



CSIR SHAREHOLDER'S COMPACT 2024/25



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



CSIR

Touching lives through innovation



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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
CO₂	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
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 the Witwatersrand



ii.

THE SHAREHOLDER'S COMPACT

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: 2024/25–2028/29 (Annexure A); and
 - Annual Performance Plan: 2024/25 (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:
 - CSIR Top Risk Register for 2024/25 (Annexure H).



THE SHAREHOLDER'S COMPACT AGREEMENT

FOR THE CYCLE COMMENCING 1 APRIL 2024
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

Mr Vuyani Jarana in his capacity as Chairperson
representing the CSIR Board
(hereinafter referred to as 'the Accounting Authority')

WHEREAS:

The Parties wish to conclude a Shareholder's Compact 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 2024/25 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 2024/25; the Group's three-year Financial Plan and the three-year Borrowing Plan); and
- Annexure H being the CSIR Top Risk Register 2024/25.

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 2024.

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 2024.

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 2025.

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 2024/25 planning cycle; the CSIR's Risk Management Strategy; the CSIR's FPP; the Materiality Framework; the Budget and Cash Flow for 2024/25; 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 renegeing 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 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 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 OF TRANSFORMATIVE TECHNOLOGIES AND ACCELERATE THEIR DIFFUSION.

This SO seeks to ensure that the CSIR undertakes cutting-edge research, development and innovation (RD&I) 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

This is a measure of an intermediate output of RD&I 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.

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 enterprises (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. 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 (HC) and investment in infrastructure to drive industrialisation and the advancement of society.

KPI 12: Total science, engineering and technology 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 science, engineering and technology (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 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 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 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. Property, plant and equipment (PPE) investment is the amount invested in CSIR and 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 (R&D) contracts (contract R&D income), income derived from licences and royalties, Parliamentary Grant (PG) received through the Science Vote, as well as 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 provision); 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 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.

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 PFMA and the Municipal Finance Management Act (MFMA). 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 R&D contracts and other income received from foreign entities.

KPI 29: Broad-Based Black Economic Empowerment rating

The indicator is a measure of the CSIR's compliance to the Broad-Based Black Economic Empowerment (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

The recordable incident rate (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 2024/25

KPI		Actual 2020/21	Actual 2021/22	Target 2023/24	Target 2024/25
SO1: Conduct RD&I of transformative technologies and accelerate their diffusion.					
KPI 01:	Publication equivalents	422.5	398	408	298
KPI 02:	New priority patent applications filed	7	8	8	6
KPI 03:	New patents granted	16	19	8	12
KPI 04:	New technology demonstrators	55	62	54	49
KPI 05:	Number of technology licence agreements signed	12	10	18	12
SO2: Improve the competitiveness of high-impact industries to support South Africa’s re-industrialisation.					
KPI 06:	Number of localised technologies	14	16	14	13
KPI 07:	Number of joint technology development agreements being implemented for industry	25	37	29	27
KPI 08:	Number of SMMEs supported	99	116	86	97
SO3: Drive the socioeconomic transformation through RD&I, which supports the development of a capable state.					
KPI 09:	Number of reports contributing to national policy development	22	14	21	14
KPI 10:	Number of standards delivered or contributed to support the state	8	14	9	9
KPI 11:	Number of projects implemented to increase the capability of the state	86	130	60	79
SO4: Build and transform HC and infrastructure.					
KPI 12:	Total SET staff	1 551	1 555	1 598	1 642
KPI 13:	Percentage of SET staff who are black	66.5%	70%	67%	69%



KPI		Actual 2020/21	Actual 2021/22	Target 2023/24	Target 2024/25
KPI 14:	Percentage of SET staff who are female	39.1%	39%	38%	38%
KPI 15:	Percentage of SET staff with PhDs	20.5%	20%	21%	19%
KPI 16:	Total Chief Researchers	15	15	16	18
KPI 17:	Percentage of chief researchers who are black	13.3%	27%	19%	28%
KPI 18:	Percentage of chief researchers who are female	13.3%	20%	13%	28%
KPI 19:	Total principal researchers	188	195	189	195
KPI 20:	Percentage of principal researchers who are black	34%	38%	35%	37%
KPI 21:	Percentage of principal researchers who are female	19%	21%	20%	24%
KPI 22:	Number of staff involved in exchange programmes with industry	31	42	31	32
KPI 23:	PPE investment (Rm)	104	161.3	148	160
SO5: Diversify income, maintain financial sustainability and good governance					
KPI 24:	Total income (Rm)	2 654	2 861	3 054	3 121
KPI 25:	Net profit (Rm)	137	43.57	-38.1	-67.6
KPI 26:	South African public sector income (% total income)	56%	56%	56%	58%
KPI 27:	South African private sector income (% total income)	9%	9%	11%	8%
KPI 28:	International contract income (% total income)	8%	9%	9%	11%
KPI 29:	B-BBEE rating	1	1	1	1
KPI 30:	Recordable incident rate	0.14	0	≤0.6	≤0.4
KPI 31:	Audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion

REPORTING

- The Accounting Authority will report on the achievement of its KPIs quarterly, based on PFMA requirements.
- 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.
- 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 2024/25 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 2024/25 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: in the care of the Office of the Chief Executive Officer, 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 approved 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

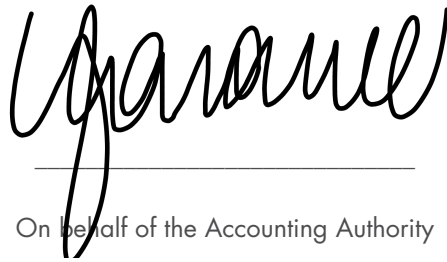
The Minister of Higher Education, Science and Innovation, Dr Blade Nzimande, approves of this approach and looks forward to the successful implementation of the undertakings embodied in this Shareholder's Compact and its annexures. The Minister accepts that, although the detail of this Shareholder's 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 Mthatha on 9 February 2024

Mr Vuyani Jarana



On behalf of the Accounting Authority

Agreed to and signed in PRETORIA on 20 February 2024

Dr Blade Nzimande



The Executive Authority

A

**STRATEGIC
PLAN**

2024/25 –
2028/29





A1 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 are, through 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 the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act”.

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 innovating and localising technologies, while providing knowledge solutions 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 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-CENTERED

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 treated.



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 governance.



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.1.4 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 South African 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.1.5 STRATEGIC OBJECTIVES

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

	SO1	Conduct 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.	This strategic objective seeks to improve the competitiveness of South Africa’s high-impact industries.
	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 government to drive 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 HC, and investment in infrastructure to drive industrialisation and the advancement of society.
	SO5	Diversify income, maintain financial sustainability and good governance.	This strategic objective seeks to improve the CSIR’s financial sustainability by diversifying revenue source, optimising the organisation’s business model and advancing good efficient and sound governance.

The CSIR Strategy for 2024/25 – 2028/29 is shaped by key global and regional trends, national imperatives and priorities.



A2

THE STRATEGY

A.2.1 EXTERNAL CONTEXT

Global context

“A fragmented world is unlikely to achieve progress for all or to allow us to tackle global challenges such as climate change or pandemic preparedness. We must avoid that path at all costs”. This plea, expressed by Pierre-Olivier Gourinchas, the Economic Counsellor and Director of Research for the International Monetary Fund (IMF), is in response to the dire state of current affairs plaguing the globe, as captured in the IMF’s World Economic Outlook (WEO) for April 2023. The increasing threat of geoeconomic fragmentation could exacerbate trade tensions, negatively impact foreign direct investment, and slow down the pace at which innovation and technology is adopted across these geopolitical blocs. This threat, however, is only one of the contributing factors for the recent slowdown in global economic growth. The other “ominous forces” include uncertainty and vulnerabilities within the financial sector, including banks and non-bank financial institutions; high debt levels; the slow pace of structural reforms; the continued scarring impact of the Covid-19 pandemic and the ongoing war in Ukraine¹.

The current baseline forecast for global economic growth, based on the assumption that the financial sector turmoil is contained, estimates economic growth to slow from the 3.4% recorded in 2022 to 2.8% in 2023 before it increases slowly to reach 3% in the next five years – notably, “...the lowest medium-term forecast in decades”². Global inflation will decrease, albeit at a slower pace than what was anticipated, from 8.7% in 2022 to 7.0% in 2023, noting that it is unlikely that inflation rates will reach their targets before 2025. Quite critical to note is that the economic slowdown is in fact concentrated in the advanced economies, with a significant fall from 2.7% in 2022 to 1.3% in 2023; the emerging markets and developing economies are expected to see growth rates rising from 2.8% in 2022 to 4.5% this year. Positive drivers include the easing of supply chain disruptions as economies that were hit hard by the pandemic, predominantly China, have begun recovering and the energy and food prices that increased significantly at the onset of the Russian invasion of Ukraine have begun moderating. These drivers, however, are not sufficient to mitigate against the effects of the risks mentioned above, particularly the stresses within the financial sector.

