	New patents granted	6	**8**	10	12	14	17
KPI 04:	New technology demonstrators	54	**56**	59	66	69	74
KPI 05:	Number of technology licence agreements signed	18	**18**	25	29	35	39
SO2:	**Improve the competitiveness of high-impact industries to support South Africa's re-industrialisation by collaboratively developing, localising and implementing technology**						
KPI 06:	Number of localised technologies	11	**15**	24	28	32	37
KPI 07:	Number of joint technology development agreements being implemented for industry	27	**30**	42	47	52	56
KPI 08:	Number of SMMEs supported	72	**90**	169	128	135	139
SO3:	**Drive socioeconomic transformation through RD&I that supports the development of a capable state**						
KPI 09:	Number of reports contributing to national policy development	13	**22**	30	33	32	34
KPI 10:	Number of standards delivered or contributed in support of the state	9	**9**	15	15	18	18
KPI 11:	Number of projects implemented to increase the capability of the state	45	**60**	84	91	97	106
SO4:	**Build and transform human capital (HC) and infrastructure**						
KPI 12:	Total SET staff	1598	**1598**	1667	1713	1764	1822
KPI 13:	Percentage of SET staff who are black	67%	**67%**	68%	68%	68%	68%
KPI 14:	Percentage of SET staff who are female	38%	**38%**	39%	39%	39%	39%
KPI 15:	Percentage of SET staff with PhDs	21%	**21%**	21%	21%	21%	21%
KPI 16:	Total chief researchers	16	**16**	17	22	23	27
KPI 17:	Percentage of chief researchers who are black	19%	**19%**	18%	32%	35%	44%
KPI 18:	Percentage of chief researchers who are female	13%	**13%**	18%	23%	33%	36%

Indicator		Target 2022/23	Target 2023/24	Target 2024/25	Target 2025/26	Target 2026/27	Target 2027/28
KPI 19:	Total principal researchers	189	**189**	200	210	225	235
KPI 20:	Percentage of principal researchers who are black	34%	**35%**	36%	37%	37%	38%
KPI 21:	Percentage of principal researchers who are female	20%	**20%**	20%	23%	23%	24%
KPI 22:	Number of staff involved in exchange programmes with industry	26	**31**	33	37	39	44
KPI 23:	PPE investment (Rm)	259.8	**148**	153	157	162	167
SO5: Diversify income, maintain financial sustainability and good governance							
KPI 24:	Total income (Rm)	2903	**3 104**	3 346	3 678	3 899	4 133
KPI 25:	Net profit (Rm)	-5.4	**11.5**	19.9	88	105.6	126.7
KPI 26:	SA public sector income (% total income)	51%	**56%**	55%	51%	51%	51%
KPI 27:	SA private sector income (% total income)	12%	**11%**	12%	15%	15%	15%
KPI 28:	International contract income (% total income)	8%	**9%**	10%	12%	12%	12%
KPI 29:	B-BBEE rating	1	**1**	1	1	1	1
KPI 30:	RIR	<1	**≤0.6**	≤0.5	≤0.4	≤0.4	≤0.4
KPI 31:	Audit opinion	Unqualified audit opinion	**Unqualified audit opinion**	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion

A.4 KPI DEFINITIONS

KPIs provide an understanding of performance in terms of inputs, outputs, and efficiencies and, to some extent, provide lead indicators of the outcomes and impact that are required for the CSIR to fulfil its mandate. The question of whether the CSIR is meeting its strategic objectives related to achieving outcomes and impact cannot be resolved by KPI assessment alone and requires a process of programme evaluation as described in the National Evaluation Policy Framework. The strategic objectives provided in the CSIR Strategic Plan make specific statements on planned outcomes that will serve as the basis for future evaluation of performance in this regard. The CSIR KPIs provide a basket of measures that reflect various aspects of the organisation's performance. The targets that are set reflect, in the context of limited resources, a strategic choice about the areas in which the greatest impact can be achieved.

KPI 1: 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	Research publications are a measure of the CSIR's research capabilities and outputs. The quantity and quality of peer-reviewed research publications is a measure of the quality and depth of the scientific knowledge base.
Performance assessment	The CSIR considers a performance equal to and above 95% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	Publications are entered in the CSIR Technical Outputs Database (TOdB), which provides the information for reporting.
Data responsibility	BEI: CSIR Information Services.
Method of calculation	The number of publication equivalents assigned to each type of publication as per the approved Publication Equivalent Guidelines. The publications are counted over the calendar year preceding the year in which the financial year ends.
Limitations	Authors submit publications for inclusion in TOdB via WorkFlow. There may be some under-reporting if individual authors do not submit their manuscripts for inclusion. However, there are also measures in place to automatically include publications whose authors are affiliated to the CSIR.
Type of indicator	Output.
Exclusions	Publications not submitted to the TOdB will not be allocated publication equivalents. Publications not subjected to scholarly peer review.

KPI 2: NEW PRIORITY PATENT APPLICATIONS FILED

Indicator Title	New Priority Patent Applications Filed
Definition	A priority patent is the first patent application filed for the protection of a particular invention with the CSIR named as an applicant/assignee/co-applicant/co-assignee.

Indicator Title	New Priority Patent Applications Filed
Purpose	The basic purpose [of the right of priority] is to safeguard, for a limited period, the interests of a patent applicant(s) in their endeavour to obtain international protection for their invention. At the CSIR, priority patent filings serve as a pipeline indicator of patent families.
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	Knowledge Sharing Systems (KSS) records containing evidentiary supporting documentation (from patent attorneys, patent offices and/or reliable patent databases) offices.
Data responsibility	BEI: Intellectual Property & Technology Transfer.
Method of calculation	Number of qualifying records on KSS.
Limitations	Steps must be taken to avoid double counting of applications that have been previously filed but withdrawn and refiled at a later date (despite obtaining a new priority number and priority date).
Type of indicator	Output.
Exclusions	• Any patent application that is not the first application filed in respect of a particular invention, including (without limitation) re-filings/conversions/nationalisations/ continuations/divisional, etc. of a previously filed application. • Patent applications for which evidentiary supporting documentation is lacking. • Patent applications that do not name the CSIR as an applicant/assignee/co-applicant/ co-assignee.

KPI 3: NEW PATENTS GRANTED

Indicator Title	New Patents Granted
Definition	Patents are exclusive rights granted for inventions granted by an examining patent authority with the CSIR named as an applicant/assignee/co-applicant/co-assignee.
Purpose	Patents provide a lead indicator of the potential impact to be achieved when technologies are commercialised.
Performance assessment	The CSIR considers a performance equal to and above 80% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	KSS records containing evidentiary supporting documentation (from patent attorneys, patent offices and/or reliable patent databases).
Data responsibility	BEI: Intellectual Property & Technology Transfer
Method of calculation	• Number of qualifying records on KSS. • For patents from the same patent family granted in multiple territories, each patent granted by an examining authority is counted individually. • Where a patent is granted by a regional patent authority (e.g. EPO), only the EPO grant is counted, not the national validations in designated countries. • In cases where notification of a patent is only received after the results for the financial year have been completed, that patent will be included in the subsequent financial year's results. Only co-owned patents or patents in the name of the CSIR are counted.

Indicator Title	New Patents Granted
Limitations	South Africa and certain other countries do not have examining patent offices. Therefore, patents filed in these countries are not counted for this KPI. The time taken for a patent to be granted after filing is unpredictable and can range from one to eight or even more years, depending on the efficiency of the patent authority concerned and the complexity of the examination process.
Type of indicator	Output.
Exclusions	Patents granted by non-examining patent authorities. Patents for which evidentiary supporting documentation is lacking. Patents that do not name the CSIR as an applicant/assignee/co-applicant/co-assignee. Patents that are national validations of a patent granted by a regional patent authority.

KPI 4: NEW TECHNOLOGY DEMONSTRATORS

Indicator Title	New Technology Demonstrators
Definition	A prototype, a rough example of a conceivable technology (product or system) derived from existing knowledge gained from research and/or practical experience as proof of concept.
Purpose	Measure an intermediate output of research, development and innovation activities with the potential to be developed further and that can be transferred for socioeconomic impacts.
Performance assessment	The CSIR considers a performance equal to and above 85% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	All data are collated in a centralised repository of the Technology Demonstrator Evaluation Panel.
Data responsibility	BEI: RD&I Office.
Method of calculation	Technology demonstrators are submitted by clusters for adjudication to the Technology Demonstrator Evaluation Panel. Count of technology demonstrators as approved by the Technology Demonstrator Panel and adjudicated according to the CSIR Technology Demonstrator Evaluation Framework.
Limitations	None.
Type of indicator	Output.
Exclusions	Only outputs that result from experimental development are considered technology demonstrators, e.g. development of frameworks is not considered.

KPI 5: NUMBER OF TECHNOLOGY LICENCE AGREEMENTS SIGNED

Indicator Title	Number of Licensed Technologies
Definition	A licence agreement is an agreement in terms of which the CSIR grants rights to another party to exploit IP developed by the CSIR, typically in exchange for royalty payments and/or other licence fees. Technologies licensed in this manner must have been disclosed via the invention disclosure process.
Purpose	This indicator is a measure of the uptake of CSIR IP in the market. Technology licences facilitate commercialisation by other parties of the CSIR's scientific and technological outputs.

Indicator Title	Number of Licensed Technologies
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	Copies of signed licence agreements and records in KSS.
Data responsibility	BEI: Intellectual Property & Technology Transfer
Method of calculation	• Number of licence agreements signed. • Technology licences are proposed and negotiated with other parties by CSIR divisions and are approved and granted in accordance with relevant legislation and the CSIR Commercialisation and Approval Frameworks. • Assignments of IP shall also be included if all other criteria are met, if the assignment is not a conversion of licensed rights to the same IP that have already/previously been licensed to the assignee.
Limitations	None.
Type of indicator	Output.
Exclusions	Only full licence agreements negotiated and concluded with another party are counted. This KPI excludes: • Instant access licences; and • Evaluation agreements (or similar).

KPI 6: NUMBER OF LOCALISED TECHNOLOGIES

Indicator Title	Number of Localised Technologies
Definition	A localised technology is a technology that has been invented or commercialised outside of South Africa and that has been or will be introduced/adapted in South Africa for commercial or scientific benefit or a technology that has been locally developed as an import replacement.
Purpose	The indicator aims to diffuse technologies commercialised or industrialised from elsewhere in the world that have demonstrated potential to positively affect the competitiveness of industry upon competent adoption by users or is a strong candidate to be an input into innovation or improvements of other systems for improvement of industrial activities or capabilities of the state.
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	Evidence for localised technologies is reviewed by the Planning, Reporting, Monitoring and Evaluation Sub-Committee of the CSIR Operations Committee (OpCo) and should include: • Proof that the technology originated from outside the borders of South Africa, such as licence agreements and intellectual property rights ownership, including in the case of expired or lapsed IP rights; and • An implementation report or technology package developed, or other relevant proof that the technology has been piloted or applied/implemented in local South African conditions.
Data responsibility	CSIR clusters. Central Repository held by BEI: Institutional Planning.

Indicator Title	Number of Localised Technologies
Method of calculation	Number of technologies localised.
Limitations	• The agreement date may be before the current financial year. • The KPI can only be claimed once all eligible evidence is satisfied, which may span several years.
Type of indicator	Output.
Exclusions	Excludes a general list of technologies developed by CSIR R&D.

KPI 7: NUMBER OF JOINT TECHNOLOGY DEVELOPMENT AGREEMENTS BEING IMPLEMENTED WITH INDUSTRY

Indicator Title	Number of Joint Technology Development Agreements being Implemented with Industry
Definition	A joint technology development initiative with an industry partner under a written agreement, where each party brings needed capability for the development and implementation of the technology. A third party may fund the initiative. Industry refers to the private sector and public sector corporations (state-owned enterprises).
Purpose	This indicator measures the CSIR's technology development collaborations with industry partners with the intention to commercialise and industrialise.
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	• A signed joint technology development agreement. • Proof of joint activities, such as joint R&D outputs (R&D reports, papers, patents, computer aided design models, technology test reports, etc.); and • Proof of activities performed in the current financial year.
Data responsibility	Divisional and Cluster BD&C. Central Repository maintained by BEI: Institutional Planning.
Method of calculation	• Industry includes private sector and public sector corporations (SOEs) that have a direct impact on/contribution to the economy in terms of commercial operations, delivery of products, delivery of services, etc. These include, but are not limited to, the likes of Eskom, Transnet and Denel. • Number of signed agreements for joint technology development and implementation. • Number of active technology agreements in the current financial year.
Limitations	• This definition of the KPI does not differentiate between large joint projects involving many SET-base members and small teams. • This definition does not prescribe a minimum ratio of hours contributed by each party (this ratio will change as projects progress through TRLs).
Type of indicator	Output.
Exclusions	• Pure contract R&D where there is no joint team with an industry partner. • Projects where there is no specific product or process development with industry. • Projects done with government departments.

KPI 8: NUMBER OF SMMES SUPPORTED

Indicator Title	Number of SMMEs Supported
Definition	Support of SMMEs as described in the 2019 Revised Schedule 1 of the National Definition of Small Enterprise in South Africa (Government Gazette No. 42304 of 15 March 2019) under the National Small Enterprise Act, 1996 (Act 102 of 1996), read with the National Enterprise Amendment Act, 2003 (Act 26 of 2003) and the National Small Enterprises Act, 2004 (Act 29 of 2004) through the implementation of RD&I and technology interventions that contribute to SMMEs becoming more productive, efficient, and sustainable.
Purpose	The indicator measures the CSIR's contribution to socioeconomic development and industrialisation through the support of SMMEs.
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	• Signed agreement with the SMME; and • Proof of SMME status as per National Small Enterprise Act (from, e.g. Central Supplier Database (CSD) reports or a signed affidavit); and • Proof of work done or an acknowledgment of delivery of support by the SMME.
Data responsibility	CSIR clusters. Central repository maintained by BEI: Institutional Planning.
Method of calculation	The number of signed agreements with SMMEs. Assumption: even under third-party funding an agreement with a specific SMME should be in place.
Limitations	This is a proxy for impact measurement. Actual impact will only be available from SMME revenue, job growth, growth in number of SMME business contracts.
Type of indicator	Output.
Exclusions	Routine analytical services. Subcontracting of SMMEs, unless there is an agreement in place to do capacity development of the SMME to enable delivery.

KPI 9: NUMBER OF REPORTS CONTRIBUTING TO NATIONAL POLICY DEVELOPMENT

Indicator Title	Number of Reports Contributing to National Policy Development
Definition	Evidence-based policy development support provided to various arms of government.
Purpose	The indicator measures the CSIR's support to government with evidence-based policy development and decision-making that can benefit from a significant SET input.
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	• The policy report delivered; and • Acknowledgment of delivery of the policy report by the government department.
Data responsibility	CSIR clusters. Central repository maintained by BEI: Institutional Planning.
Method of calculation	Count of final reports related to new or updated policies received and accepted by the implementing government department. Work completed in the previous financial years but only signed-off in the current financial year will be counted.

Indicator Title	Number of Reports Contributing to National Policy Development
Limitations	The KPI as defined here does not account for: • All national policies that do not have the same level of complexity from a SET point of view; and • The effort put in by the CSIR (SET hours), some policy development projects require less input than others.
Type of indicator	Output.
Exclusions	• Development of internal policies for government departments, for example general human resources policies, quality management policies and general management policies. • Contribution to creation or updating of CSIR policies.

KPI 10: NUMBER OF STANDARDS DELIVERED OR CONTRIBUTED TO IN SUPPORT OF THE STATE

Indicator Title	Number of Standards Delivered or Contributed to in Support of the State
Definition	New or updated standards adopted by the state and SOEs that the CSIR has developed and delivered or to which it contributed.
Purpose	The indicator measures the CSIR's support for government policy and regulation through the development of standardised practice guidelines across economic and social sectors
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.
Data source / eligible evidence	• The standard delivered or contributed to; and • Acknowledgment of delivery of the standard by the government.
Data responsibility	CSIR clusters and portfolios. Central repository maintained by BEI Planning and Knowledge Management.
Method of calculation	Count of new or updated standards adopted by government. In the case of updated standards, significant changes from previous versions must be demonstrated. Examples of standards include interoperability standards, accessibility standards, products, or infrastructure standards. Work completed in the previous financial years but only signed-off in the current financial year will be counted.
Limitations	None.
Type of indicator	Output.
Exclusions	None.

KPI 11: NUMBER OF PROJECTS BEING IMPLEMENTED TO INCREASE CAPABILITY OF THE STATE

Indicator Title	Number of Projects Implemented to Increase the Capability of the State
Definition	The CSIR-facilitated implementation of technologies (CSIR-created or otherwise) that improve the efficiency of government, SOEs and South African universities.
Purpose	This indicator measures the number of projects that the CSIR implements on behalf of the state.
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable. Performance in excess of the target is a positive result.

Indicator Title	Number of Projects Implemented to Increase the Capability of the State
Data source / eligible evidence	• An active agreement with a government department/SOE/South African university; and • A progress report of the project being implemented on behalf of government institutions.
Data responsibility	CSIR clusters. Central repository maintained by BEI: Institutional Planning
Method of calculation	Number of projects the CSIR implements on behalf of the state.
Limitations	None.
Type of indicator	Output.
Exclusions	None.

KPI 12: TOTAL SET STAFF

Indicator Title	Total SET Staff
Definition	Number of CSIR staff qualified in the fields of SET.
Purpose	The indicator 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 equal to and above 95% of the target as acceptable.
Data source / eligible evidence	Number of SET staff extracted from PeopleSoft HR system.
Data responsibility	CSIR Human Capital.
Method of calculation	Head count of SET staff at the end of the financial year.
Limitations	Human Capital ensures the correct classification of staff in PeopleSoft.
Type of indicator	Output.
Exclusions	Bursars, visiting students/scientists and vacation work appointments.

KPIS 13 AND 14: PERCENTAGE OF SET STAFF WHO ARE BLACK AND FEMALE, RESPECTIVELY

Indicator Title	Percentage of SET staff who are black and female, respectively
Definition	Percentage of SET staff who are black (as per B-BBEE Act definition) and percentage of SET staff who are female, respectively. South African citizens who are actively involved in RD&I activities. As per B-BBEE Act definition, black South Africans are Africans, coloureds and Indians, who meet the following criteria: • Citizens of the Republic of South Africa by birth or descent; • Became citizens of the Republic of South Africa by naturalisation before 27 April 1994; or • After 27 April 1994 and who would have been entitled to acquire citizenship by naturalisation prior to that date.
Purpose	These indicators measure the degree of demographic transformation within the RD&I capacity of the organisation.
Performance assessment	• Performance is influenced by the growth in SET staff numbers and may be negatively affected if the target number of SET staff is not achieved. • The CSIR considers a performance within two percentage points from the target as acceptable.

Indicator Title	Percentage of SET staff who are black and female, respectively
Data source / eligible evidence	Number of employees who are classified as black, as a percentage of the total SET staff extracted from PeopleSoft system.
Data responsibility	CSIR Human Capital.
Method of calculation	The percentages of black South African and female South African staff of total SET staff at the end of the financial year.
Limitations	None – Human Capital ensures the correct classification of staff on the Human Capital database.
Type of indicator	Output.
Exclusions	None.

KPI 15: PERCENTAGE OF SET STAFF WITH DOCTORAL QUALIFICATIONS

Indicator Title	Percentage of SET Staff with doctoral qualifications
Definition	Proportion of SET staff who have a doctoral level qualification.
Purpose	The indicator measures the organisation's capacity to conduct and supervise quality research and to innovate.
Performance assessment	• Performance is influenced by the growth in SET staff numbers and may be negatively affected if the target number of SET staff is not achieved. • A performance within one percentage point from the target will be considered as acceptable.
Data source / eligible evidence	Number of SET staff with PhD qualifications as a percentage of the total number of SET staff extracted from the PeopleSoft system.
Data responsibility	CSIR Human Capital.
Method of calculation	The percentage of SET staff with doctoral level qualifications at the end of the financial year.
Limitations	None – Human Capital ensures the validity of data and that evidence of the qualification is on file.
Type of indicator	Output.
Exclusions	None.

KPI 16: NUMBER OF CHIEF RESEARCHERS

Indicator Title	Number of Chief Researchers
Definition	The number of CSIR staff recognised as Chief Researchers through the formal Career Ladder process.
Purpose	The indicator is a measure of the quality of SET capacity and their potential influence in the local and international RD&I spaces (capacity to collaborate and share resources).
Performance assessment	• Promotion or appointment at these senior research levels is based on growth in skill and proficiency as measured through the CSIR Career Ladder process. • A performance of equal to and above 90% of the target is considered acceptable.
Data source / eligible evidence	Total number of staff appointed as Chief Researchers as extracted from the PeopleSoft system.
Data responsibility	CSIR Human Capital.

Indicator Title	Number of Chief Researchers
Method of calculation	Count of the number of SET staff who are classified as Chief Researchers at the end of the financial year.
Limitations	None – Human Capital ensures the validity of data and that the required evidence is on file.
Type of indicator	Output.
Exclusions	Staff not recognised through the career ladder process.

KPIS 17 AND 18: PERCENTAGE OF CHIEF RESEARCHERS WHO ARE BLACK AND FEMALE, RESPECTIVELY.

Indicator Title	Percentage of Chief Researchers who are black and female, respectively
Definition	The proportion of black (as per B-BBEE Act definition) South African and proportion of female South African citizens who are Chief Researchers (as per CSIR's Career Ladder process). As per B-BBEE Act definition, black South Africans are Africans, coloureds and Indians who meet the following criteria: • Citizens of the Republic of South Africa by birth or descent; • Became citizens of the Republic of South Africa by naturalisation before 27 April 1994; or • After 27 April 1994 and who would have been entitled to acquire citizenship by naturalisation prior to that date.
Purpose	These indicators measure the level of demographic transformation within the Chief Researcher level.
Performance assessment	• Promotion or appointment at these senior research levels is based on growth in skill and proficiency as measured through the CSIR Career Ladder process. • A performance of within five percentage points from the target is considered acceptable
Data source / eligible evidence	Percentages of Chief Researchers who are black and female, respectively, are extracted from the PeopleSoft system.
Data responsibility	CSIR Human Capital.
Method of calculation	The percentage of black South African and female South African Chief Researchers at the end of the financial year.
Limitations	None – Human Capital ensures the validity of data and that the required evidence is on file.
Type of indicator	Output.
Exclusions	None.

KPI 19 NUMBER OF PRINCIPAL RESEARCHERS

Indicator Title	Number of Principal Researchers
Definition	Number of CSIR staff recognised as Principal Researchers through the formal Career Ladder process.
Purpose	The indicator is a measure of the quality of SET capacity and their potential influence in the local and international RD&I spaces (capacity to collaborate and share resources).
Performance assessment	• Promotion or appointment at these senior research levels is based on growth in skill and proficiency as measured through the CSIR Career Ladder process. • A performance of equal to and above 95% of the target is considered acceptable.

Indicator Title	Number of Principal Researchers
Data source / eligible evidence	Employees who have been appointed as Principal Researchers, as indicated on extracted from the PeopleSoft system.
Data responsibility	CSIR Human Capital.
Method of calculation	Count of the number of SET staff who are classified as Principal Researchers at the end of the financial year.
Limitations	None. Human Capital ensures the validity of data and that the required evidence is on file.
Type of indicator	Output.
Exclusions	Staff not recognised through the career ladder process.

KPIS 20 AND 21: PERCENTAGE OF PRINCIPAL RESEARCHERS WHO ARE BLACK AND FEMALE, RESPECTIVELY

Indicator Title	Percentage of Principal Researchers who are Black and Female, respectively
Definition	Percentage of principal researchers who are black South Africans and percentage of Principal Researchers who are female South Africans. As per B-BBEE Act definition, black South Africans are Africans, coloureds and Indians who meet the following criteria: • Are citizens of the Republic of South Africa by birth or descent; • Became citizens of the Republic of South Africa by naturalisation before 27 April 1994; or • After 27 April 1994 and who would have been entitled to acquire citizenship by naturalisation prior to that date.
Purpose	These indicators measure the level of demographic transformation within the Principal Researcher level.
Performance assessment	• Promotion or appointment at these senior research levels is based on growth in skill and proficiency as measured through the CSIR Career Ladder process. • A performance of within three percentage points from the target is considered acceptable.
Data source / eligible evidence	KPI information is extracted from the Human Capital database.
Data responsibility	CSIR Human Capital.
Method of calculation	The percentage of black South African and female South African Principal Researchers at the end of the financial year.
Limitations	None – Human Capital ensures the validity of data and that the required evidence is on file.
Type of indicator	Output.
Exclusions	None.

KPI 22: NUMBER OF STAFF INVOLVED IN EXCHANGE PROGRAMMES WITH INDUSTRY

Indicator Title	Number of staff involved in exchange programmes with industry
Definition	The exchange of staff between the CSIR and industry for a period of time to share/gain expertise for the advancement of business growth opportunities and capacity development.

Indicator Title	Number of staff involved in exchange programmes with industry
Purpose	The indicator measures the level at which CSIR shares expertise and resources to strengthen collaborations with industry to achieve organisational growth.
Performance assessment	The CSIR considers a performance equal to and above 75% of the target as acceptable.
Data source / eligible evidence	A signed transfer/secondment agreement.
Data responsibility	CSIR Human Capital.
Method of calculation	• Industry includes private sector and public sector corporations (SOEs) that have a direct impact on/contribution to the economy in terms of commercial operations, delivery of products, delivery of services, etc. These include, but are not limited to, the likes of Eskom, Transnet and Denel. • Number of staff involved in exchange programmes for a minimum period of one month.
Limitations	None – Human Capital ensures relevant data are captured.
Type of indicator	Output.
Exclusions	Exchange programmes with government departments.

KPI 23: INVESTMENT (Rm) IN PROPERTY, PLANT AND EQUIPMENT

Indicator Title	Investment in Property, Plant and Equipment (PPE)
Definition	PPE investment is the amount invested in CSIR and government grant-funded PPE, as well as qualifying leases (as per Accounting Standard on Leases) for a financial year.
Purpose	This indicator provides a measure of the CSIR's investment in research infrastructure to develop and maintain world-class facilities and equipment to provide the quality of RD&I that is expected of it.
Performance assessment	The CSIR considers a performance equal to and 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 / eligible evidence	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finance.
Method of calculation	Value of investment in PPE 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 PPE balance and to break this down among additions, disposals and depreciation. This breakdown is also disclosed in the year-end annual financial statements.
Limitations	None.
Type of indicator	Input.
Exclusions	Equipment that goes back to the third party at the end of the project and is not logged in the CSIR asset list.

KPI 24: TOTAL OPERATING INCOME (Rm)

Indicator Title	Total operating income
Definition	Total operating income includes revenue declared on R&D contracts (contract R&D income), income derived from licences and royalties, PG received through the Science Vote, and other income.
Purpose	The indicator reflects the ability of the CSIR to ensure financial sustainability. Growth in total operating income indicates 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 equal to and above 95% of the target as acceptable.
Data source / eligible evidence	Total operating income measured in South African rand extracted from the Income Statement from the CSIR financial systems.
Data responsibility	CSIR Finance.
Method of calculation	• The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. • The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None.
Type of indicator	Output.
Exclusions	Net finance income is not included in the definition of total operating income.

KPI 25: NET PROFIT (%TOTAL INCOME)

Indicator Title	Net Profit (% Total Income)
Definition	Profit for a financial year 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.
Performance assessment	• Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. • The CSIR considers a performance equal to and above 95% of the target as acceptable. • Reducing the budget target is a successful result and is not the consequence of an inappropriate target.
Data source / eligible evidence	The information for the financial KPIs is obtained from the CSIR financial systems.
Data responsibility	CSIR Finance.
Method of calculation	• The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. • The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None.
Type of indicator	Output.

Indicator Title	Net Profit (% Total Income)
Exclusions	None.

KPI 26: SA PUBLIC SECTOR INCOME (% TOTAL INCOME)

Indicator Title	SA public sector income (% Total Income)
Definition	South African public sector income is the total income earned from South African government departments (i.e. national, provincial and local), constitutional entities, and public entities (as listed in the schedules to the PFMA). This includes revenue declared on R&D contracts (contract R&D income), directed/ring-fenced PG received through the Science Vote and any other forms of funding received from South African public entities.
Purpose	South African public sector income reflects the degree of public sector investment in the CSIR.
Performance assessment	• The CSIR's annual target is the percentage of South African public sector income included in the annual total operating income budget, which the CSIR aims to achieve or reduce. • Future targets are set to ensure increased income diversification and impact in other sectors. • The CSIR considers a performance equal to and above 95% of the target as acceptable.
Data source / eligible evidence	The total income received from South Africa public organisations, as a percentage of total income, obtained from the PeopleSoft financial system.
Data responsibility	CSIR Finance.
Method of calculation	• The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. • The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None.
Type of indicator	Output.
Exclusions	None.

KPI 27: SA PRIVATE SECTOR INCOME (% TOTAL INCOME)

Indicator Title	SA private sector income (% Total Income)
Definition	South African private sector income is the total income earned from South African non-public entities (not listed as public entities in the schedules to the Public Finance Management Act and the Municipal Finance Management Act). This includes not-for-profit organisations. Licences, royalties and interest income is not included in the definition of South African private sector investment.
Purpose	South African private sector income reflects the degree of private sector investment in 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 equal to and above 95% of the target as acceptable.

Indicator Title	SA private sector income (% Total Income)
Data source / eligible evidence	The total income received from South African private organisations, as a percentage of total income, obtained from the PeopleSoft financial system.
Data responsibility	CSIR Finance.
Method of calculation	• The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. • The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None.
Type of indicator	Output.
Exclusions	Licences, royalties and interest income are not included in the definition. Income from government departments.

KPI 28: INTERNATIONAL CONTRACT INCOME (% TOTAL INCOME)

Indicator Title	International contract income (% total income)
Definition	International contract income is the total income earned from foreign customers (i.e. entities incorporated outside the borders of South Africa). This includes revenue declared on R&D contracts (contract R&D income) and other income received from foreign entities.
Purpose	International contract income reflects the global relevance of the CSIR. Growth in international investment is a key indicator of income diversification, as well as the relevance and impact of the CSIR within the global economy.
Performance assessment	• Performance on financial KPIs needs to be assessed in the context of the prevailing economic climate. • The CSIR considers a performance equal to and above 95% of the target as acceptable.
Data source / eligible evidence	• The information for the financial KPIs is obtained from the CSIR financial systems. • The total income received from foreign organisations, as a percentage of total income, obtained from the PeopleSoft financial system.
Data responsibility	CSIR Finance.
Method of calculation	The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None.
Type of indicator	Output.
Exclusions	Licences and royalties received from foreign entities are not included in the definition of international contract income.

KPI 29: B-BBEE RATING

Indicator Title	B-BBEE rating
Definition	A B-BBEE rating is a verification certificate issued by a SANAS-approved verification agency that determines the CSIR's contribution to black (as per B-BBEE Act definition) economic empowerment.

Indicator Title	B-BBEE rating
Purpose	The indicator is a measure of the CSIR's compliance to the B-BBEE Act in its contribution to support socioeconomic transformation in South Africa.
Performance assessment	The CSIR would not consider failure to reach a target because of amended Codes of Good Practice targets as a negative result. Improving on the target is a successful result.
Data source / eligible evidence	B-BBEE certificate from a SANAS-approved verification agency.
Data responsibility	CSIR Procurement Office.
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 regarding a number of measurements as indicated in the B-BBEE Codes of Good Practice. The B-BBEE rating is a composite score that is made up of the following components: • Management and control. • Skills development. • Preferential procurement. • Socioeconomic development; and • Equity ownership.
Limitations	The external audit ensures that there is no subjectivity in the B-BBEE assessment.
Type of indicator	Output.
Exclusions	As the CSIR is a government business enterprise, equity ownership does not contribute to the B-BBEE rating score.

KPI 30: RECORDABLE INCIDENT RATE (RIR)

Indicator Title	Recordable Incident Rate
Definition	The Recordable Incident Rate (RIR) is the number of recordable incidences (or cases); multiplied by 200 000; divided by the number of hours worked. A recordable incident is a work-related injury or illness that results in one or more of the following criteria: • Death; • Loss of consciousness; • Restricted work or transfer to another job; • Days away from work; and/or • Medical treatment beyond first aid.
Purpose	• RIR indicates the effectiveness of the health and safety management system within the organisation in a year. • The CSIR SHEQ policy seeks to establish an effective, accountable and transparent framework for managing, maintaining and implementing SHEQ within the organisation.
Performance assessment	The CSIR aims to achieve its annual target of an RIR less or equal to 0.6 (equivalent to 20 recordable incidents/ cases) through identifying health and safety risks and implementing proactive health and safety interventions to reduce the number of recordable incidents/ cases.

Indicator Title	Recordable Incident Rate
Data source / eligible evidence	• Statistics of the recordable incidents that occurred at the CSIR, obtained from the SHEQ sub-portfolio. • The information for the health and safety KPIs is obtained from the CSIR SHEQ systems.
Data responsibility	CSIR SHEQ.
Method of calculation	The RIR is an indication of the percentage of employees exposed to work related injury or illness and classified as recordable incident per year. It is calculated by the number of recordable cases multiplied by 200 000 divided by the number of hours worked.
Limitations	None.
Type of indicator	Output.
Exclusions	None.

KPI 31: AUDIT OPINION

Indicator Title	Audit Opinion
Definition	The Auditor-General defines a 'clean audit' as achieving an unqualified audit opinion on the audits of annual financial statements and pre-determined objectives, as well as not having material findings on the audit of compliance with laws and regulations.
Purpose	The indicator is a measure of CSIR's accountability and governance.
Performance assessment	The CSIR would like to maintain a clean audit outcome at the end of each annual audit.
Data source / eligible evidence	Report of the Auditor-General as published in the Annual Report.
Data responsibility	CSIR Finance.
Method of calculation	A clean audit is based on the overall opinion of the Auditor-General after the performance of the annual statutory audit.
Limitations	Data from the Auditor-General regarding the audit opinion are only available in the third quarter of the financial period. This KPI relates to the audit opinion of the previous financial year.
Type of indicator	Output.
Exclusions	None.

ANNEXURE B

ANNUAL PLAN: 2022/23

B.1 OPERATIONAL PLAN OVERVIEW

The RD&I priorities for 2023/24 are listed in table B1 below. In essence the programmes/projects include the development of new technological processes, decision support frameworks, product development, and diagnostic tools, amongst others. Outputs include publications, patents, technology demonstrators, and various processes such as field quantification and evaluation, and integration of systems and databases. The collaborations in these projects span across Government, private sector, and international partners.

Table B1: Strategic Research, Development and Innovation Initiatives for 2023/24

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
1. Chemicals				
1.1	Production of bio-based platform chemicals and products.	Various with some technologies reaching TRL 6	• Tech demos, publications and tech transfer	International partners, local universities, local industry
1.2	Development of methods for production of chemicals using green chemistry biocatalysis methods for industry.	Various TRL 3–6	• Tech demos and tech transfer	5 local universities (hub and spoke model), several SMMEs
1.3	Development of processes for production of biological products as replacements for harmful chemical products. Include probiotics and agri-biologicals.	Various TRL 3–6	• Tech demos, publications and tech transfer	Several universities, SMMEs
1.4	Development of processes for the manufacture of chemicals from sustainable raw materials.	Various TRL 3–6	• Tech demos, publications and tech transfer	Universities and SMMEs
1.5	Development of processes for the manufacture of biopharmaceuticals and enzymes used in biopharma synthesis.	Various TRL3–6	• Tech demos, publications and tech transfer	International technology partners
1.6	Development of continuous flow-based processes for the production of small-molecule active pharmaceutical ingredients	Various TRL3–6, with pipeline projects at TRL2–3	• Expression of Interest calls for co-development of processes, tech demos, publications,	Local and international universities (UP, SU, Wits, ICL, etc.)
1.7	Translational research to develop sustainable and environmental/skin-friendly functional ingredients for topical formulations.	2 products at TRL 6, wound healing product at TRL 4–5	• 2 tech demos, 1 publication, 2 SMMEs assisted	Local industry as well as HEIs (UP, NWU, Sefako Makgatho Univ, TUT)

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
1.8	Development of advanced delivery systems/carriers for biologics (i.e. biopharmaceuticals)	2 products at TRL 6	• 2 tech demos, 2 publications, 2 SMMEs supported	Several HEIs (e.g. UP, UCT); 2 industry partners
1.9	Developing delivery systems of labile active compounds by means of the supercritical fluid-based encapsulation technology	1 product at TRL 6	• 1 tech demo, 1 SMME supported, 1 publication	Stellenbosch University, and local industry
1.10	Development of biodegradable materials to replace single-use plastics (biodegradable mulch films and flexible films for medical applications).	Various TRL 6–7	• 2 tech demos, publications	Consortium with Elizade University (Nigeria), industry partners (Henrose Plastic; Berry and Spence)
1.11	Development of new nano/micro-composites and waste beneficiation technologies for industrial (automotive) applications.	TRL6 for Kaolinite-based polymer nanocomposites	• 1 tech demo, 1 license agreement with industry partner	Industry partners – KGPC
1.12	Development of a 'smart' gas nanosensor for early spoilage detection in food products to support rapid and early detection of spoilage.	TRL 4	• 2 tech demos, publications, 1 patent	Local universities (UFS, WITs, UniVen and UNISA), public sector (DARRLD, NMISA), BRICS partnership
1.13	Developing highly stable, sensitive, and specific gas sensors based on nanostructured materials for monitoring toxic gases, i.e. CH_4 for environmental safety.	TRL 4	• 1 tech demo, publications, 1 patent	Local universities (UFS and WITs), private sector (Denel/ INCOMAR Schauenberg), public sector (Department of Fisheries, Forestry and the Environment - DFFE)
1.14	Breath analysis using gas sensors to develop non-invasive disease detection systems.	TRL 7: Lung cancer detection, TRL 8: Breathalyser	• Publications, 2 tech demos	Local universities (TUT, WITs and UP), private sector (Kiara Health/ Innocom)
1.15	Lab-on-Chip Nano-Micro Manufacturing Facility to develop LOC-based devices supporting both academia and industry.	Various TRL3 to TRL5.	• 1 tech demo, 1 patent	Universities (US, UWC, UP, RU, Wits, MIH), International (TNO, THWAS, KIT) Local Industry (Nanosense4Life, Meditech, Pathcare, LifeAssay)
1.16	Development of technology and processes to manufacture graphene and its incorporation in polymers to achieve advanced materials, and in sensors to achieve advanced sensing capability.	Graphene production TRL7, Polymer nano-composites TRL6	• 2 tech demos	Collaboration already established with UN, UL and others will follow as we provide graphene to them. Industry: Steamboat and LumoSA want to license the tech. International: Versarien, 2Dtech.
1.17	Provision of materials characterisation, testing and analytical services to academia and industry.	N/A (routine analyses for clients)	• ISO 17025:2017 accreditation	Collaboration with 2 universities

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
1.18	Supporting the hydrogen economy through RD&I focusing on production of 'Turquoise Hydrogen' from biogas/ biomethane, development of hydrogen safety, codes and standards.	1 x TRL 3 (biogas upgrading), 1 x TRL 4 (green methanol), 2 x TRL 4–5 (turquoise hydrogen, sorbent materials)	• 4 publications, 1 tech demo, 2 international and 2 local conference presentations	International: 10 European institutions Continental (Africa) collaborations with 3 universities, 2 local, 4 industry/SMMEs
2. Advanced Agri and Food Cluster				
2.1	Development of extraction technologies to demonstrate local applicability of such technologies and formulation of innovative cannabinoids and formulation of cannabis-related products.	TRL 6	• 2 tech demos, 8 SMMEs supported	Private: Labat, Wits, UFS Public: DSI, TIA, DBSB, GDARD International
2.2	Development of complementary medicines, cosmetics and food products and assist companies to navigate the IKS regulatory framework to ensure compliance and that the benefits accrued from commercialising IKS-based products accrue to the indigenous knowledge holders.	TRL 4	• 2 publications	Private: THPs, Mashaba Herbs, Conoche, UFS, UKZN, Univ of Limpopo Public: DSI, TIA, IDC International
2.3	Addressing food waste in a circular economy model and post-harvest management technologies.		• 1 publication, 1 SMME supported	
2.4	Supporting industries along the agricultural value chain with actionable farm-level data or intelligence to enable precision agriculture and cost-effective business decisions (yield predictions, climate impact modelling, etc.) at all levels of the value chain.	TRL 7	• 2 tech demos, 5 publications, 2 SMMEs supported	Private: FarmSol, InnovBiz, Wits, UKZN Public: DSI, TIA
3. Next-Generation Health Cluster				
3.1	Identification of markers for antiretroviral-induced damage. Identification of proteomic signatures for early detection of chronic kidney disease as well as verification of protein signatures for gall bladder and pancreatic cancers.	TRL 7	• 3 publications, 1 tech demo	Private: Bio- Pharma (Biovac, NBI, CapeBiopharm), FACS SA, NHLS, Lancet Public: SA MRC, DSI, NRF, TIA International: B&M Gates, EU, UK

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
3.2	Establishment of automated high-throughput screening and workflows for the development of diagnostic arrays tools and platforms for communicable and non-communicable diseases.	TRL 8	• 3 publications, 1 priority patent filled, 1 SMME supported	Private: Discovery, mines, cannabis sector Public: Strategic DSI funding on precision medicine International: Strategic partnerships with BMG, Canada, UK
3.3	Development of a plant-expressed, PAPMV VLP-based platform for the targeted delivery of a conjugated biotherapeutic to multiple myeloma cells. Plant-produced SARS-CoV2 VLP vaccine validated in animal models.	TRL 8	• 2 publications, 1 priority patent filled, 1 SMME supported	Private: 3Sixty, Grayson Jockey Club Research Foundation (GJCRF), TIA, GALVmed (iVacBio) Public: SA MRC, DSI, TIA International: B&M Gates, EU, US, UK
3.4	Development of a prototype molecular diagnostic assays/kit for detection of Tilapia Lake Virus and Infectious Spleen and Kidney Necrosis Virus which cause significant mortalities in aquaculture farming.	TRL 4	• 3 publications, 1 tech demo	Public: SA MRC, DSI, TIA International: SADC
3.5	Establishment of digital precision medicine platform using genomics, proteomics, and microbiome. Bioengineered micro-liver screening platform.	TRL 8	• 3 publications, 1 tech demo	Private: Discovery Public: DSI, MRC, NRF, TIA International: Gates Foundation, Pharma (e.g., Novartis, Merck, Pfizer)
3.6	Establishment of drug repurposing platform for cancer precision medicine. Cancer Precision Medicine: Drug repurposing (blood and ovarian cancer) (Industrial Synthetic biology for Precision Medicine).	TRL 5	• 3 publications	Private: Discovery and biopharma Public: Strategic DSI funding on precision medicine and biofoundry; MRC, TIA, NRF International: BMG, Canada, UK, ICGEB, OWSD, Welcome Trust, Horizon Europe
4. Defence and Security Cluster				
4.1	Development of long range cameras (TYTO/RINO visible NIR, RINO in short wave) to accelerate the transition to safer communities through custom video surveillance and intelligence solutions.	TRL 7	• Improved software and improved reliability in performance.	SANParks, SANDF, RRS
4.2	Integrated face, body and number plate recognition. Smart CCTV for naval bases.	TRL 7	• System deployed in a user environment.	CCTV industry
4.3	K-line UAV technology for forest fire disaster management.	TRL 6	• Joint deployment with SMME	Industry and universities

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
4.4	Expand the INUNDU pod capabilities for local and international markets.	TRL 3	• First prototype ground testing	SANParks, SANDF, RRS
4.5	Expand the Optronic System Simulator capabilities for air-to-surface engagements	TRL 6	• Integration of Denel material databases	Industry
4.6	Expand electronic countermeasure trainer software for pilots to include use cases in association with pilots training curriculum.	TRL 6	• Joint deployment and testing with SMME	Industry and universities
4.7	70 mm rocket 70 mm surrogate Localisation	TRL 6	• Field evaluation	Defence industry
4.8	Lightweight tactical vehicle TIU 2nd generation	TRL 6	• Field evaluation	Defence industry
4.9	TEM LTL LTL surrogate Crowd management	TRL 7	• Qualification	
4.10	Understanding and supporting the operational context of the soldier through innovation for SA Army boots and uniform renewal.	TRL 7	• Rollout	Dick Whittington, Da Gama Textiles
4.11	Multiplatform vehicle.	TRL 7	• Evaluation	Defence industry
4.12	APC Turret.	TRL 7		Defence industry
4.13	9mm ammunition test evaluation and selection.	TRL 9*	• Acquisition support	
4.14	CIT Vehicle replacement strategy phase 2.	TRL 9*	• Acquisition support	
4.15	Social network analysis. Intelligence-led operations.	TRL 4	• Publication, tech demo submission	UP
4.16	IDC mission controller.	TRL 7	• Tech demo	DoD
4.17	Flood risk management using a Bayesian network.	TRL 3	• Publication	UP, KZN, OP
4.18	Smart asset management solution.	TRL 5	• Publication	
4.19	Development a smart warehouse management system.	TRL 7	• Publication	DoD

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
4.20	Develop and test a minimum viable product for small UAV (<100kg class) powered by hydrogen fuel cells.	TRL 6/7	• Flight testing	Industry, Denel, IFAR
4.21	Develop, test, and qualify a locally developed hydrogen fuel cell propulsion unit for UAVs.	TRL 8	• Integrated into UAV as sole propulsion unit and flown	Industry, state, IFAR
4.22	Develop and test a launcher for high-performance target drones.	TRL 7	• Tech demo	Industry, Denel
4.23	Develop and test engineering development model for flight control system in fixed-wing UAVs.	TRL 8	• Tech demo	Industry
4.24	Development of surveillance radar systems (ILOVANE)	TRL 4	• System prototype	Hensoldt, state entities
4.25	Development of surveillance products using UAV synthetic aperture radar.	TRL 6	• System prototype	Industry, international
4.26	Development of spaceborne synthetic aperture radar.	TRL 4	• Engineering model, key technology	Industry, international
4.27	Develop to maturity and commercialise the CSIR passive radar technology into a product for air traffic control.	TRL 6	• User Requirement Specification as reference specification product for passive radar	Industry, state entities
4.28	Electronic warfare mission support system development.	TRL 4	• Minimum viable demonstrator	Industry
4.29	Electronic warfare test (Integrated airborne, surface and lab-based), evaluation and training on Inundu & Enigma.	TRL 6	• Enigma: Critical Design Review • Inundu: Minimum viable demonstrator subsystems	Industry, International
4.30	Advanced adaptive jammer/electronic attack technology demonstrator for protection against radar guided weapons systems.	TRL 2	• Detail design supported by simulations models	Industry, International
4.31	Advanced design, manufacturing and innovative technologies for the Special Operations (Armed Forces) environment.	TRL 4	• Tech demo	Defence industry
4.32	Enhance the protection of a deployed operator in a complex battlespace.	TRL 6	• Tech demo	Defence industry
4.33	Enhance mobility in the Special Operations (Armed Forces) environment.	TRL 9	• Operational product	Defence industry
4.34	Improve communication in the Special Operations (Armed Forces) environment.	N/A	• Product	Defence industry

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
4.35	Energy source generation in the Special Operations (Armed Forces) environment.	TRL 3	• Publication	Defence industry
4.36	Development of unmanned and autonomous systems for the Special Operations (Armed Forces) environment.	TRL 4	• Publication	Defence industry
4.37	Establishment of virtual reality testbed for Special Operations (Armed Forces) technologies.	TRL 4	• Tech demo	Defence industry
4.38	Establish and maintain integrated capabilities for integrated safety and security.	TRL 6–9	• Publication, policies	CSIR Security SAPS (Regulator/GSSC) SARB Transnet Corporate PSiRA
4.39	Development of Cerebus – a data processing ecosystem for public and private intelligence applications.	TRL3/4	• Mature frameworks (process/ procedures/ models/protocols) • Implement secure collaboration platform	Various CSIR stakeholders
5. Manufacturing Cluster				
5.1	Point-of-care medical device development & industry support.	Various TRL4 to TRL7	• TRL7 cardiology probe for point-of-care testing (Cardiflo) • Machine learning algorithm for signal quality implemented on commercialised fetal system (Umbiflow) • 6 medical device SMMEs supported in the regulatory space • Targeting new mobile app development opportunities	Medical device & diagnostics innovation cluster programme (MeDDIC, funded by TIA), SA Medical Research Council, SEDA, DSBD, SABS, UP, UCT, Lodox, medical SMMEs, Gates Foundation
5.2	Sonar R&D / logistical support to the SA Navy, development of exportable sonar systems.	Various TRL3 to TRL6	• Synthetic aperture array sonar system and an underwater communication system • Localisation of outboard cable manufacture for naval platforms • TRL5 prototype sonar array for use on underwater vehicles for overseas OEM application	South African Navy, Armscor / Institute for Maritime Technology, MECS-ECA (SA/French), UJ, UCT, Cybicom Atlas Defence

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
5.3	IoT sensor platform and sensor development targeted at mobile / distributed sensing applications.	TRLs 3–5	• Distributed acoustic sensing TRL4 prototype for powerline inspection • TRL4 IoT sensor package to demonstrate remote pylon monitoring	Eskom, Transnet, UJ, TIA
5.4	Development and commercialisation of a large preproduction additive manufacturing machine in collaboration with industry, as well the development of a number of market segments for its printed parts, especially spare parts (digital inventories).	TRL 6–7	• Completed pre-production machine established markets for local metal additive manufactured parts	Anglo American, Aditiv Solutions, Paramount, NACAAM, CPAM
5.5	Additive manufacturing of spare parts for the mining and automotive industries.	TRL 9	• Regular supply of 3D printed spare parts to various industries	Anglo American, Aditiv Solutions, Paramount, NACAAM, CPAM
5.6	Development of local laser shock peening. Technology to be fully industrialised and a commercial service offering for the defence, energy and mining sectors.	TRL 6	• Life enhancement solutions for high-wear surface components/parts.	PAR Systems, Eskom, Barloworld, Caterpillar, Master Drill, NOV Technologies
5.7	Development of framework to structure the learning content in an effective, consistent and repeatable manner for the Learning Factory.	N/A	• Framework and new content offerings	merSETA, False Bay TVET, Impact Catalyst, Eskom, Siemens
5.8	Operationalise the Smart Factory through pilot assembly production, factory for assembly in B17A Pilot production of localised technologies/components/products.	TRL 4	• Factory commissioned	DSI, Siemens, Akacia Medical, Lodox
5.9	Expansion of cloud-based services.	TRL 6	• Expansion of Trackless Mobile Machinery (TMM) risk management service, automated QA services for welding, road safety services, Learning Factory services, patient healthcare data management	Minerals Council, SAIW, JA Engineering, Impact Catalyst
5.10	Development of low-cost robotic solutions for niche applications.	TRL 5	• Robotic arm development and industry implementation • Development and pilot of perimeter security patrol robot	JA Engineering, Eagle Technologies

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
5.11	Development and piloting of a low-cost Manufacturing Execution System (MES) for SMMEs.	TRL 6	• Refinement of MES in line with international standards • Software code baseline establishment with associated documentation • Local guideline for MES implementation	MESA, Siemens
5.12	Development of Optimisation Digital Twins tool for factories.	TRL 6	• Maturity assessment and benchmarking of a factory together with the implementation of 4IR technologies and automation • The optimisation of the factory using intelligent layout, modelling and simulation tools captured in a digital twin • Further refinement and optimisation using AI and machine learning; increasing the predictive behaviour of a process or production, leading to new business model and unknown flexibility	JA Engineering, Centurion Systems
5.13	The industrialisation of Metal Injection Moulding (MIM)	TRL 8	• Industrial debinding & sintering furnace commissioned and operating in the dedicated MIM Facility • MIM Facility proceeds with incubating an SPV (Special Purpose Vehicle), MIM.Co. • Conducting industry-led and industry-funded production of industrial components on a toll basis (two lead-user firms already identified)	Got Ya Hook, VUT, TUT, Coba manufacturing, Wagner systems
5.14	Development of die and tooling capabilities to enable design and manufacture to enable rapid product development	TRL 8–9	• Approved list of tooling facilities on supplier database and SLAs in place based on project (e.g. MIM demands) with several commercial tooling systems successfully implemented	TUT, tooling association of SA, Several commercial tool shops as per registered list on CSD

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
5.15	Establishment of dtic-funded Foundry Technology Centre at CSIR	Multiple casting projects at different TRL stages (TRL 4–8)	• Foundry technology centre established and opened by dtic minister • Industry-led and 4IR-enabled projects completed • Start-up foundry incubated	Rapid Casting Solutions
5.16	The Laser Loan Pool programme supports photonics-based R&D projects at local university through a competitive peer-reviewed process through the provision of access to researchers to CSIR owned equipment.	All projects are typically between TRL 1–3, some projects support can be at TRL 4	Laser loan pool programme supports • 10 projects • >10 peer-reviewed journals publications • >1 book chapters • >10 conference papers/presentations	South African universities and research institutions across Africa involved in photonics-based R&D activities
5.17	The African Laser Centre funds collaborative R&D projects in photonics and photonic applications between researchers from South Africa and the rest of Africa.	All projects are typically between TRL 1–3, some projects support can be at TRL 4	African Laser Centre • 15 research collaborations supported • 15 post-graduate scholarships • 2 knowledge exchange projects supported • 4 training events supported. • > 30 peer reviewed journal publications • >15 conference papers/presentations	South African universities and research institutions across Africa involved in photonics-based R&D activities
5.18	The Collaborative Programme in Additive Manufacturing (CPAM) supports a network of R&D partners active in RDI programmes in metal and polymer additive manufacturing, with projects covering the full innovation chain with the objective to increase the TRL of additive manufacturing as an advanced manufacturing technology.	Projects between TRL 3 up to TRL 6	Supporting 20 additive manufacturing-focused projects supporting more than 40 postgraduate (M and Doctoral) students annually, producing • 10 Doctoral and 20 MSc graduations • 20 peer reviewed journal publications • 30 Conference papers / presentation • 2 new patent filings • 6 technology demonstrators • 4 SMMEs supported through the CPAM SMME support programme	Research institutions throughout South Africa including industry partners active in additive manufacturing

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
5.19	Laser Engineering Services provides laser-based surface engineering solutions for refurbishment, performance enhancements and laser-based processing services as a fabrication technology to our industry clients.	All services are already at TRL9	• Commercialisation framework to allow the business opportunity to grow to its full potential	Industry partners
5.20	The Mechanical Testing Facility provides reliable, cost-effective support on CSIR-wide projects, including externally to industry/private clients.	All services at TRL8–9 (Accredited Facility)	• Increased support across all CSIR Manufacturing Cluster R&D projects, & commercialisation activities (AM, MIM, P&S, LES, LSP, HIP, PM-HIP, etc.) coupled with improved test methods/standards	CSIR Manufacturing Cluster & other, external/private clients
5.21	Laser systems for mining and manufacturing and sensing industries using a high-power industrial laser system developed for De Beers as platform.	TRL 6–9	• 1-2 lasers for de Beers, 1 laser for Additive Manufacturing and Defence, 1 laser for Marking, 1 laser for GasCAM (Uvirco)	De Beers, NAMPAK, ARMSCOR Uvirco
5.22	Using Optical Coherence Tomography (OCT) for non-destructive testing and measurements in gem beneficiation, fruit analysis, during and after additive manufacturing.	TRL 6	• Specialised OCT and software for 2 applications	State Diamond Traders University of Johannesburg, NLight.
5.23	Undertaking high-impact project implementation to enhance commercialisation for the export market. One local advanced manufacturing OEM utilising SMME supply chain for product development.	TRL 4–7	• Commercialised radar product for aerospace and marine application	Collaboration between advanced manufacturing industry OEM, SMME supply chain, CSIR
5.24	Developing local advanced manufacturing SMMEs through focused interventions to increase supplier development and export readiness (including product qualification and certification).	TRL 4–7	• SMMEs integrated into local supply chains that service an export market	Industry, industry associations, OEMs and the dtic
5.25	Development of technology strategy to address designated component and product supply for the South African advanced manufacturing market.	TRL 4–7	• Industry support projects to enable technology transfer to address designation requirements in advanced manufacturing	Industry, industry associations, OEMs and the dtic
6. Mining Cluster				
6.1	TMM Digital Twin is a digital risk profiling tool for Open Pit and UG Mines.	TRL 4	• Achieve TRL 5, 6 and 7	Mining industry

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
6.2	Development and implementation of competency-based immersive and experiential mine worker emergency response training to support mining extraction safety and efficiency.	TRL 5	• Implement new training modules incorporating virtual reality technology and mock mine	Mining industry
6.3	Data analytics applied to rope test database and rope visual inspection video analytics for improved insights in and prediction of rope life/deterioration.	TRL 4	• At least one on-mine video monitoring trail installation • Data analytics insights on rope life as a service offering	Mining companies.
7. Next-Generation Enterprises and Institutions Cluster				
7.1	AI-orchestrated intelligent spectrum management, developing the foundational capability in smart spectrum sharing using AI techniques.	TRL 5	• Researched & developed technologies for distributed AI-based intelligent spectrum management	DSI
7.2	Integrated Platform for Cloud and Network Architectures.	TRL2–5	• Developed network infrastructure sharing management system • Applied network slicing system architecture to infrastructure sharing • Added fog computing to the cloud platform • Containerised the network core functions • Verification of developed core features, integration to management systems and operational effectiveness	DSI, BIFN-C, UCT, UKZN, TUT, mobile operators, SMMEs (MVNO), UCT, UKZN, Liquid telecom, MEF

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
7.3	Cost-efficient open mobile network infrastructure supporting IoT applications.	TRL4–6	• Delivered initial open 5G platform to support telecoms industry (including SMMEs), regulators and academia • 5G open RAN testbed available for joint RDI with the NSI. • Intelligent RAN slicing technology • Peer-reviewed articles • Supporting local industry (SMMEs and big telcos) • Developed a first prototype of a physical layer energy-efficient antenna	DSI, mobile operators (Vodacom), UCT, UKZN, TUT, Sentech, BIFN-C, TIP (Facebook), Intel Corporation, Kutleng Engineering Dynamics (Pty) Ltd, Sentech (SoE), University of Fort Hare
7.4	Low-cost next generation cloud streaming with rural inclusion (distributed computing solution).	The system comprises 4 cloud container components that will be between TRL4 to TRL6 – system average at TRL5	• Content Brokering Service cloud container component technology demonstrator • Stream multiplier cloud container software at TRL4	DSI, ICT SMMEs
7.5	Developing capabilities in voice computing for the local resource-scarce languages to support the digital transformation of the country.	TRL2–5	• Suite of tools to facilitate manipulation of grammar objects, voice conversion for data augmentation and a system for the creation of speaker embeddings that will support voice conversion and multi-speaker TTS Speech scoring techniques for learner speech analysis incorporating advanced ASR acoustic modelling	DSI, DBE, HEIs
7.6	Implementation of the Rural Television White Spaces Network Operator Support Programme funded by the UNDP and the United Kingdom's Foreign Commonwealth Development Office (FCDO).	Implementation of our solution (TRL9)	• 7 SMMEs supported, connecting over 6 000 users in rural areas to the internet, created over 60 direct/indirect jobs	UNDP, United Kingdom FCDO (international), local SMMEs (~10)

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
7.7	Development of a Framework for Dynamic Spectrum Access and Opportunistic Spectrum Management that will allow efficient utilisation of national radio frequency spectrum resources to support the exponential growth of demand for data intensive applications and services.	N/A	• A white paper (or discussion document) on the adoption of a dynamic spectrum access framework for efficient spectrum utilisation and management beyond TVWS in South Africa	ICASA
7.8	Development of voice computing technology to support low resourced (African) language towards multilingual/ multispeaker text-to-speech voices, harvesting existing sources of speech data and speech corpus development, and wide coverage resource grammar for Nguni languages.	TRL5	• Framework architectures and models for TTS voice development • 50+ hours of transcribed speech data for all local languages and a speech corpus containing 100 hours of transcribed official speeches • An opensource computational grammar resource for isiZulu, and an initial version of a Siswati Resource Grammar	South African Centre for Digital Language Resources (SADiLaR), HEIs, GCIS, Saigen (SA SMME)
7.9	Development of voice computing technology to support early language literacy.	TRL 3	• Development of a mobile application that supports foundation phase literacy • Sentiment analysis for text-to-speech • Development of a language learning game that can be integrated with classroom teaching • An automatic speech recognition framework for supporting dictation • Computer vision and NLP4TTS resources that will support the verbalisation of bitmap images in documents opened by reading and writing application for education	DBE, HEIs, DSAC, Provincial Depts of Education, private schools, SMMEs involved in e-learning
7.10	Use machine-learning methods to develop tools for accelerating the discovery of new materials-property-process relationships.	TRL 6	• Publications, tech demos	DSI, Industry and HEIs

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
7.11	Apply multiscale modelling techniques to design new methods and technologies for beneficiating fine coal, potentially for use as briquettes in power plants and metallurgical industries.	TRL 6	• Patent	DSI, Industry and HEIs
7.12	Develop linkable quantum and classical mechanics models and simulation tool.	TRL 6	• Publications, tech demos	Industry and HEIs
7.13	Develop coupled DEMCFD models to predict greenhouse gas emissions from coal discard dumps.	TRL 6	• Publications, tech demos	Industry and HEIs
7.14	The Source Treatment Optimisation and Water Resource Management Decision Support Tool couples a water quality model with a cost optimisation algorithm to simulate and prescribe effluent pre-treatment levels to a network of waste water treatment plants prior to discharge into a natural water system.		• Web-based decision-support model	State entities
7.15	Joint development of a Disaster Response Operations Decision Support System aims to produce an effective databased decision support to resource planners for decision-making and an effective resource allocation in disaster management.	TRL 6	Several Technologies	Industry Joint technology development agreement signed in 2020/2021 with Midnite Aerospace Solutions
7.16	Customer Service Analytics Digital Platform collaboration with SENTECH in building a data analytics platform for customer services and social media analysis.	TRL 6	• Publications, Conference, tech demos	State entity
7.17	Development of the Motheo toolkit for extraction of data from various types of documents, audios, text files, PDF and present in a format usable for natural language processing or machine learning to derive insights from such data.	TRL 6	• Publications, Conference, tech demos	Audit firms, internal audit departments in public and private entities.
7.18	Development of Smart Transactive Microgrid/ A-IoT tools, techniques and systems to support an energy transition to resilient microgrid-based networks supporting energy transactions between prosumers designed for renewable energy integration.	TRL 0–3	• Transactive Energy Management System Context awareness system to manage digital counterparts Marketplace emulation with smart contracting and tokenised energy trade facility	DSI

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
7.19	The focus is on deep/machine learning, natural language understanding and AI bias, through the following projects: Decision-making platform, textual analysis and AI bias.	TRL 0–3	• A decision-making tool • An AI bias framework • A textual analysis system	DSI
7.20	Development of Augmented Reality Industry Solution for remote training with an emphasis immersive systems.	TRL 3	• An augmented reality tool for remote training	DSI, Mentorconsult
7.21	Development of digital ledger technology products & services.	TRL 0–3	• Trade & commerce tools for Metaverse • A self-sovereign identity application	DSI
7.22	Development of a pipeline of technologies to enhance mine safety to be licensed as products.	TRL 3–8	• Licensee for GoafWarn • MSDF at TRL4 • ITAD at TRL6	-
7.23	A 3D metaverse platform prototype space for conducting real-world activities in a virtual world such as training, healthcare, gaming, and general commerce.	TRL 3	• A virtual space for conducting real-world activities, Tools & infrastructure for enabling trade & commerce	-
7.24	Development of a 4IR-enabled Solar PV Electroluminescence Image Defect Detection and Classification tool	TRL 7	• An AI/ML algorithm that identifies and predicts defects on solar panels; the output is a decision-making tool	PVInsight
7.25	Digital Health for the National Health Insurance Information System to establish the foundational infostructure of a national Digital Health platform and the information systems required to implement the NHI.	TRL 9	• HNSF gazetted • New and operational versions of core technologies incl. HPRS for hospitals, MFL, Data Lake	NDoH, provincial govt, district health offices, public and private health institutions, NHLS, industry, NGOs, HEIs
7.26	The national oceans and coastal information systems. There are several decision-support tools within OCIMS.	Sea rescue and open data cube for marine to be at TRL 6/7	• Delivery of national systems and five decision-support tools, i.e. integrated vessel tracking; water quality, fishery and aquaculture support; sea rescue and coastal flood hazard	-
8. Smart Places Cluster				
8.1	Decision-support for local government and other role players with assessing the smart-readiness of a city and with making informed decisions related to the identification, planning and implementation of inclusive smart city initiatives.	N/A	• Impartial decision-support capabilities to develop smart interventions that are appropriate to their specific context	DSI, DCoG (CoGTA), SALGA, Anglo American Municipal Capability and Partnership Programme

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
8.2	The Urban Knowledge Exchange Southern Africa Initiative is an online knowledge repository and concomitant network of people and organisations designed to support and build a capable state to produce and maintain better quality cities, towns and villages in partnership with a wide array of other built environment stakeholders.	N/A	• The online repository to assist and support public officials, researchers and academics, professionals and practitioners, industry partners, and civil society members	DSI, SALGA, Anglo American Municipal Capability and Partnership Programme, all human settlements sector
8.3	Development of a modelling and simulation platform (CityPlan Scenario Planning) to support cities in land-use planning and optimising the location of facilities and services.	FaciliPlan: social facility accessibility and location optimisation platform – web-based application. TRL 6	Have the following functionality in the CityPlan suite of tools: • Data management app to manage the datasets feeding into the various applications • Link UrbanSim modelling outputs dynamically with the facility planning tool– • Integrate UrbanSim population growth outputs to the GreenBook population risk profiles to provide the GreenBook with a futures view– • Use UrbanSim modelling outputs on growth projections with revenue data to predict future city revenue	City Support Programme at National Treasury, City of Johannesburg and eThekwini Metro Gauteng province
8.4	(GreenBook 2.0) Planning support to cities on climate adaptation to develop and disseminate a unique combination of planning support tools, models, guidelines and strategies aimed at creating climate resilient, hazard resistant settlements.	MetroView version of the Green Book. Strat technology demonstrator submission for 2023/4 fin year at TRL 6	• Update the climate risk zone conceptual framework. Develop and implement the GB MetroView in two metros: eThekwini and Buffalo City	Santam, ABSA, CDRF, DigiCall, DFFE, eThekwini Metro, Buffalo City

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
8.5	(InvestMap) Regional economic development planning support all spheres of government with a regional approach to planning.	N/A	• Identify, collect and publish a host of fundamental spatial layers that support regional development online • Develop a database to collect both spatial data and organisational network information to see the location and links of development initiatives in specific geographic areas	The Impact Catalyst, Anglo American, DSI
8.6	Establishment of project management office for the Roadmap for Science, Technology and Innovation for Sustainable Human Settlement.	N/A	• Shape public and private sector partnerships and stimulate investment • Articulate a high-level framework for stakeholders to plan, reflect, invest and make decision and prioritise key initiatives • Set a strategic direction for coordinating and shaping human capital development • Articulate a research and development agenda	DSI, Departments of Human Settlements, Nelson Mandela University, ABT Association; Agrément SA; DFFE; DMRE; GBCSA; DWS; NHBRC; NMU; SALGA; TIA; WRC; and UKZN
8.7	Establishment of a Green Cement Pilot Plant for pilot scale geopolymer and metakaolin and other green materials demonstration, testing and business development for enhanced materials.	TRL 7	• Cementitious materials at a production volume of 30 tonnes per day • Access to small and medium concrete manufacturers to material for use in their concrete businesses • Tech demo of geopolymer concrete pavements, geopolymer bricks/pavers and geopolymer ready-mix	Samanjalo EcoTeq
8.8	Municipal Capability Partnership Programme is a collaboration with the respective municipalities to enhance the capability and experience of the people in leadership positions, in shaping the socioeconomic future of the municipalities to address challenges exacerbated by unique dynamics in mining towns, such as access to water, infrastructure sustainability, and service delivery in fast-growing towns.	N/A	• Support to 10 municipal partners in mitigating critical risks to service delivery related to mine closure, collaborate with municipal partners to improve service delivery and strengthen partnerships to address current and future development challenges	Anglo American 10 x local municipalities

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
8.9	Programme management for National Treasury ring-fenced funding for Research Infrastructure Project Investments in all divisions of the CSIR. [Future Pharma – Open Lab to support local pharmaceutical manufacturing; Learning Factory; Advanced Road Materials Testing Laboratories; and Model Hall.]	N/A	• Progress towards projects milestones, concept and design development, specifications, and tender preparations	All CSIR divisions
8.10	Advanced analytics and decision support for a) Enviro Risk and Opportunities Analysis toolkit b) Decision-support tools for business to advance the circular economy c) Development of a systems modelling platform to support environmental impact assessment.	TRL 3–TRL 5	Several Technologies	Plastic SA and Manufacturing, food and packaging sector industries, Wits, World Bank, UNIDO, Japan
8.11	A programme advancing integrated marine and maritime decision support through satellite and remote sensor technologies. Coupled with innovation to modernise environmental management and systems for 5th generation multipurpose ports. Together with an integrated approach to develop decision-support tools for -coastal city-based ecological infrastructure.	TRL 2–TRL 6	Several Technologies	Aquaculture Sector Industries, coastal municipalities, port owners in SA and West Indian ocean region, NMU, UKZN, Norce, West Indian Ocean countries, and European Union
8.12	Understanding the mechanisms that explain climate sensitivity of CO_2 fluxes in the Southern Ocean.	TRL 5	• Publications, HCD outputs	University of Cape Town (UCT)
8.13	Applying numerical climate models and simulating present-day climate variability and projecting future.	TRL 3	• Seasonal forecasting, long-range forecasting, Publications	University of Pretoria
8.14	Development of a DHM controller which assumes control of the water distribution network to manage water demand, pipe leakage, and remove any unnecessary pipe stress by using actuators (e.g. pumps and valves) to minimise disruptions and losses in water transfers.	TRL 6	• Tech demos, Publications, HCD outputs, Software as a Service (SaaS)	UCT, Magalies Water, Rand Water, Siemens, DBSA
8.15	Tailor-made a solution for the reclamation of drinking water and valuable minerals from acid mine water.	TRL 6	• Publication equivalents, mobile and modular pilot plant	Memcon, Exxaro, South 32, UCT
8.16	Recovery of nutrient, water and energy from wastewater treatment plants to support circular economy.	TRL 5–6	• Mobile and modular pilot plants, publications, tech demos	Johannesburg Water, City of Tshwane, ERWAT, Agricultural Research Council, University of Johannesburg

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
8.17	Development of the decentralised wastewater treatment packaged plant for small communities.	TRL 5	• HCD outputs, publications	Amanzi Water
8.18	To lead research in support of a just energy transition from a coal-based economy towards a sustainable, low carbon just energy future while supporting the development of SMMEs in regions most adversely affected.	N/A	• Publications, SMME support, international knowledge exchange	EWSETA, SAICA ED, University of Johannesburg, HSRC, GIZ, British High Commission, University of Stellenbosch, Mpumalanga government, Eskom, BMF Gauteng, AfD
8.19	Assist power system operators, network planners and microgrid developers in Africa with new frameworks for planning and operating networks and microgrids with high VRE shares. And to provide technical support to regulators and policymakers to respond to the energy transition.	TRL 6	• Publications • Tech demo: Costing tool for collector substation design for use by grid planners • National policy development: Input into integrated resource plan development/ updates on grid aspects • Inputs into standards and codes: NRS 097 updates and grid code updates	
8.20	To establish a state-of-the-art advanced technology research platform on the CSIR Pretoria Campus for testing, optimisation, pilot, and demonstration of modern energy storage technology.	N/A	• Publication equivalents; commercial services provided for cell and module testing; outdoor testbed detailed design and procurement	VITO, uYilo, University of Western Cape, Nelson Mandela University
8.21	To quantify the available renewable energy resources for policy determination, development, deployment and operation of cost-effective renewable energy technologies.	N/A	• Publication equivalents; continue supply of QC'ed data to the SA public sector in support of development of the renewable energy sector • Offshore wind resource measurement campaign	University of Stellenbosch; UFH; DMRE. Danish Energy Agency, World Bank, AfDB, PJC, SANEDI, ESKOM
8.22	To enable the deployment of demand response in the residential, commercial, and industrial sectors in South Africa as a flexible resource for reducing energy consumption and balancing energy supply and demand in constrained and high renewable energy penetration power systems.	N/A	• Publications; capability and skills development in detailed flexibility assessment methods	NCPC-SA, NREL, ESKOM, SANEDI, University of Stellenbosch, University of Johannesburg

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
8.23	Support the photovoltaic (PV) industry and the national grid by localising and developing: PV module quality and reliability testing for locally assembled and imported PV modules; accelerated stress testing methods to predict future performance of PV plants; 4IR machine learning system to detect and classify defects in EL images; technoeconomic modelling of PV + storage systems; optimisation of the CSIR commercial scale embedded generation PV systems; monitoring systems for long-term performance of PV systems.	TRL 7	• Publications • Pilot the TRL-6 EL defect detection system at one factory in South Africa • Pilot the cloud-based software for EL image defect detection and classification and a PV module test lab	PV insight, GEOSUN, TIA, ART Solar, Seraphim, SAPVIA; Wits, UFH, NMU, HU (Egypt)
8.24	To conduct modelling and technology development into Waste Heat Recovery, Power-to-Heat and Thermal Energy Storage systems to support industrial competitiveness.	N/A	• Publications • Case studies of WHR savings • SMME support • Guideline for WHR in an industrial sector	NCPC-SA, CERADVANCE; ESKOM, SIEMENS
8.25	To develop, host and provide consistent, periodic and transparent platforms that inform long-term integrated energy system insights and strategic direction at regional, national, provincial/state, district, city and institutional levels.	N/A	• Publications • Beta version of full-sector energy modelling framework for South Africa (national) • Version 1.0 of datasets for technologies	UCT ERC; KTR (Sweden); ESKOM; DMRE; IPP Office, CoCT, Stellenbosch Municipality, City of Tshwane, SAPVIA, SAWEA
8.26	Develop electrode materials for stimulating the battery manufacturing industries in South Africa and Africa to support the renewable energy, transport, and portable sectors; beneficiation of local graphite-based materials for use in the SA battery industry.	TRL 4, TRL 7	• Publication equivalents • SMME support • Mn and Ni rich cathodes processes at 10kg scale • lab-scale graphite treatment developed with private sector	Solzen Energy, NG Global Energy, AEVERSA, Steamboat, DSI Energy Storage Consortium, MINTEK, NECSA, IMR-China

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
9. Smart Mobility Cluster				
9.1	Provision of public transport systems design and creation of solutions to improve the performance of transport network operations and associated management systems.	TRL 2–8	• An established Transport Safety Laboratory dedicated to the investigation of transport users, infrastructure and environmental behaviour and elements that contribute to transport unsafety • Development of a Roadworthy Assessment Tool • Development of digital solutions for law enforcement in the Minibus Taxi Industry • The implementation of subsidised bus contracts	Regional and local and government departments, SOEs
9.2	Provide sustainable freight transport and sustainable infrastructure management solutions and systems.	TRL 2–8	• Development of a joint passenger-freight data portal, foundational for improved decision support as well as digitalisation of transport networks • Finalise the development of the DigiSol mobile application	Government departments and SOEs, private transport operators, industry, state entities, local industry, international
9.3	Smart logistics management for enhanced functioning of the national logistics system.	TRL 4	• Logistics observatory: Produce State of supply chains report	SMME farmers, SOEs
9.4	Road material testing	TRL 4–8	• Test methods/procedures • Standards and specifications • Alternative road construction materials, inclusive of binders (e.g. bitumen replacement) • Provision of routine and value-add laboratory testing services to industry • Product development and commercialisation	HEIs, local industry, regional and local and government departments, SOEs

No.	Programme/Project Description	Planned Technology Readiness Level by 31 Mar 2023	Planned Outputs 2023/24	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
9.5	Pavement design and construction to provide smart road infrastructure solutions that effectively address the accessibility and mobility needs in support of socioeconomic development.	TRL 4–8	• PADS/GAMES suite of software products, linked to SaaS • Advanced maintenance and construction technologies • Smart road technologies • Data capturing instruments/sensors • Publications	SOEs, international
9.6	Development of technologies and support systems that will improve the safety and efficiency of ports and protect coastal infrastructure.	TRL 4–8	Smart port and coastal Infrastructure technologies: • Detached breakwaters as a cost-effective alternative • Vessel Motion Forecast tool for the port of Ngqura, as well as for other ports in SA and elsewhere • IPOSS – Operational support to SA ports through the provision of wind, wave, tide and current data • Guide for local coastal authorities on coastal defence solutions (in collaboration with Coastal Systems) on a 'Working with and Working for Nature' guide for government departments and local authorities	SOEs, local industry, international, African ports

B.2 HUMAN CAPITAL DEVELOPMENT AND CAPITAL EXPENDITURE PLAN

B.2.1 Human Capital Development

To achieve the fourth CSIR strategic objective (SO4), the CSIR has adopted five strategic pillars aimed at aligning the Human Capital Strategy and operational planning with the CSIR Strategy, vision, mission, and values. The human capital strategic pillars and key initiatives to deliver on the SO4 objectives include:

Strategic Objective	Key Initiatives for 2023/24
Building A Diverse Talent Ecosystem and A Sustainable Future Supply	Entrenching talent management and succession planning initiatives; Continuing to improve the absorption of the student pipeline which is informed by a workforce skills plan; Reviewing and improving the e-Learning platform as part of the repositioning of the learning and development programmes to continue offering a blended approach to complement classroom learning; Enhancing the CSIR's skills development strategy through strategic partnerships with key stakeholders in the NSI with the focus on SETAs; Actively participating in outreach programmes specifically in rural areas to increase awareness of the CSIR and HC development programmes.
Strengthening Leadership and Deepening Professionalism	Implementing the Principal Researcher and Development Programme; Implementing the Capability Investment Development Programme; Enhancing the career ladders and introduction of support services career ladders; Implementing the new employment equity targets; Entrenching leadership and management development programmes to equip all levels of management, from supervisory to executive, with critical management competencies with a focus on succession planning; Implementation of the attraction and retention framework for Principal Researchers, Chief Researchers and SET women.

Strategic Objective	Key Initiatives for 2023/24
Improving Individual and Organisational Performance	Continuing to offer psychosocial interventions targeted at employee wellness to promote an engaged, healthy and performing workforce; Continuing to drive change management within the business and entrench the CSIR EPIC values, namely excellence, people-centered, integrity and collaboration; Continuous development and enhancement of skills and knowledge of our staff is imperative to ensure effective and efficient service delivery; Continuing with the implementation of the Climate Survey Response Action Plan to improve employee satisfaction and employee engagement.
Increased Efficiency and Effectiveness of HC Systems and Processes	Enhancing and automating HC processes; Implementing HC system's functionality for talent reviews, talent pools and succession planning; Enhancing and modernising the current HC system (PeopleSoft) with more functionality.
Advancing Women, Youth, and People with Disabilities	Implementing the developed attraction and retention framework concepts with the intention of reducing turnover of critical staff, including black and female researchers; Continuing to focus on the advancement of people with disability as per the CSIR's Employment Equity Plan targets; Leveraging on the establishment of the women's forum to support women's development agenda and implementing initiatives developed by women for a conducive working environment; Implementing initiatives by the Youth Forum to influence the strategic future of the CSIR. The CSIR advances the employment of people with disabilities and currently employs 1.8% with a target of 2%. The emphasis is on the employment of unemployed youth with disabilities in SET through the YES programme.

B.2.2 Skills Development:

The CSIR has mapped all the 21 SETAs against all 9 research Clusters and Portfolios. The engagement with SETAs to date has yielded 70% of MOUs/MOAs on skills development initiatives, research and future collaboration. The plan for the FY 2023/24 is to complete engagements with all the other SETAs and expand on the skills development programmes. Further to the above, the CSIR continues to engage with the NSA on MOU and support for funding of current and future skills development initiatives.

In addressing the the skills and capability gaps, the CSIR has partnered with the DSI and provided input to the critical and scarce skills list and the STI Decadal Plan.

B.2.3 Climate Survey

With the climate survey concluded in 2021/22, the focus in 2022/23 was the development and adoption of the climate survey response action plans. The implementation of the response plans has since commenced with internal CSIR teams, and more specialist interventions are designed and implemented in partnership with external partners and will continue in the 2023/24 FY. The interventions will include Values-based 360° Feedback, Pulse Survey, Focus Groups, People Analytics, and Team Effectiveness Interventions.

B.2.4 Corporate Social Investment (CSI)

The CSIR has a Corporate Social Innovation Programme as a flagship programme with a dedicated CSI Office within the organisation. The programme seeks to leverage employee volunteerism to address pressing socioeconomic problems through innovation projects, in line with the CSIR CSI Strategy, and deliver a positive lasting impact in communities. In 2023/34, the programme will continue with impactful projects aligned with the CSIR CSI Strategy.

B.2.5 The Youth Employment Services (YES) Programme

With the continued success of the YES programme, which has seen 145 unemployed youth being offered employment experience at the CSIR and partners since the inception of the programme, the focus will be on increasing the number of people with disabilities in the new cohort for the 2023/24 FY. The CSIR advances the employment of people with disabilities and currently employs 1.8% with a target of 2%. In this regard, all skill development programmes prioritise women, youth and people with disabilities candidates. The CSIR will continue with the appointment of unemployed youth through the YES programmes with a focus on increasing the percentage of people with disabilities to 2.5%.

B.2.6 The Sports Club

The CSIR sports club was relaunched in 2022/23 with a new operational model and exciting new offerings for both CSIR employees and external members of the community. The sports club focuses on promoting the physical, health and mental well-being of its members and offers collaboration opportunities between the CSIR and external stakeholders. For the 2023/24 FY, the sports club will endeavour to increase its membership and offer top-class services to the selected sporting codes such as road running, soccer, netball, squash, tennis, table tennis, hiking and golf.

B.3 FINANCIAL PLAN

It has been three financial years since the CSIR implemented a new strategy that is geared to deliver on the mandate and specifically, to support industrialisation. The COVID-19 pandemic had a negative impact on the organisation's plans to diversify its revenue by increasing private and international sources of income. The focus on private and international income is to reduce the financial risk associated with a significant reliance on public sector income. Diversification is expected to be driven by the new commercialisation strategy, which aims to derive more benefit from IP and technology that has been developed. This diversification of revenue streams will assist the organisation to become more financially strong in the future.

Capability development, human capital development and infrastructure investments are critical to the success of the new strategy. More government investment is required to respond more effectively to support various prioritised industry sectors with technology solutions.

Reduction in income because of adverse economic conditions (i.e., lower budget votes for government departments and public entities as well as private sector cutting down on discretionary spending which include R&D) is one of the key risks that impact on the organisation's ability to generate revenue.

The baseline Parliamentary Grant (baseline PG) for 2023/24 has increased with only 0.4% in comparison to the 2022/23 amount, this in real terms has decreased due to inflation and the numerous budget cuts that were effected by DSI/NT over the past few years. The 2023/24 figure (R856,1 million including VAT) is lower than the allocation for 2018/19 financial year (R874,1 million including VAT). This decline in PG remains a concern since the execution of our developmental mandate should always be adequately supported. It is of vital importance that the State continues to fund the R&D space and not see it as an expense, but rather as an investment into the future. Many successful countries have achieved their success through the continued investment in R&D In this regard, it would be beneficial if the PG allocation was positively reconsidered going forward.

In addition, CSIR would like to become the partner of choice for providing R&D activities to other State-owned entities, Government Departments and Municipalities, in line with its Mandate. In this regard the support of National Treasury is crucial to achieving this stated objective.

On 3 December 2021, the finance minister has published in the government gazette his approval to increase annual limits of financial guarantee facility to R922 million, R1.088 billion & R1.144 billion in 2022, 2023 & 2024 respectively. This enables the CSIR to take on more revenue generating opportunities.

The CSIR is budgeting for a net profit R11.5 million for the 2023/24 financial year. The financial performance is expected to improve over the Medium Term Expenditure Framework (MTEF) period, and accordingly the organisation has budgeted to earn profits of R19,6 million and R87,9 million in 2024/25 and 2025/26 respectively.

Conservative balance sheet practices, including working capital and cash flow management, remain important to enable the CSIR to invest in the scientific equipment and infrastructure required to support strategic objectives.
All financial resources are invested in line with the CSIR's mandate.

B.3.1 Revenue Growth

The CSIR has budgeted for the year 2023/24 an increase of 9.3% in total operating revenue on 2022/23 forecast (see Table G1). Contract income and baseline grant funding increase on a comparative basis (i.e. budget 2023/24 vs 2022/23 forecast) by 12.4% and 0.4% respectively.

Income from the South African public and private sectors as well as international contract income are budgeted to increase by 12.1%, 7.2% and 29.8% respectively when compared to the 2022/23 forecast.

Included in contract income from the South African public sector is the Cyber Infrastructure ring-fenced allocation from the DSI. These contracts have historically been reflected as such and are included as part of public sector income for comparative purposes. All necessary efforts are set to generate maximum possible revenue from the opportunities in the sectors that the CSIR supports.

B.3.2 Expenditure

Total expenditure is budgeted to increase in 2023/24 by 6.2% on 2022/23 forecast. Employee remuneration costs and operating expenses are expected to increase by 3.3% and 8.3% respectively, while depreciation budgeted to increase by 29.5%.

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

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

The CSIR continues to enforce strict cost containment measures have been implemented across the organisation.

B.3.3 Royalty income

Royalty income is budgeted at R1,7 million and is based on current registered license agreements. Royalty income is budgeted to increase by 54.5% from the 2022/23 forecast (R1.1 million).

B.3.4 Financial Sustainability

For the 2023/24 the CSIR has budgeted a net profit of R11.5 million against the 2022/23 forecast loss of R67.6 million. As indicated above the financial performance is expected to improve and the expectation is that the organisation will be profitable over the MTEF period.

Table G1 in Appendix G. provides the high-level CSIR statement of comprehensive income reflecting the forecast for 2021/22, the budget for 2022/23 and estimates for 2023/24 as well as 2024/25. A summary of parliamentary grant income for the MTEF period is provided in Table G7 in Appendix G.

B.3.5 Statement of financial position

A CSIR statement of the financial position for the MTEF period is provided in Table G2 in Appendix G.

One needs to consider the budgeted current assets of R1.9 billion, cash balance of R1.3 billion in conjunction with the current liabilities of R1.4 billion. The current ratio (current assets/current liabilities) is expected to remain at approximately 1.39.

B.3.6 Investment in property, plant and equipment

The budgeted investment in property, plant and equipment for the 2023/24 financial year is R 148 million (Table G5).

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

B.3.7 CSIR Subsidiary and authority to issue guarantee instruments

As depicted in the figure below, the CSIR has only one whole owned subsidiary (Technifin SOC Ltd) which is dormant and accounts for an insignificant portion of the total Group's budget.

The five-year authority to issue guarantee instruments is provided in Table G8 in Appendix G.

Figure B1: CSIR Subsidiary

B.4 ANNUAL AND QUARTERLY TARGETS: 2023/24

Table B2: Phased quarterly KPI targets

Indicator		Q1	Q2	Q3	Q4
SO1:	**Conduct RD&I, localise transformative technologies and accelerate their diffusion**				
KPI 01:	Publication equivalents	49	119	200	**408**
KPI 02:	New priority patent applications filed	0	0	3	**8**
KPI 03:	New patents granted	0	0	3	**8**
KPI 04:	New technology demonstrators	0	9	21	**56**
KPI 05:	Number of technology licence agreements signed	0	2	6	**18**
SO2:	**Collaboratively improve the competitiveness of high-impact industries to support South Africa's re-industrialisation**				
KPI 06:	Number of localised technologies	0	1	5	**15**
KPI 07:	Number of joint technology development agreements being implemented for industry	3	8	16	**30**
KPI 08:	Number of SMMEs supported	10	27	48	**90**
SO3:	**Drive socioeconomic transformation through RD&I that supports the development of a capable state**				
KPI 09:	Number of reports contributing to national policy development	0	4	9	**22**
KPI 10:	Number of standards delivered or contributed in support of the state	0	1	4	**9**
KPI 11:	Number of projects implemented to increase the capability of the state	6	18	33	**60**
SO4:	**Build and transform HC and infrastructure**				
KPI 12:	Total SET staff	1540	1556	1575	**1598**
KPI 13:	Percentage of SET staff who are black	67%	67%	67%	**67%**
KPI 14:	Percentage of SET staff who are female	38%	38%	38%	**38%**
KPI 15:	Percentage of SET staff with PhDs	21%	21%	21%	**21%**
KPI 16:	Total chief researchers	14	14	16	**16**
KPI 17:	Percentage of Chief Researchers who are black	14%	14%	19%	**19%**
KPI 18:	Percentage of Chief Researchers who are female	14%	14%	13%	**13%**
KPI 19:	Total principal researchers	181	182	186	**189**
KPI 20:	Percentage of Principal Researchers who are black	34%	34%	34%	**35%**
KPI 21:	Percentage of Principal Researchers who are female	20%	20%	20%	**20%**
KPI 22:	Number of staff involved in exchange programmes	11	16	21	**31**
KPI 23:	PPE investment (Rm)	28	81	100	**148**

Indicator		Q1	Q2	Q3	Q4
SO5:	**Diversify income, maintain financial sustainability and good governance**				
KPI 24:	Total income (Rm)	675	1 438	2 214	**3 104**
KPI 25:	Net profit (Rm)	-64.0	-38.0	-60.0	**11.5**
KPI 26:	SA public sector income (% total income)	56%	54%	55%	**56%**
KPI 27:	SA private sector income (% total income)	10%	11%	11%	**11%**
KPI 28:	International contract income (% total income)	7%	8%	8%	**9%**
KPI 29:	B-BBEE rating	1	1	1	**1**
KPI 30:	RIR	≤ 0.6	≤ 0.6	≤ 0.6	**≤ 0.6**
KPI 31:	Audit opinion	N/A	N/A	N/A	**Unqualified Audit Opinion**

ANNEXURE C
GOVERNANCE STRUCTURE

C.1 GOVERNANCE STRUCTURES

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

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

C.1.1 CSIR Board

The members of the CSIR Board are:

- Prof. Arnold van Zyl (Chairperson)
- Dr Thulani Dlamini (CEO)
- Prof Yunus Ballim
- Mr Vuyani Jarana
- Dr Christine Render
- Dr Vuyo Mthethwa
- Ms Jules Newton
- Mr. Maleke Matolong
- Mr. Mahesh Fakir
- Ms Michelle Govender

The CSIR Board has three sub-committees, namely, Research, Development and Industrialisation Committee, ARC and HRSEC. The members of these committees will be determined during February 2023.

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

Table C.1 - Board Member details

Age	Sex	Race	Qualifications	Years	Position(s) on other Boards
Prof. Arnold van Zyl (Chairperson)					
63	Male	White	**University of Cape Town** PhD (Engineering) MSc (Engineering) BSc (Engineering)	0	None
Dr. Thulani Dlamini (CEO)					
53	Male	Black	**University of the Witwatersrand** PhD Chemistry, Catalysis BSc (Hons) Chemistry BSc Chemistry **University of South Africa** Master of Business Leadership	6	Council Member: National Advisory Council on Innovation Board Member: Industry Advisory Board of the Faculty of Engineering and Built Environment United Nations Development Programme (UNDP) SA programme Tshwane University of Technology Institute for Future for Work

Age	Sex	Race	Qualifications	Years	Position(s) on other Boards
Prof Yunus Ballim					
66	Male	Indian	**University of the Witwatersrand** PhD MSc (Engineering) BSc (Civil Engineering) BSc Ichthyology, Zoology,	0	None
Mr Vuyani Jarana					
52	Male	Black	**University of Stellenbosch** Masters in Business Administration Hons in Business Administration **University of Transkei (Walter Sisulu University)** Bcom Economics Business Commercial Law	0	Executive Director Ilitha Telecommunications Ilitha Infrastructure Jarana Investment Holdings Non-Executive Director Enx Pty Ltd ECDC Teconica Telecommunications Related Party Company JBV Consulting Agency Council Member Water Sisulu University
Dr. Christine Render					
65	Female	White	**Leeds University (England)** PhD (Chemical Engineering) BSc Hons. (Chemical Engineering)	4	Partner Owner Team Consultation Pty (Ltd)
Dr. Vuyo Mthethwa					
54	Female	Black	**University of KwaZulu-Natal** PhD Student Governance MSc Industrial and Labour Studies BSc Hons BSc	4	Deputy Vice Councillor Durban University of Technology
Ms Jules Newton					
55	Female	White	**University of the Witwatersrand** BA (Education)	3	Non-Executive Director Inhlabathi Pty (Ltd) Executive Director and Shareholder Newton van Rensburg Properties Non-Executive Director Inhlabathi Pty (Ltd) Trustee Jeppe Trust

Age	Sex	Race	Qualifications	Years	Position(s) on other Boards
Mr. Maleke Matolong					
44	Male	Black	**University of North West** Master of Business Administration Bcom Accounting **Southern African Institute of Business** Accountant (SAIBA) BAP (SA) Associate Member The Chartered Institute of Government Finance, Audit and Risk Officers (CIGFARO)	0	Non-Executive Director Northwest Cricket Board
Mr. Mahesh Fakir					
61	Male	Indian	**University of London** MSc (Development Finance) **University of Durban** – Westville Master of Business Administration MSc **University of Natal** Post Graduate Diploma in Civil Engineering BSc (Civil Engineering) **ML Sultan Technikon** National Diploma	0	None
Ms Michelle Govender					
36	Female	Indian	**University of KwaZulu Natal** BSc (Electrical Engineering) **Engineering Council of SA** Professional Engineer **University of South Africa** Post Graduate Diploma: Applied Risk Management	0	Non-Executive Director Circle of Global Business Women – Pro Bono

C.1.2 Executive Management

Several changes have been made to the CSIR Executive portfolios to improve efficiency in the organisation and address:

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

To address these concerns and augment the impact of our key deliverables for organisational efficiency, the CSIR Executive portfolios have been consolidated and are now structured as follows:

- CEO – Dr Thulani Dlamini
- Finance – CFO: Mr Ashraf Dindar
- Business Excellence and Integration – Group Executive: Dr Kaven Naidoo
- Advanced Chemicals and Life Sciences – Divisional Group Executive: Dr Rachel Chikwamba
- Advanced Production and Security – Divisional Group Executive: Dr Motodi Maserumule
- Smart Society – Divisional Group Executive: Dr Sandile Malinga
- Human Capital and Strategic Communications – Group Executive: Mr Andile Mabindisa
- Legal Compliance and Business Enablement (LCBE) – Group Executive: Adv. Esmé Kennedy.

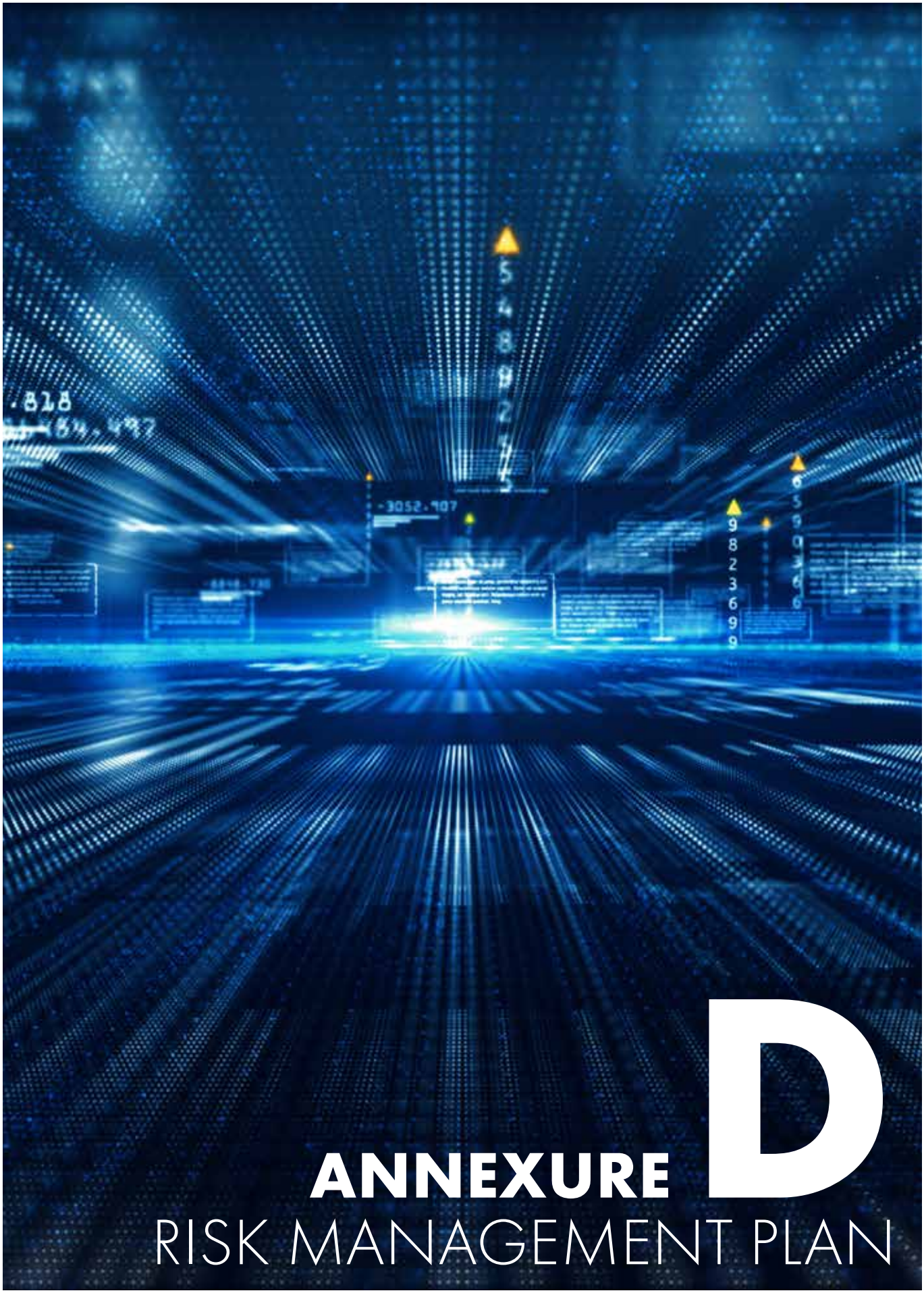
Table C2: Details of CSIR Executive Committee Members

Age	Gender	Race	Qualification	Years at CSIR Executive Level	Position(s) on other Boards
Dr. Thulani Dlamini (CEO)					
52	Male	African	*University of the Witwatersrand* PhD (Chemistry) *University of South Africa* Master of Business Leadership *University of the Witwatersrand* BSc (Hons) Chemistry *University of the Witwatersrand* BSc (Chemistry) 3 Yrs *University of South Africa* Programme (Business Leadership)	9 years, 10 months	• National Advisory Council on Innovation (NACI): Council Member • Industry Advisory Board of the Faculty of Engineering and Built Environment, Wits University: Board Member • United Nations Development Programme (UNDP) SA Programme: Board Member • Tshwane University of Technology (TUT) Institute for Future of Work: Board Member

Age	Gender	Race	Qualification	Years at CSIR Executive Level	Position(s) on other Boards
Adv. Esmé Kennedy – Group Executive: LCBE					
44	Female	White	*High Court of South Africa* Admitted as an Advocate *General Council Bar of South Africa* Admitted as member of the Johannesburg Bar *Potchefstroom University* LLB LLM (Import and Export Law) *North-West University:* Potchefstroom Business School MBA *University of Pretoria* B.Proc	4 years 4 months	*Trustee* CSIR Pension Fund *Director* Technifin *Professional Membership Institute* of Directors S.A.
Mr Andile Mabindisa – Group Executive: Human Capital and Strategic Communications					
52	Male	Black	*University of Natal* B Soc Sc (Hons) *University of Natal* B Soc Sc *University of Natal* Postgraduate Diploma in IR	3 years, 9 months	None

Age	Gender	Race	Qualification	Years at CSIR Executive Level	Position(s) on other Boards
Dr Motodi Maserumule – Divisional Group Executive: Advanced Production and Security					
54	Male	Black	***Rensselaer Polytechnic Institute (USA)*** PhD Mathematics Clark Atlanta University MSc Mathematics. Applied Math ***Morris Brown College*** BSc Mathematics ***IMD, Lausanne, Switzerland*** Mastering Technology Enterprise ***SA National Defence College*** Executive National Security Programme	5 years, 3 months	***Professional Membership*** Institute of Directors S.A. Society of Industrial and Applied Mathematics
Mr Ashraf Dindar – CFO					
53	Male	Indian	***Gordon Institute of Business*** Sciences (GIBS) Management Development Programme Global Executive Development Programme ***University of the Witwatersrand (WITS)*** BCom, BAcc Chartered Accountant (SA)CFO (SA) ***Global Institute of Leadership Development***	2 years, 6 months	***Trustee:*** CSIR Pension Fund Professional Membership: Institute of Directors S.A. SA Institute of Chartered Accountants SA Institute of Business Accountants Member of Global Workgroup on Digitisation And Automation

Age	Gender	Race	Qualification	Years at CSIR Executive Level	Position(s) on other Boards
Dr Kaven Naidoo – Group Executive: Business Excellence and Integration					
45	Male	Indian	*University of the Witwatersrand* PhD Aeronautical Engineering BSc Aeronautical Engineering *University of Pretoria* BEng Honours Mechanical Engineering *South African National Defence College* Executive National Security Programme	1 year	*Director* Students for the Exploration and Development of Space South Africa NPC Enterprise K2020192513 (STEM Education)
Dr Rachel Chikwamba – Divisional Group Executive: Advanced Chemicals and Life Sciences					
54	Female	Black	*Iowa State University* PhD (Genetics) *University of Queensland* MSc (Agricultural studies) *Gordon Institute of Business Science* MBA	11 years	*Member* Persomics AB Board African Union (AU) high-level committee on Science, Technology and Innovation Strategy for Africa 2024 (STISA 2024) *Director* Wits Health Consortium (Pty) Ltd *Advisory Board Member* Australian Center for International Agricultural Research Advisory Committee for the IBM Research laboratory Gauteng Provincial Government (GPG) 4th Industrial Revolution (4IR) Advisory Panel
Dr Sandile Malinga – Divisional Group Executive: Smart Society					
55	Male	Black	*Rhodes University:* PhD in Physics *The Netherlands Business School:* Master of Business Administration	0 years, 5 months	None



ANNEXURE D
RISK MANAGEMENT PLAN

D.1 RISK MANAGEMENT PLAN

D.1.1 Risk management philosophy

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

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

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

The CSIR Executive Committee and the Board of Directors (CSIR Board), acting through the ARC, will assess the CSIR risk philosophy on an annual basis, as well as report and implement any recommended and approved changes.

To eliminate uncertainty among employees and stakeholders about the policies and procedures that shape the CSIR's approach to risk management, the CSIR has developed and implemented a Risk Management Plan (RMP). A risk tolerance framework aligned with the RMP will continuously be assessed and defined in support of the strategic objectives and operating landscape of the CSIR.

D.1.2 Purpose of the RMP

The RMP is developed to support the successful implementation and achievement of the CSIR strategy, and to outline what risk management activities are necessary during the financial year. In addition, it aims to entrench a culture of risk management aligned with the CSIR's EPIC values. The development of the RMP for 2023/24 considers the CSIR Strategy and the annual performance plan.

Risk management, as set out in King IV, addresses a much wider spectrum of risk than in the past. In addition, the corporate governance drivers behind risk management today require new ways of reporting and monitoring risk exposures. Therefore, it is important to note that the RMP is an evolving instrument. The contents of the plan reflect the current risk management requirements of the CSIR. The document is reviewed and updated annually by CSIR Executive Committee, ARC and the CSIR Board.

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

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

D.1.3 Legislative context

The RMP is developed in line with the prescripts of applicable legislation and as amended from time to time, including but not limited to:

- The Public Finance Management Act, 1999 (Act 1 of 1999);
- Treasury Regulations issued in terms of the PFMA;
- The Scientific Research Council Act,1988 (Act 46 of 1988);
- Occupational Health and Safety Act, 1993 (Act 85 of 1993); and
- Labour Relations Act (LRA), 1995 (Act 66 of 1995).

The RMP also incorporates the requirements of the King IV report on good Corporate Governance, COSO framework on Integrated Risk Management, as well as ISO 31000 as best practice guidelines/framework on risk management.

D.1.4 Scope of application

The RMP applies to all business activities of the CSIR.

D.2 COMPONENTS OF THE RMP

The CSIR manages risk through a well-defined risk-governance model, commonly referred to as the five lines of assurance model. Each component of this governance model is defined through several supplementary organisational structures, guidelines, templates and implementation tools that provide clarity and enhancement for stakeholder use and ensure a single approach to enterprise-wide risk management. The governance model comprises the elements outlined below.

D.2.1 Risk governance model and framework

The CSIR adopted the five lines of assurance model when approaching risk management as outlined in Figure D1 below. This model is a revised version of the traditional three lines of assurance model as recommended by best practice.

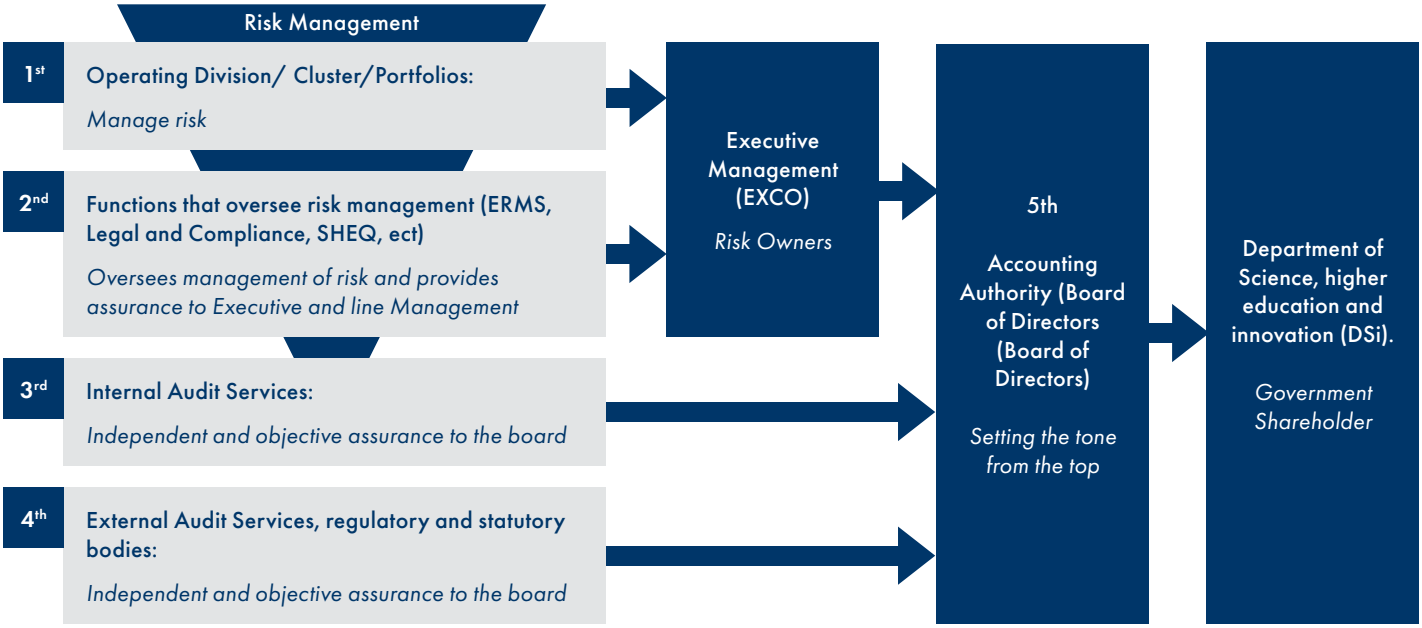


Figure D1: CSIR five lines of assurance model

As this model illustrates, the ownership and management of risk lies with those who undertake the operations within the organisation **(1st line assurance).** Operational staff are also responsible for implementing and maintaining effective internal controls, executing risk and control procedures on a day-to-day basis, and implementing corrective actions to address process and control deficiencies. They identify, assess, and mitigate risks, guiding the development and implementation of internal controls, policies and procedures and ensuring that activities are consistent with goals and objectives.

Enterprise Risk Management Services (ERMS) and other functions that oversee risk management **(2nd line assurance)** coordinate the management of risk in support of the risk owners (CSIR Executive Committee), who in turn reports to the CSIR Board. The latter retains ultimate accountability for risk governance. The Internal Audit function **(3rd line assurance)** provides independent assurance directly to the CSIR Board on the adequacy and effectiveness of internal controls, risk management frameworks, systems, and implementation.

The new five lines of assurance model recognises the external audit function as the **4th line assurance** providing an independent and objective assurance to the CSIR Board and the shareholder on the CSIR financial statements (statutory audit). The Auditor-General of South Africa is the statutory body performing this function.

Robust oversight by the CSIR Board and CSIR Executive Committee **(5th line assurance)**, establishes the cornerstone of effective risk management and set the tone from the top. To give effect to their fiduciary responsibility, the ARC supports the CSIR Board. The ARC is an oversight body delegated with the responsibility of implementing an effective risk governance strategy, supported by an appropriate risk management framework that include adequate control mechanisms to ensure effective risk management. The ARC also reviews the overall effectiveness of the risk management system, i.e. policy, framework, methodology, technology system, structures, response strategies, etc.

D.2.2 Risk management framework overview

The main elements of the CSIR's Risk Management Framework, as per the ISO 31000 standard, are reflected in the Risk Management Process depicted in Figure D2 below:

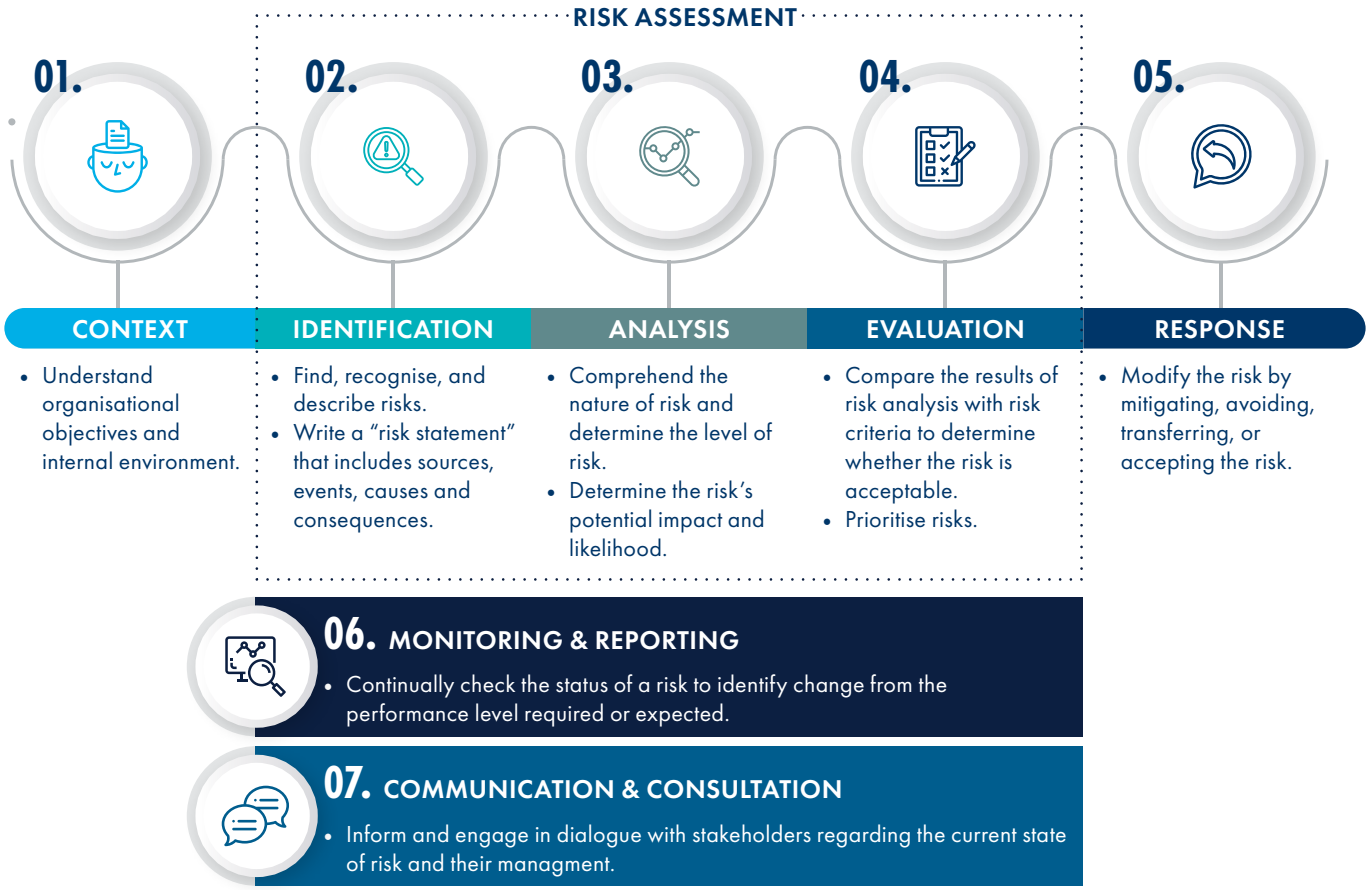


Figure D2: Risk Management Process

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

1. Establishing the risk context

Establishing the risk context entails analysis of the CSIR's external and internal operating environment which is considered when managing risk as per table D3 below:

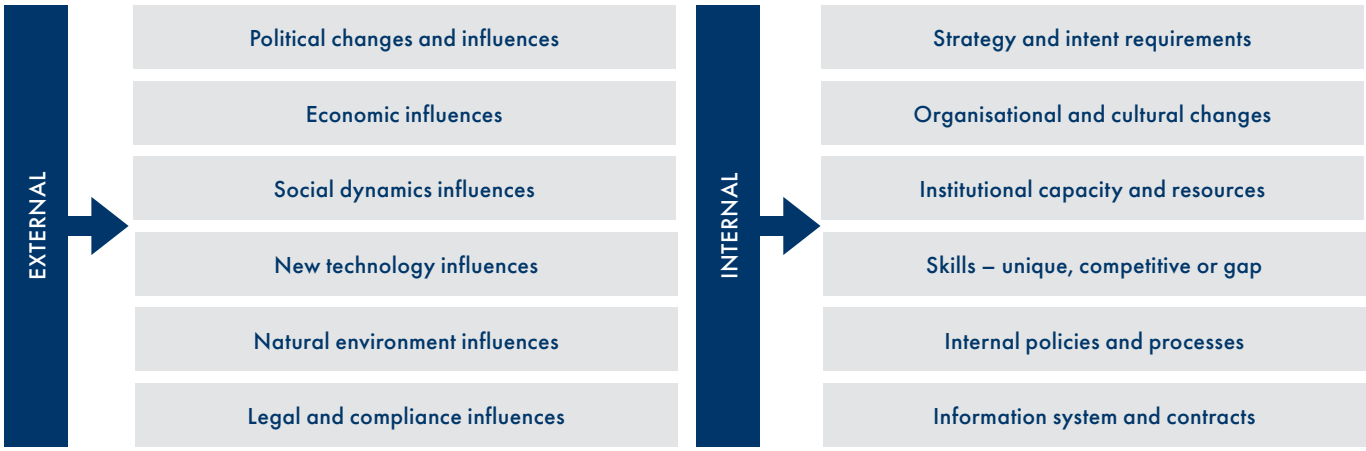


Figure D3: Risk context

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

2. The risk assessment process

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

3. Risk identification and categorisation

Risk identification involves the identification of risk sources and events, their causes, and potential consequences. Management meetings, strategy sessions, engagements with heads of operating divisions, clusters, research centres and portfolios are all part of the risk identification process.

4. Risk analysis and evaluation to determine prioritisation

The outcomes of the risk identification and classification processes are compiled into risk registers within each area of the organisation.

Risks are thus identified for each cluster or portfolio in the CSIR, with major risks reported to the next level, ultimately culminating in the formulation of the CSIR's top risks. This escalation process involves executive-level, in-depth analysis of risks that might not be identified at the level below, but which often represent the most critical risks for the organisation. All operational areas are required to compile and maintain a risk register, which is achieved through risk assessment workshops coordinated by ERMS.

Risk registers are reviewed and updated on a quarterly (as well as ad hoc) basis through meetings with the risk and control owners. After any strategic, policy, mandate or structural change, a risk assessment workshop is conducted to review and update the applicable risk register.

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

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

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

Annexure A to this document identifies the top organisational risks that have been identified through the top-down and bottom-up risk evaluation processes. The process is based on the following:

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

5. Risk mitigation

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

- **Tolerate/accept** – accepting the risk by keeping activities unchanged. This option is applied when exposure is tolerable, control is impossible, or the cost of control exceeds the potential benefit.
- **Treat/reduce** – adjusting (adding or revising) relevant activities.
- **Transfer** – sharing the risk by involving relevant stakeholders. This works well for financial risks, and risks to assets and includes securing conventional insurance or sourcing a third party to manage or undertake the risk.
- **Terminate/Avoid** – avoiding or cancelling the activities that give rise to the risk after considering the cost/benefit analysis.

6. Monitoring and Reporting

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

- Changes in the assessment of the risk;
- Changes to risks as forced by the macro environment;
- Suggested changes to the risk mitigation strategy;
- Progress made against the detailed action plans; and
- Any material factors from the internal and external environment.

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

Furthermore, the CSIR will utilise the OpCo forum to establish a focused agenda for a Risk Management, Compliance and Audit Steering Committee to steer and take responsibility for the CSIR RMP and to ensure the effective implementation thereof in support of combined assurance and ensure that key risks are being managed appropriately. It will also implement a fit-for-purpose, combined assurance operating model that will help the CSIR to effectively address its governance, risk management and compliance (GRC) agenda.

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

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

D.3 CONCLUSION

The CSIR proposes a proactive approach towards risk management and will continue to take the necessary measures to improve its ERM practices. The top risks identified for the CSIR during the 2022/23 financial year are depicted in Annexure A hereto. The CSIR's top risks are considered and updated quarterly to address risk movements and emerging risks and should be considered a living document.

ANNEXURE E
FRAUD PREVENTION PLAN

E.1 FRAUD PREVENTION PLAN

E.1.1 Background

The CSIR's FPP was developed in compliance with section 3.2.1 of the Treasury Regulations of the PMFA. The CSIR subscribes to the principles of good corporate governance, which require business to be conducted in an honest, ethical and transparent manner. Consequently, the CSIR is committed to preventing and eradicating fraudulent behaviour at all levels within the organisation.

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

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

The CSIR has zero **tolerance and zero appetite** for fraud and corruption. The organisation established a whistleblowing (i.e. protected disclosures) facility to support the efforts of this FPP. This facility is operated by an independent service provider on a 24 hours, 7 days basis.

In line with the Legal and Compliance portfolio's strategic business plan for 2022/23 and going into 2023/2024, the portfolio, working with the CSIR's Communications function, has been rolling out extensive training on the CSIR's FPMP and the Ethics Statement and Code of Conduct to all CSIR employees and other stakeholders. This portfolio has also been creating awareness on the existence, purpose and use of the whistleblower hotline. A comprehensive process of establishing a combined assurance model with other key role-players in the business to drive an adequate and effective GRC management capability is currently underway as part of the broader CSIR review of internal governance committees. The target date for the completion of the implementation of the revised governance framework is end 2023/24.

The FPP is a dynamic plan and will continuously evolve as the CSIR strives to continue promoting ethics and preventing fraud.

E.1.2 Purpose of the FPP

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

The primary objectives of the CSIR FPP are to:

- Provide guidelines in creating awareness of, preventing, detecting and reporting fraudulent activities within the CSIR;
- Create and encourage a culture within the CSIR where all stakeholders continuously behave ethically in their dealings with, or on behalf of the CSIR;
- Improve the application of applicable systems and compliance with applicable policies, procedures and regulations;
- Encourage all employees and stakeholders to strive towards the prevention and detection of fraud impacting or with the potential to impact on the CSIR;

- Encourage all employees and stakeholders to report suspicions of fraudulent activity without fear of reprisals or recriminations; and
- Provide a governance framework within which the initiatives that support the creation of awareness, enforcement and investigation of incidents, or suspected incidents of fraud and corruption, are implemented and overseen.

E.1.3 Legislative context

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

- The Constitution of the Republic of South Africa, 1996;
- The PFMA;
- Treasury Regulations issued in terms of the PFMA in April 2001;
- The Scientific Research Council Act;
- The Protected Disclosures Act, 2000 (Act 26 of 2000);
- The Prevention of Organised Crime Act, 1998 (Act 121 of 1998);
- The Prevention and Combatting of Corrupt Activities Act, 2004 (Act 12 of 2004); and
- All mandatory policies adopted by the Board of the CSIR contextualising legislative and related compliance requirements.

E.1.4 Scope of application

The FPP applies to all corruption, fraud, theft, financial misconduct and maladministration or suspected irregularities of such nature involving the following persons or entities:

- All members of the CSIR Board;
- All employees of the CSIR;
- Consultants, suppliers, contractors, collaborators, and sponsors and other providers of goods or services to the CSIR; and
- All parties representing the CSIR and its business activities in an official capacity.

E.1.5 Policy stance

The policy of the CSIR is one of **zero tolerance** to fraud and corruption. All alleged cases of fraud and corruption will be investigated and followed up by applying all remedies available to the full extent of the law. These measures include existing financial and related controls, implementation of appropriate prevention and detection measures and verification mechanisms as prescribed in the systems, policies, and procedures of the CSIR.

The CSIR seeks and intends to facilitate a culture of voluntary disclosure of information relating to suspected fraud and related misconduct by employees in a responsible manner. Employees and stakeholders are encouraged to report suspicions of fraudulent activity without fear of reprisals or recriminations.

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

The policy stance is currently encapsulated in the FPMP and various CSIR policies and procedures, including, but not limited to, the CSIR Code, the CSIR Conditions of Service, CSIR Disciplinary Code and Procedure, CSIR ICT Policy, the Information Security Policy, Conduct of Research Policy and the CSIR Ethics Hotline Procedure.

To support and enforce this policy stance, the Compliance function within the Legal and Compliance portfolio encompasses specialist roles in Business Ethics and Compliance Specialist, Privacy Specialist, and Governance and Company Secretariat reporting to the Manager: Compliance.

The Compliance function serves a management function primarily focused on devising, implementing and overseeing organisational processes to meet its statutory and regulatory obligations. The Compliance function's objective is to integrate legal analysis, design and implement appropriate controls and form part of the Combined Assurance Plan of the organisation. Compliance services focus on educating the Board, senior management and other employees, as well as preventing and rooting out misconduct, whether legal, ethical, criminal or otherwise. Upon its implementation, the Compliance function will serve as the dedicated custodian of fraud prevention, fraud risk management and the process that is adopted by the CSIR in putting mechanisms in place to manage the CSIR's vulnerability to fraud. Such mechanisms are designed to prevent, deter and detect fraud.

E.2 COMPONENTS OF THE FPP

E.2.1 Guiding principles

The FPP of the CSIR is based upon the CSIR's EPIC values of pursuit of 'Excellence', being 'People centred', personification of 'Integrity' and welcoming 'Collaboration'. The FPP places emphasis on Integrity. This principle is founded on honesty in business and other dealings, creating a culture of openness and disclosure, promoting the eradication of criminal, unethical and other irregular conduct and adopting a zero-tolerance approach towards fraud and corrupt activities.

This FPP applies to all allegations, attempts and incidents of fraud that have an impact on or with the potential to impact the CSIR.

All CSIR employees, management and other stakeholders must comply with the spirit and content of the FPP.

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

E.2.2 Components

The CSIR's FPP encompasses controls that have three SOs:

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

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

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

Fraud prevention is a business imperative, and a shared responsibility between management and employees. The FPP forms part of the Shareholder's Compact that is approved by the CSIR Board annually.

The components of the FPP are as follows:

- The CSIR's core organisational EPIC values;
- The Code;
- CSIR systems, policies, procedures, rules and regulations;
- The CSIR Disciplinary Code and Procedure;
- Internal controls to prevent and detect fraud;
- Physical and information security management;
- Internal Audit function;
- Ongoing risk assessments;
- Reporting and monitoring of fraud allegations;
- Creation of fraud and corruption awareness among employees and relevant stakeholders through communication and education;
- Continued establishment and maintenance of a combined assurance committee to steer and take responsibility for the FPP and its effective implementation; and
- Ongoing review of the FPP.

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

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

E.3 APPROACH TO FRAUD PREVENTION

E.3.1 Preventing fraud

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

1. The Code

The Code establishes clear guidelines for contracted and non-contracted stakeholders of the CSIR regarding the standard of conduct required in their internal and external dealings for and on behalf of the CSIR.

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

- Lack of buy-in or compliance with the requirements of the Code by management and employees or official CSIR representatives;
- Lack of awareness and/or inadequate communication and training strategy relating to the Code;

- Employees with low integrity and/or standards of professional conduct seeking to enhance personal benefit; and
- Strict compliance with and acceptance of gifts and strong disclosure elements.

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

- A hard copy and/or easy access to an online of the Code will continue to be circulated to all employees and CSIR representatives, and will remain part of the induction packs for new employees/representatives;
- In line with international trends and practices, in October of each year the CSIR will create greater awareness of the principles in the Code as part of the Global Ethics Month;
- Relevant aspects of the Code will be included in awareness presentations, training sessions and communication programmes to create awareness thereof among employees and relevant stakeholders. Further objectives of this training include the following:
  - Assisting stakeholders to understand the meaning of fraudulent and corrupt behaviour;
  - Presenting case studies to assist employees in developing behaviour to articulate and encourage attitudes and values that support ethical behaviour in all conduct; and
  - Communicating the implications of unethical behaviour and its impact for individuals, the workplace, professional relationships, the CSIR as a whole, external stakeholders and the public.

With the CSIR Manager: Compliance having been appointed in 2022/23, the Compliance function will continue with its responsibility for reviewing and reviving the relevance and implementation of the Code, its communication and supportive education.

2. Systems, policies, procedures, rules and regulations

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

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

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

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

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

In addition, the CSIR continues to undertake the following actions to mitigate the risks identified:

- A training programme on the Code, finalised in 2022/23 will continue to guide the CSIR activities on fraud prevention and management into the future. The activities take the form of in-person training, online tuition, CSIR Intraweb snippets and posters.
- Review of other CSIR policies that may be in conflict with the Code to bring them in harmony with the Code's core principles and prescribed procedures.

- Review of relevant CSIR policies to align them with the UN Global Compact and the UK Pact.
- Distribution of pocket-size and/or access to online copy, as the circumstances may demand, of a quick-reference booklet on the Code to employees.
- Internal audits and ad hoc risk assessments, either in accordance with a combined assurance plan or due to a perceived risk, will continue to be undertaken to monitor and evaluate the extent of compliance with policies and procedures. This exercise may also take the form of surprise audits in areas of the organisation identified as of high risk or strategic importance where an undetected incident of fraud could have seriously devastation effect.
- In instances where breaches occur, swift and appropriate disciplinary action will be undertaken to set an example to other potential wrongdoers.
- Staff and third party or stakeholder (security) vetting. This exercise involves checks on employment references, criminal records, civil judgement records, disciplinary records, insolvency enquiries, connection with other businesses, validity of qualification and the like on prospective employees. To this end the CSIR is in the process of acquiring an electronic tool for the conduct of due diligence exercises on all stakeholders with whom it engages. This will assist the CSIR in mitigating against the risk of reputational damage by association.
- A specific effort will be made to ensure that measures are put in place for the censure of suppliers and/or other providers of goods and/or services who are found guilty of unethical conduct or other irregularities. Any employee found to be colluding with suppliers will be subjected to immediate disciplinary action with a possible sanction of dismissal and/or personal liability for losses suffered.

3. Disciplinary Code and Procedure

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

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

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

- With the Human Capital department having reviewed and realigned the Disciplinary Code and Procedure with the principles of the Code by establishing specific offences emanating from the Code, the Legal and Compliance portfolio will continue with its training and awareness programme.
- Making sure all managers are aware of the content of the Disciplinary Code and Procedure, their responsibility for maintaining discipline, the standards of discipline expected of them, the procedure for the application of disciplinary measures and the disciplinary process through communication and awareness exercises.
- Ongoing training of managers and investigating officers with regard to the content of the Disciplinary Code and Procedures, the application of disciplinary measures and process, and sustaining this training in conjunction with the Compliance and Human Capital functions.
- The development of a system to facilitate the consistent application of disciplinary measures, e.g. a monitoring system that includes proper record keeping of all disciplinary actions taken.
- The development of a system where managers are held accountable for the management and addressing of misconduct and fraud within their areas of oversight.
- Implementation of a private and/or public recognition (as circumstances may demand) of those employees and other stakeholders who display conscientiousness by passing on information about fraudulent activities.

4. Internal controls

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

- Prevention controls: These are divided into two sub-categories, namely:
  - Authorisation; and
  - Physical.
- Detection controls: These are divided into four categories, namely:
  - Arithmetic and accounting;
  - Physical;
  - Supervision; and
  - Management information.
- Segregation of duties.

Prevention Controls

- **Authorisation:**
  All transactions require authorisation or approval by a responsible person with the appropriate authority limits. The authority limits are specified in the CSIR Approval Framework, the latter having been recently reviewed and approved by the Board.
- **Physical:**
  These controls are mainly concerned with the custody of assets and involve procedures and security measures designed to ensure that access to assets is limited to personnel who have been duly authorised, in writing. The CSIR Fixed and Movable Assets Policy governs the controls associated with the recognition, de-recognition, financing and transfer of assets.

Detection Controls

- **Arithmetic and accounting:**
  These are basic controls within the recording function that check that transactions to be recorded and processed have been authorised and that they are completely and correctly recorded and accurately processed. Such controls include checking the arithmetical accuracy of the records, the maintenance and checking of totals, reconciliation and accounting for documents.
- **Physical:**
  These controls relate to the security of records. Therefore, they underpin arithmetic and accounting controls. Their similarity to preventive controls lies in the fact that they are also designed to limit access to unauthorised persons.
- **Supervision:**
  This control relates to managers' supervision of day-to-day transactions and the recording thereof.
- **Management information:**
  This relates to the review of management accounts and budgetary control. These controls are normally exercised by management outside the day-to-day routine of the system.

Segregation of duties

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

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

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

In the context of fraud, segregation of duties lies in separating either the authorisation or custodial function from the verification function, thus introducing and maintain the vital checks and balances in the performance of fraud-prone obligations.

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

- The CSIR will continue to regularly re-emphasise to all managers that consistent compliance by employees with internal control is in itself one of the fundamental controls in place to prevent fraud. Managers will be encouraged to recognise that internal control shortcomings identified during the course of audits are, in many instances, purely symptoms and that they should strive to identify and address the causes of these internal control weaknesses.
- The CSIR will ensure that the performance appraisal of senior managers will take into account the number of audit queries raised and the level of seriousness of the consequent risk to the CSIR, as a result of the internal control deficiency identified. This is intended to raise the level of accountability for internal control by the Accounting Officer and managers. Where managers do not comply with basic internal controls, e.g. non-adherence to the limits of the CSIR Approval Framework, firm disciplinary action will be considered.

5. Physical and information security

- **Physical security:**
  Recognising that effective physical security is one of the 'front line' defences against fraud, the CSIR will take regular steps to improve it and access control at its sites of operation, in order to limit the risk of theft of assets. The CSIR will also conduct a regular review of the physical security arrangements at its offices and facilities and improve on weaknesses identified.
- **Information security:**
  The CSIR will ensure that employees are sensitised to the risks of fraud associated with poor management of information security on a regular basis, in order to enhance their understanding thereof and the risks to the CSIR associated with poor control over confidential information. The CSIR's efforts, through its ICT function, include continuous information security breach tests, simulations, and awareness.

Regular reviews of information and computer security will also be considered. Weaknesses identified during these reviews will be addressed with the respective managers. The CSIR Information Security Policy expresses the CSIR's position and intent to implement, maintain and improve its information security measures.

E.3.2 Detecting, reporting and investigating fraud

Detection controls are designed to discover any fraud or corruption as soon as possible after it has occurred. In spite of best practice prevention activities, fraud and corruption may occur. The next line of defence is a robust suite of detection strategies to discover any incident of fraud and corruption as soon as possible to minimise any detrimental impacts. The CSIR's detection controls include:

- Maintaining an effective system of internal controls;
- Review and approval of financial transactions;
- Review and approval of management reports;
- Internal and external audits;
- Monitoring and evaluation;

- Data analysis; and
- The CSIR Ethics Hotline Procedure to report allegations of fraud, corruption and unethical conduct.

1. Response

The CSIR's response strategies ensure that appropriate mechanisms are in place to:

- Take corrective actions;
- Minimise the impact of fraud and corruption risks;
- Improve prevention and detection strategies; and
- Report any occurrences to the relevant stakeholders.

All identified occurrences of fraud and corruption will be investigated in accordance with the principles enshrined in the Protected Disclosure Act, 2000 (Act 26 of 2000), the CSIR Ethics Hotline Procedure and this FPP. The principles include confidentiality, protection from victimisation, and the application of justice.

Key CSIR response strategies include:

- Investigation of all allegations of fraud and corruption;
- Central registry of all fraud and corruption allegations maintained, reported and monitored;
- Disciplinary procedure;
- Review of internal controls post incident;
- Implementation of corrective and preventative actions and recommendations;
- Recovery of losses through appropriate legal mechanisms; and
- Fidelity and employee dishonesty insurance.

2. Whistleblowing and protection of whistleblowers and the falsely accused

Based on the Protected Disclosures Act, the CSIR commits itself to guarantee protection to whistleblowers and stakeholders against victimisation and is intended to encourage and enable stakeholders to raise serious concerns without fear of victimisation. To ensure that the protection measures are effective, the hotline is administered by an outside third party that undertakes strict confidentiality. It is also important for the organisation to get the right CSIR professionals trained in, and who understand, professional privilege and confidentiality in the conduct of investigations and consistently taking disciplinary action against those who breach this confidentiality and privilege. These professionals are the legal counsel and privacy specialist within Legal and Compliance portfolio, and by virtue of their training and work appreciate the principles of confidentiality and legal privilege and the serious effects of a breach of these. Through education and screening reported cases to establish prima facie facts and evidence pointing to possible misconduct or breach of the Code and, where necessary, taking disciplinary action against any false accusers, the CSIR aims to limit incidents of abuse.

The protected disclosures set-up must also possess the ability to identify hoax calls or reports, and allegations that spring from personality clashes or possess political or racial undertones that do not by themselves seek to point to a suspected fraud and corruption incident. The identification of these is cardinal in ensuring the integrity of the hotline and to avoid wasting the organisation's resources on chasing wild geese.

E.3.3 Further implementation and maintenance

1. Creating awareness

This component of the plan comprises two approaches, namely education and communication. The strategic weaknesses identified in this area are as follows:

- Lack of a formalised strategy to create awareness among employees of the manifestations of fraud and the risks of fraud facing the CSIR; and
- Lack of knowledge of approaches to prevent and detect fraud in specific processes and transactions.

Key CSIR response strategies include:

- **Education:**
  The CSIR will ensure that regular presentations and formal training are carried out for employees to enhance their understanding of the manifestations of fraud prevention and detection techniques and the components of the FPP.
- **Communication:**
  Communication is crucial in creating awareness of the FPP among employees and other stakeholders. This is intended to facilitate a culture where all stakeholders strive to make the FPP a success and sustain a positive, ethical culture within the CSIR. This will increase the prospect of fraud being reported and improve the CSIR's prevention and detection ability.

The CSIR will consider various means of communicating its fraud prevention initiatives, some of which are already in implementation, including the following:

- Conducting workshops and creating awareness about the FPP;
- Developing a poster campaign aimed at all stakeholders to advertise the CSIR's stance on fraud and its expectations with regard to the ethics and integrity of all stakeholders;
- Circulating appropriate sections of the Code to other stakeholders and integrating by reference, giving a web link to, the Code into all contracts, e.g. consultants and contractors;
- Publicising 'lessons learned', following investigations into allegations of fraud among employees;
- Circulating successes related to the FPP and fraud modus operandi;
- Placing notices or other communiqués related to the FPP on notice boards and other areas to which employees and the public have access;
- Giving copies of the Code to suppliers of goods and services and seeking commitments from them, in writing, as a precondition to contracting with the CSIR;
- Developing promotional items communicating the FPP or components thereof; and
- Using the Intranet to communicate issues relating to the prevention and detection of fraud, including matters reported and action taken.

Combined assurance forum/committee

The CSIR has established an operationally based combined assurance collaboration forum to steer and take responsibility for the FPP and ensure the effective implementation thereof, in support of combined assurance and ensuring that key fraud risks are being managed appropriately in the CSIR.

The objectives of the combined assurance forum are mainly to:

- Identify and specify the sources of assurance over the CSIR's risks;
- Provide the ARC, HRSEC, Accounting Officer and Executive Management with a framework of the various assurance parties;
- Establish a combined assurance strategy and plan;

- Link risk management activities with assurance activities;
- Assist the Accounting Officer with reviewing the effectiveness of the risk management system; and
- Provide a basis for identifying any areas of potential assurance gaps.

The forum is responsible for the ongoing maintenance and review of the FPP, including:

- Evaluating reports of fraud and highlighting areas of risk within the CSIR;
- Considering fraud threats to the CSIR and addressing these;
- Monitoring action taken to implement recommendations relating to incidents of fraud;
- Steering and taking responsibility for the FPP;
- Reviewing and making appropriate amendments to the FPP;
- Continuous monitoring of the effectiveness of controls already in place and making improvements where necessary; and
- Ensuring that ongoing implementation strategies are developed and carried out.

2. Control environment

The CSIR's ARC and HRSEC significantly influence the fraud control environment, particularly by setting the tone at the top. This is done in the discharge of its duties in terms of the PFMA and Treasury Regulations.

The ARC and HRSEC systematically oversee and periodically review the internal controls established by the management of CSIR. Oversight extends to:

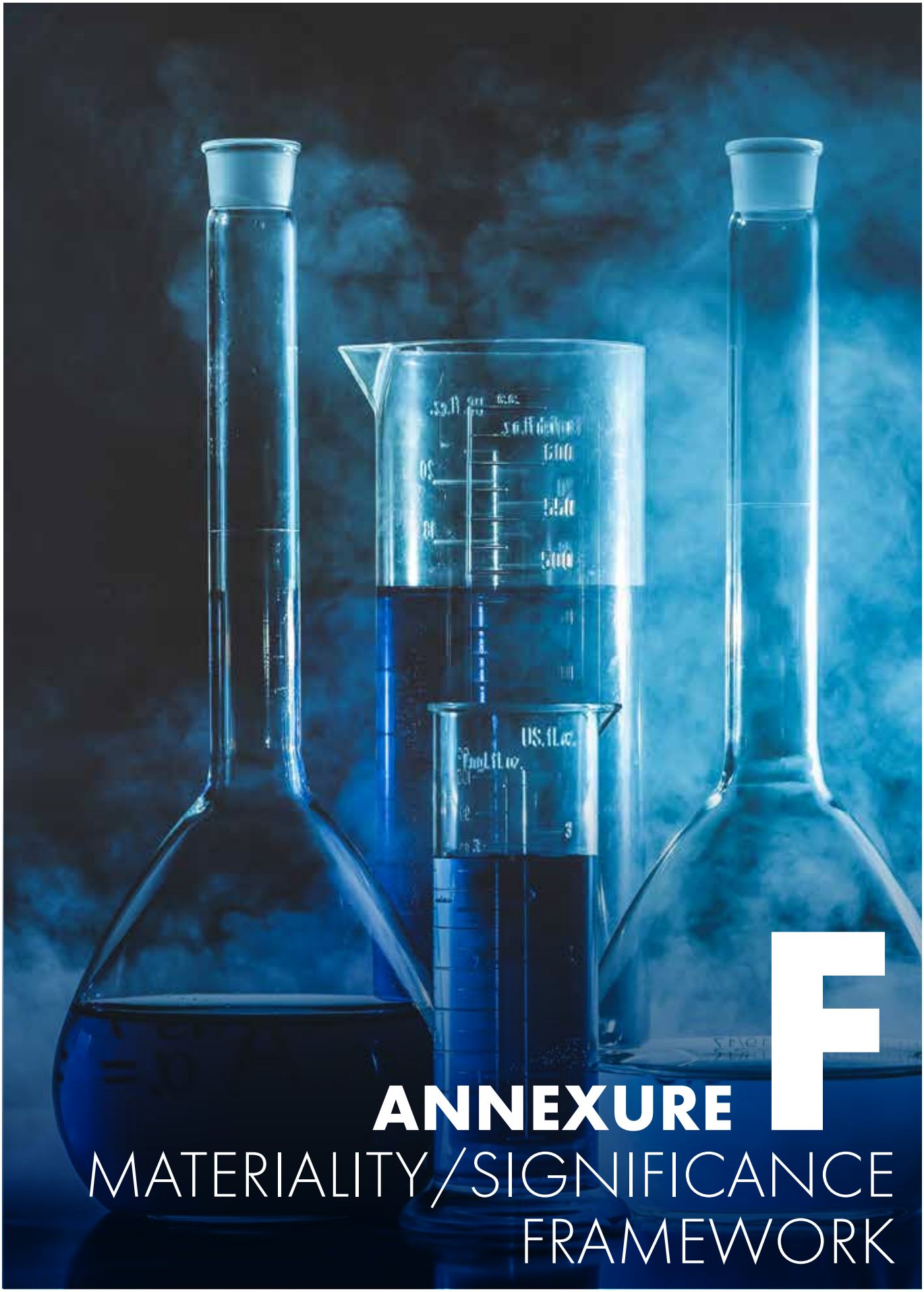
- Enterprise risk and fraud risk management;
- The potential for management to override controls or exercise other inappropriate influence over the financial reporting process;
- Mechanisms for employees to report concerns;
- Receipt and review of periodic reports describing the nature, status and eventual 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;
- The involvement of other experts, such as legal and HR, as needed to investigate any alleged or suspected wrongdoing;
- The review of accounting principles, policies and reasonableness of significant estimates used by the CSIR;
- The review of significant non-routine transactions (if any) entered into by management and employees; and
- Functional reporting by internal and external auditors to the ARC.

3. Independent assurance

The internal and external auditors will provide an independent assurance on the adequacy and effectiveness of the CSIR's internal controls to prevent, detect and manage fraud and corruption. The independent risk assurers will, in addition to assisting the CSIR to benchmark the efficacy of its fraud management measures, also advise on the effectiveness of the CSIR's FPP.

E.4 CONCLUSION

The CSIR proposes a proactive and progressive approach towards managing fraud risk in the organisation. It seeks to make ethics and integrity an intuitive response to ethical dilemmas confronting all CSIR stakeholders. The approach seeks to entrench ethical principles as an important consideration in business transacting and laying a foundation for sustainable collaboration with all stakeholders. This exercise is much in line with the stated EPIC values that aim to make the organisation and its people a blueprint of business morality. Consequently, the CSIR has adopted a zero tolerance approach towards fraud, theft and corruption and will continue to take the necessary measures to ensure that the risks are managed effectively.



ANNEXURE F

MATERIALITY/SIGNIFICANCE FRAMEWORK

F.1 MATERIALITY AND SIGNIFICANCE FRAMEWORK

F.1.1 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 seven decades, depends on the nature of every business transaction, conducted by every employee, on a daily basis. It is built on an implicit set of values, which inspires our employees to maintain the highest ethical standards in all their dealings with our clients and stakeholders, as well as their relationships within the CSIR.

The CSIR is committed to a policy of fair dealing and integrity in conducting its business. This commitment is based on a fundamental belief in honest, fair and legal conduct in all business activities. We expect all our employees to share this commitment to high morals, ethics and legal standards.

Ethics involve the ability to distinguish right from wrong and a commitment to do what is right. Values are core beliefs that create individual attitudes. Although individual values may differ, this does not imply a choice about behaving ethically in the business environment of the CSIR. Our Code of Conduct, as well as the Constitution of the Republic of South Africa and the national laws and regulations, prescribe the legal conduct that embodies values based on ethical principles, while respecting cultural diversity.

F.1.2 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 on a framework of acceptable levels of materiality and significance with the relevant Executive Authority in consultation with the external auditors."

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

Material		
Section 50 (1)	(1) The Accounting Authority for a public entity must –	
	a) exercise the duty of utmost care to ensure reasonable protection of the assets and records of the public entity;	Significant audit findings that could negatively impact on the CSIR's operations and the attainment of strategic goals.
	b) act with fidelity, honesty, integrity and in the best interest of the public entity in managing the financial affairs of the public entity;	The CSIR sets high standards on fidelity, honesty and integrity. The best interest of the public entity is always relevant in fulfilling its mandate and in the execution of the Shareholder's Compact. Any acts of dishonesty, infidelity and others that are not in the best interests (from a research, financial and reputation perspective) of the CSIR are viewed in a serious manner.
	c) on request, disclose to the Executive Authority responsible for that public entity or the legislature to which the public entity is accountable, all material facts, including those reasonably discoverable, which in any way influence the decision or actions of the Executive Authority or that legislature; and	The CSIR is committed to disclosing any relevant information to its stakeholders. Materiality can only be determined if the nature of the information is known.
	d) seek within the sphere of influence of that Accounting Authority, to prevent any prejudice to the financial interests of the state.	The CSIR employs an ongoing Enterprise Risk Management System, as well as controls that are aimed at the prevention/mitigation of any prejudice to the financial interest of the entity. Lack of the required governance processes, lack of due diligence in conducting business, and fruitless and wasteful expenditure are inherently regarded as material.

Material		
Section 55 (2)	(2) The annual report and financial statements referred to by PFMA Subsection 55 (1)(d) must –	
	a) fairly present the state of affairs of the public entity, its business, its financial results, its performance against pre-determined objectives and its financial position as at the end of the financial year concerned;	Significance/materiality is calculated as 1% of revenue, which amounts to R31 043 000.
	b) include particulars of –	
	i. any material losses through criminal conduct and any irregular expenditure and fruitless and wasteful expenditure that occurred during the financial year;	R1 000 000. All cases are unique and will thus be treated as such. These will be subject to internal audit reviews.
	ii. any criminal or disciplinary steps taken as a consequence of such losses or irregular expenditure or fruitless and wasteful expenditure;	R1 000 000. All cases are unique and will thus be treated as such. Issues that inform steps to be taken are: • The level of responsibility and position of the person involved; • The affected core business/support/operational; and • The impact on other areas of operation of the CSIR. These will be subject to internal audit reviews.
	iii. any losses recovered or written off;	R1 000 000 (excluding losses incurred through normal operating activities)
	iv. any financial assistance received from the state and commitments made by the state on its behalf; and	Will disclose as prescribed.
	v. any other matters that may be prescribed; and	Will disclose as prescribed.
	c) include the financial statements of any subsidiaries	All subsidiaries are consolidated.
Section 66 (1)	(1) An institution to which this Act applies may not borrow money or issue a guarantee, indemnity or security, or enter into any other transaction that binds or may bind that institution or the Revenue Fund to any future financial commitment, unless such borrowing, guarantee, indemnity, security or other transaction – a) is authorised by this Act; and b) in the case of public entities, is also authorised by other legislation not in conflict with this Act; and c) in the case of loans by a province or a provincial government business enterprise under the ownership control of a provincial executive, is within the limits as set in terms of the Borrowing Powers of Provincial Governments Act, 1996 (Act No 48 of 1996).	The CSIR complies with this requirement.

ANNEXURE G
FINANCIAL PLAN

G1 CSIR BUDGET AND PARLIAMENTARY GRANT CASH FLOW 2023/24

G.1.1 CSIR statements of comprehensive income over the MTEF period

Table G1: Statement of Comprehensive Income – MTEF Period

	Forecast 2022/2023 R'000	Budget 2023/2024 R'000	Estimate 2024/2025 R'000	Estimate 2025/2026 R'000
Total Operating Revenue	**2 840 815**	**3 104 300**	**3 346 347**	**3 678 453**
R & D Contract Income	**2 098 100**	**2 358 100**	**2 566 574**	**2 863 690**
Public - South Africa	1 444 700	1 619 600	1 700 580	1 734 592
Private - South Africa	315 900	338 700	406 440	540 565
International	207 600	269 400	323 280	446 126
Parliamentary Grant - Ringfenced	129 900	130 400	136 274	142 407
Parliamentary Grant	**741 615**	**744 500**	**777 903**	**812 724**
Royalty Income	**1 100**	**1 700**	**1 870**	**2 038**
Total expenditure	**2 967 115**	**3 149 900**	**3 385 798**	**3 652 843**
Employees' Remuneration	1 748 700	1 806 000	1 950 480	2 106 518
Operating Expenses	1 103 015	1 194 500	1 273 966	1 372 064
Depreciation	115 400	149 400	161 352	174 260
Operating Profit before Investment Income	**(126 300)**	**(45 600)**	**(39 451)**	**25 610**
Net Finance Income	58 700	57 100	59 384	62 353
NET PROFIT/(LOSS)	**(67 600)**	**11 500**	**19 933**	**87 963**

G.1.2 CSIR statements of financial position over the MTEF period

Table G2: Statement of Financial Position over the MTEF Period

Statement of financial position	Forecast March 2023 R'000	Budget March 2024 R'000	Estimate March 2025 R'000	Estimate March 2026 R'000
ASSETS				
Non-Current Assets	**776 924**	**775 924**	**767 424**	**750 601**
Property, plant, equipment and lease assets	769 831	768 831	760 331	743 508
Interest in joint ventures and associates	2 443	2 443	2 443	2 443
Interest in subsidiaries	4 650	4 650	4 650	4 650
Current Assets	**1 923 920**	**1 976 483**	**2 040 371**	**2 190 765**
Trade and other receivables	340 898	372 516	401 562	441 414
Inventory and contracts in progress	280 021	315 183	269 194	206 094
Cash and cash equivalents	1 303 002	1 288 784	1 369 615	1 543 257
TOTAL ASSETS	**2 700 844**	**2 752 407**	**2 807 795**	**2 941 367**
EQUITY AND LIABILITIES				
Reserves	**1 303 768**	**1 315 268**	**1 335 202**	**1 423 165**
Retained earnings	1 303 768	1 315 268	1 335 202	1 423 165
Non-current Liabilities	**19 131**	**18 574**	**18 086**	**17 660**
Post-retirement medical benefits and lease liabilities	19 131	18 574	18 086	17 660
Current Liabilities	**1 377 945**	**1 418 565**	**1 454 507**	**1 500 542**
Advances received	1 047 041	1 060 215	1 072 317	1 088 923
Trade and other payables	330 905	358 350	382 190	411 619
TOTAL EQUITY AND LIABILITIES	**2 700 844**	**2 752 407**	**2 807 795**	**2 941 367**

One needs to consider the budgeted current assets of R1.9 billion, cash balance of R1.3 billion in conjunction with the current liabilities of R1.4 billion. The current ratio (current assets/current liabilities) is expected to remain at approximately 1.39.

G.1.3 CSIR cash flow statement

Table G3: CSIR Cash Flow Statement

	March 2023	March 2024	March 2025	March 2026
Cashflow statement	**R'000**	**R'000**	**R'000**	**R'000**
Cash flow from operating activities				
Cash receipts from external customers	2 117 855	2 306 194	2 597 490	2 905 581
Parliamentary Grant income	741 615	744 500	777 903	812 724
Cash paid to suppliers and employees	(2 898 307)	(2 973 055)	(3 200 606)	(3 449 153)
Cash generated from operating activities	**(38 836)**	**77 639**	**174 787**	**269 152**
Net finance income	58 700	57 100	59 384	62 353
Net cash from operating activities	**19 864**	**134 739**	**234 171**	**331 505**
Cashflow from investing activities				
Acquisition of property, plant and equipment	(140 000)	(148 400)	(152 852)	(157 438)
Net cash utilised in investing activities	**(140 000)**	**(148 400)**	**(152 852)**	**(157 438)**
Cashflow from financing activities				
Decrease in non-current liabilities	(634)	(557)	(488)	(425)
Net cash generated from financing activities	**(634)**	**(557)**	**(488)**	**(425)**
Net increase/(decrease) in cash and cash equivalents	**(120 770)**	**(14 218)**	**80 831**	**173 642**
Cash and cash equivalents at beginning of the year	**1 423 772**	**1 303 002**	**1 288 784**	**1 369 615**
Cash and cash equivalents at end of the year	**1 303 002**	**1 288 784**	**1 369 615**	**1 543 257**

G.1.4 Twelve month cash flow projection for Parliamentary Grant: 2023/24 (including VAT)

Table G4: Cash Flow for Parliamentary Grant

R'000	Total	April	July	October	January
	1 369 211	342 303	342 303	342 303	342 301
Baseline	856 139				
National Laser Centre	41 124				
Laser Loan Programme	12 073				
African Laser Centre	6 595				
WEF Affiliate Centre	5 956				
Implementation: ICT R&D Roadmap	84 232				
Infrastructure Programme	68 904				
Cyber Infrastructure (NICIS)	294 188				

G.1.5 PPE budget summary

Table G5: PPE Budget Summary

Category	2023/24 R'000
Buildings	33 200
Equipment	68 700
ICT equipment	43 200
Furniture and fittings	1 100
Vehicles	2 200
TOTAL	**148 400**

The budgeted investment in property, plant and equipment for the 2023/24 financial year is R148.4 million, which includes fully funded grant assets.

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

G.1.6 Alignment of Parliamentary Grant Budget and Strategic Objectives

Table G6a: Link between Parliamentary Grant and CSIR Strategic Objectives

Not available yet (awaiting MTEF letter)

Table G6: Link between Parliamentary Grant and CSIR Strategic Objectives

PG ALLOCATION DESCRIPTION	Strategic Objectives	2023/24 Indicative Allocation (excl VAT) R'000	2023/24 Indicative Allocation (incl VAT) R'000
Total Baseline Allocation		**R 744 469**	**R 856 139**
Baseline Allocation to Clusters	**SO1,SO2 & SO3**	**R 319 021**	**R 366 875**
Portfolios and Support Functions		**R 196 998**	**R 226 547**
Leadership Team	SO5	R 31 889	R 36 672
Strategy Development (Synapse)	SO4	R 1 251	R 1 439
Campus Master Plan Office	SO5	R 3 078	R 3 540
Internal Audit	SO5	R 8 740	R 10 051
Research and Development Office	SO1,SO2 & SO3	R 9 507	R 10 933
Planning and Reporting	SO1,SO2 & SO3	R 11 515	R 13 242
Information and Knowledge Management	SO1,SO2 & SO3	R 13 813	R 15 884
BEI Operations	SO1,SO2 & SO3	R 12 940	R 14 881
CSIR Board and sub committees	SO5	R 2 691	R 3 095
Legal Services	SO5	R 16 487	R 18 960
Compliance	SO5	R 4 809	R 5 530
Knowledge Commons	SO5	R 3 172	R 3 648
FMSS - Embedded Engineering support	SO5	R 2 305	R 2 651

PG ALLOCATION DESCRIPTION	Strategic Objectives	2023/24 Indicative Allocation (excl VAT) R'000	2023/24 Indicative Allocation (incl VAT) R'000
Information and Communication Technology	SO5	R 33 243	R 38 229
Human Capital	SO4 & SO5	R 25 202	R 28 982
Strategic Communications and Stakeholder Relations	SO5	R 16 355	R 18 808
Capability Development Programs (Previously: Strategic Programmes) - Thematic		**R 155 000**	**R 178 250**
Research Centres	SO1,SO2 & SO3	R 45 000	R 51 750
New Capability Development Initiatives (Thematic Programme)	SO1,SO2 & SO3	R 45 000	R 51 750
RDI Infrastructure	SO1,SO2 & SO3	R 15 000	R 17 250
Human Capital Skills Development	SO4	R 46 800	R 53 820
Young Researcher Establishment Fund (YREF)	SO4	R 3 200	R 3 680
Commercialisation and Technology Transfer (Thematic)		**R 50 000**	**R 57 500**
Commercialisation Seed Fund	SO1, SO2 & SO3	R 5 000	R 5 750
Technology Demonstrator Fund	SO1,SO2 & SO3	R 0	R 0
Technogy Commercialisation (APEX)	SO1,SO2 & SO3	R 4 212	R 4 844
Commercialisation Capacity Investment	SO1,SO2 & SO3	R 40 788	R 46 906
Governance Structures and CSIR Committees		**R 6 380**	**R 7 337**
CSIR Board and sub committees	SO5	R 5 479	R 6 301
Research Ethics Committee	SO5	R 401	R 461
PG Investment Committee & Industry Panel	SO5	R 500	R 575
Discretionary Allocations (To be invested upon receipt of motivations)		**R 17 070**	**R 19 630**
Strategic Initiatives	SO5	R 17 070	R 19 630
Ring-Fenced Allocations		**R 446 150**	**R 513 073**
Laser Loan Programme	SO2 & SO3	R 10 498	R 12 073
National Laser Centre	SO2 & SO3	R 35 760	R 41 124
African Laser Centre	SO2 & SO3	R 5 735	R 6 595
WEF Affiliate Centre	SO2 & SO3	R 5 179	R 5 956
Implementation: ICT R&D Strategy	SO2 & SO3	R 73 245	R 84 232
Infrastructure Programme	SO2 & SO3	R 59 917	R 68 905
National Integrated Cyber Infrastructure System (NICIS)	SO2 & SO3	R 255 816	R 294 188
Total		**1 190 619**	**1 369 212**

Table G7: Medium Term Expenditure Framework allocation to the CSIR (excl VAT)

Category	2022/23 R'000	2023/24 R'000	2024/25 R'000	2025/26 R'000
Baseline Parliamentary Grant	**741 615**	**744 469**	**777 903**	**812 724**
Parliamentary Grant	741 615	744 469	777 903	812 724
Ring fenced allocation	**432 331**	**446 150**	**466 185**	**487 111**
Laser Loan Programme	10458	10 498	10 970	11 463
National Laser Centre	35 624	35 760	37 366	39 048
African Laser Centre	5 713	5 735	5 992	6 262
WEF Affiliate Centre	15 025	5 179	-	-
Implementation: ICT R&D Strategy	63 103	73 245	81 946	85 634
Infrastructure Programme	57 391	59 917	62 607	65 424
National Integrated Cyber Infrastructure System	245 017	255 816	267 304	279 280
TOTAL	**1 173 946**	**1 190 619**	**1 244 088**	**1 299 835**

G2 FIVE-YEAR AUTHORITY TO ISSUE GUARANTEE INSTRUMENTS

Table G8: CSIR five-year authority to issue guarantee instruments

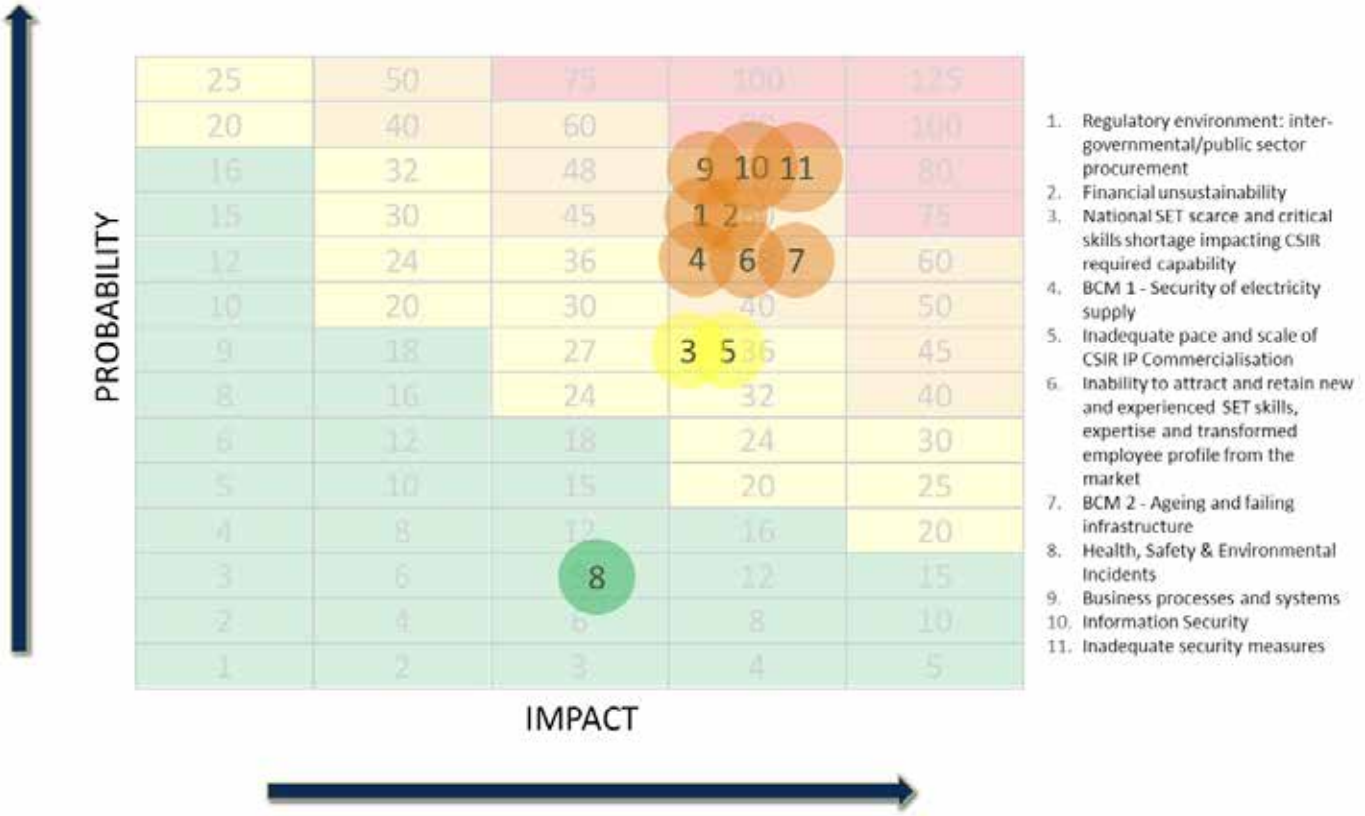
Financial year ending	Total annual limit R million
31 Mar 23 #	1 088
31 Mar 24 #	1 144
31 Mar 25 @	1 144
31 Mar 26 @	1 144
31 Mar 27 @	1 144

This is an approved amount
@ This is a planned amount

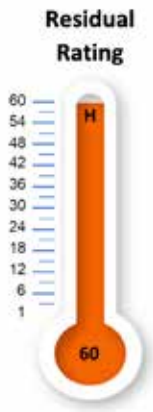
ANNEXURE H
CSIR TOP RISK REGISTER

H1 CSIR TOP RISK REGISTER

The CSIR has developed a comprehensive risk-management framework, which is approved by the Audit and Risk Committee consistent with its Board-delegated function. In terms of this framework, material risks are identified on a regular basis with relevant mitigation plans monitored by the Audit and Risk Committee at each meeting of that Committee. Risk mitigation remains a management function and is robustly managed. The CSUR follows a bottom-up approach to identify, assess and manage risk, which is subject to a biannual top-down review process to ensure completeness, proportionality to our business, and the robustness of mitigating actions. The heatmap depicts residual risk after considering mitigating risk factors.



1. SYSTEMIC RISK: Regulatory environment: inter-governmental/public sector procurement

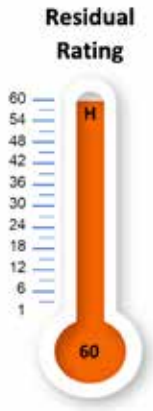


Legislative constraints on procurement inhibits strategic partnerships on national R&D capabilities with Government Departments, Constitutional Institutions and Public Entities restricting the CSIRs ability to deliver on its mandate to act in the national interest

MITIGATION STRATEGY/ ACTIONS

- Continued engagement with NT to create awareness of the CSIRs unique value proposition and the mandated role of national R&D capabilities in enabling a capable state
- The CSIRs Business Excellence and Integration portfolio in collaboration with BD&C Executives, Cluster Executives, the Strategic Procurement Unit and Finance will develop a standardised approach to empower collaborating public entities to accommodate requirements in budgets timeously or enhance their abilities to secure NT approval to contract the CSIR directly where required

2. SYSTEMIC RISK: Financial unsustainability

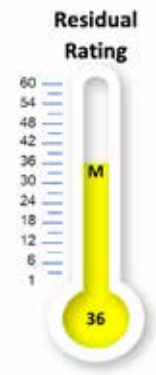


Financial unsustainability due to reduced revenue with escalating costs and compounded by a slow uptake/ commercialisation of CSIR capabilities and IP and reduced investment in RD&I.

MITIGATION STRATEGY/ ACTIONS

- Diversification of income streams
- Firm and aggressive debt management
- Cash preservation and optimised investment to increase investment returns
- Driving for cost optimisation and operational efficiency and effectiveness
- Allocation of PG to priority areas based on SOs with special focus on KPIs that directly drive economic growth/recovery and enhancing the capability of the state
- Aggressive pursuit of R&D contract work with public and private sector organisations, including international markets
- Engage with banks and fund managers to identify alternative investment instruments to increase returns on cash investments
- CSIR making input to national policy fora (e.g., NEDLAC, FOSAD) through the shareholder
- Develop the capacity of the CSIR to do an analysis of public sector entity RD&I needs
- In conjunction with shareholder, drive an ecosystem wide sector driven increase in RD&I expenditure aligned with key sectors of the economy
- Assisting in strengthening the capability of the state to rectify the gray-listing gaps e.g., SIU MoU; working with financial institutions; assisting the national security cluster; enhancing the efficiency of the state through e-services
- Contribute to the national retention drive by reducing critical skills attrition within the CSIR

3. SYSTEMIC RISK: National SET scarce and critical skills shortage impacting CSIR required capability

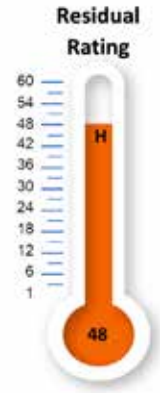


The CSIR skills and capability requirements exceeds industry minimum standards and are in short supply in the market and industry and impacts the business priorities and objectives

MITIGATION STRATEGY/ ACTIONS

- CSIR should identify specific areas of skills needs/requirements to focus on training and development.
- Perform an internal assessment to identify areas of weaknesses/exposure (skills deficiencies) to design a targeted strategy e.g., Women in science

4. SYSTEMIC RISK: Business Continuity Risk 1 - Security of electricity supply



Increased load shedding by Eskom at short notice increases the risk of loss of electrical supply to the CSIR sites

MITIGATION STRATEGY/ ACTIONS

- Business Continuity Management Plan to address both intermittent and long-term interruption

SCIENTIA CAMPUS

Short-term

- The campus does not experience load shedding due to being a National Key Point

Medium-term

- CSIR is identifying all critical loads on the Scientia
- Emergency generators will be installed for loads that do not already have an emergency generator

Long-term

- Develop a loadshedding resiliency plan for the CSIR as part of Business Continuity Strategy

REGIONAL SITES

Short-term

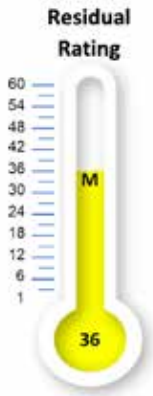
- All regional sites have back-up generators

Long term

- Develop a loadshedding resiliency plan for the CSIR as part of Business Continuity Strategy

5. STRATEGIC RISK: Inadequate pace and scale of CSIR IP Commercialisation impacting CSIR Strategic Objective 1

The CSIR is unable to commercialise its Intellectual Property at a sufficient pace and scale in line with the strategic intent of the organisation

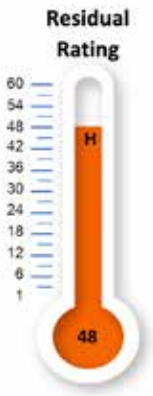


MITIGATION STRATEGY/ ACTIONS

- Establishment of Industry Advisory Panels to improve market alignment of R&D investments
- Establishment of the Business Development and Commercialisation capacity within Divisions to enhance leadership of Cluster IP portfolios and secure large commercialisation deals
- Commercialisation initiatives that fund several high potential technologies seeking to enhance maturity for the market
- The rollout of the Stage Gate Methodology will ensure consistent and effective management of investment in capabilities and technologies
- The CSIR will drive the establishment of a commercialisation vehicle which aims to accelerate the pace and scale at which IP assets are commercialised by (a) further creation of dedicated specialist capacity; (b) attracting adequate financial resources along the technology de-risking process through to commercialisation; (c) collaboration with suitable entrepreneurs and investment partners to transform CSIR technologies into marketable products, services, spinouts and startups

6. STRATEGIC RISK: Inability to attract and retain new and experienced SET skills, expertise and transformed employee profile from the market impacting CSIR Strategic Objective 4

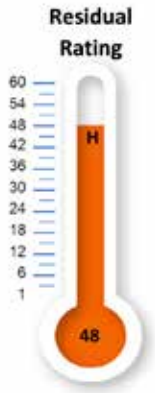
The CSIR's inability to attract and retain new, experienced and transformed SET skills from the market will result in failure to deliver on business objectives and transformation imperatives



MITIGATION STRATEGY/ ACTIONS

- Address employees' career aspiration and provide them with development in their careers
- Attraction and retention framework approved by Exco and to be implemented by Exco subcommittee to drive implementation of the standards and framework whilst addressing identified barriers
- CSIR will conduct a follow-up climate survey to assess

7. STRATEGIC RISK: Business Continuity Risk 2 – Ageing and failing infrastructure impacting CSIR Strategic Objective 4



Ageing infrastructure prone to failures and downtime, increased and costly maintenance requirements, at risk of becoming irrelevant or obsolete. The risk manifests in three areas:

- Physical accommodation infrastructure - at risk of becoming irrelevant or obsolete and non-competitive real estate offering internally and externally
- Utility infrastructure - at risk of regular utility supply interruption and/or failure and increased maintenance cost
- ICT infrastructure - Inability to meet future current and future ICT needs due to old ICT infrastructure and limited new investment
- R&D infrastructure - risk of non-delivery on the CSIR KPIs due to unavailability and obsolete R&D infrastructure

MITIGATION STRATEGY/ ACTIONS

Short-term

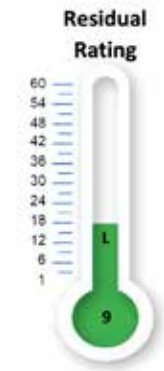
- Continue to implement planned preventative maintenance and attend to unplanned breakdowns as they occur
- Attend to findings from the building condition assessment conducted in 2022 according to a priority matrix that will ensure a budget for high-risk items are prioritised
- Continue phased ICT investment on high priority items against ICT strategy and roadmap
- Continue investment in R&D infrastructure as informed by strategic and business plans

Long-term

- Develop an infrastructure and investment framework and roadmap plan for all infrastructure investment requirements
- Develop sustainable funding model Attraction and retention framework approved by Exco and to be implemented by Exco subcommittee to drive implementation of the standards and framework whilst addressing identified barrier (refine specific strategy/plan as direct mitigation(s) for the risk (What are the specifics)
- CSIR will conduct a follow-up climate survey

8. STRATEGIC RISK: Health, Safety, and Environmental Incidents

Increase in health, safety and environmental incidents and accidents impacting on CSIR strategic objective 5



MITIGATION STRATEGY/ ACTIONS

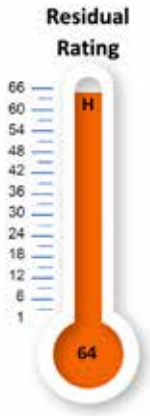
Short-term

- Entrenchment of SHEQ KPIs and monitoring of the performance of all SHE role players through SLA targets
- Implementation of a SHEQ communication, awareness and education campaign e.g., SHEQ Week
- Internal and External annual SHEQ audits and implementation of corrective measures
- Biennial Legal compliance audits
- Incorporating a near misses' educational campaign
- Implementation of PTOs (Planned Task Observations)
- Entrenchment of the incident management system and emergency response protocols

Long-term

- Implement elements of Behavioural Based Safety (BBS) i.e., Neurosafety training towards fully developed BBS program
- Implement additional SHEQ structure operational resources
- Implement a SHEQ Recognition and Reward programme
- Review environmental monitoring and reporting mechanisms and available resources
- SHEQ team members capacity building

9. OPERATIONAL RISK: Business processes and systems



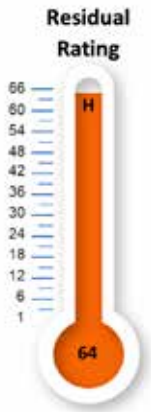
Inadequate Enhancement of Business Systems and Business Processes

MITIGATION STRATEGY/ ACTIONS

- Review of the approval framework of the organisation is currently in progress
- A review of priority administrative processes and approvals required for HR, Finance and Procurement is also being driven and monitored
- Development of a structured business systems investment plan to upgrade and address priority business requirements

10. OPERATIONAL RISK: Information Security

Inadequate Enhancement of Business Systems and Business Processes

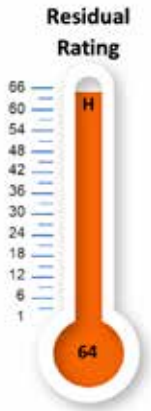


MITIGATION STRATEGY/ ACTIONS

- Continuously investing in cybersecurity awareness, prevention and security best practices as part of our culture
- Intrusion prevention and detection solutions implemented and periodically assessed
- Regular patch management with forced updates
- Periodic penetration testing and audit of ICT infrastructure
- Implementation/resolution of findings from penetration testing and implementation of other best practices
- Logical access control management
- Information security technologies implemented to mitigate risks of work-from-home arrangement (Two-factor authentication and Multi factor authentication implemented
- Updated implementation plan for improvement in maturity levels
- Dedicated human resources to focus on IS
- Increased financial resources allocated to IS
- Malware protection service (Sophos) is fully functional and receives updates directly from the internet

11. OPERATIONAL RISK: Inadequate security measures

Breach in CSIR security systems resulting in loss of assets, information and endangerment to staff and visitors



MITIGATION STRATEGY/ ACTIONS

Short-term

- Immediate closure of obvious security gaps
- Continue to implement planned preventative maintenance and attend to unplanned breakdowns immediately
- Progressive upgrade of high priority security infrastructure underway
- Establishment of internal supervisory capacity to improve management of 3rd party service provider
- Threat and risk assessment completed

Medium-term

- Develop a Security systems strategy and road map that addresses the security threat and risks identified at all CSIR campuses – in progress
- A phased security systems investment strategy is being developed

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