As a result, the IMF’s recommendation is that governments should maintain an overall tight stance – central banks should maintain their tighter anti-inflation outlook whilst being prepared to respond accordingly to any financial stability concerns; the fiscal policymakers should focus on getting inflation back to target without compromising financial stability and targeted support should be provided to those who are battling to endure the cost-of-living crisis; medium-term debt needs to be managed, and restructured where possible, and those factors hindering structural reforms need to be addressed. And, in response to those concerns expressed by Pierre-Olivier Gourinchas, governments should note that “Steps to strengthen multilateral cooperation are essential to make progress in creating a more resilient world economy, including by bolstering the global financial safety net, mitigating the costs of climate change, and reducing the adverse effects of geoeconomic fragmentation”³.

“Climate change, growing geopolitical tensions and the Covid-19 pandemic have highlighted risk, uncertainty and resilience as conditions and concerns for STI policy”⁴. These have resulted in what is known as “securitisation” of science policies, meaning that countries intent to protect themselves beyond traditional defence areas. These include biosecurity where great discoveries in areas such as synthetic biology carry inherent risks⁵.

1 IMF (2023). World Economic Outlook: April 2023, p. xvii.

2 IMF (2023). World Economic Outlook: April 2023, p. xvi.

3 IMF (2023). World Economic Outlook: April 2023, p. xvii.

4 OECD Science, Technology and Innovation Outlook 2023

5 ibid

There is rising competition in critical technologies that are expected to underpin future economic competitiveness and national security; and growing vulnerability from technology supply-chain interdependencies, for example, in semiconductors and critical minerals. Economic and security policy agendas are converging. Governments are putting in place measures to (i) reduce STI interdependency risks and restrict international technology flows; (ii) enhance industrial performance through STI investments; and (iii) strengthen international STI alliances among like-minded economies⁶.

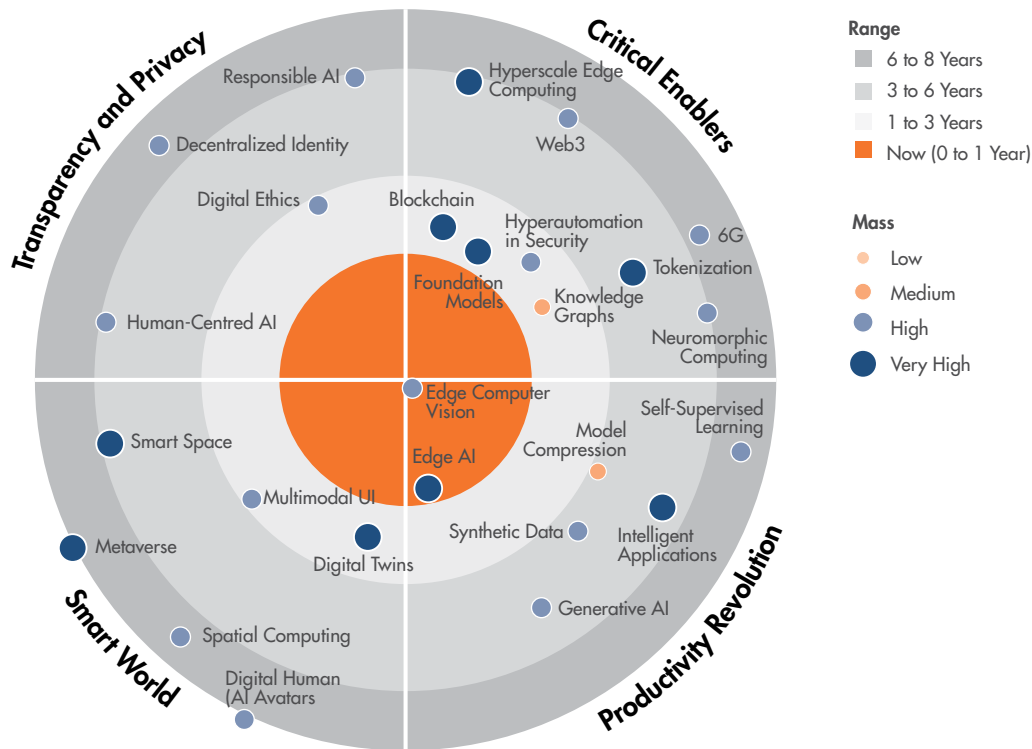


Figure A1: 2023 Gartner Emerging Technologies and Trends Impact Radar

The 2023 Gartner Emerging Tech Impact Radar highlight the technologies and trends that will potentially impact several industry sectors. Twenty-six of the highest impact emerging technologies and technology trends are highlighted⁷. Currently, edge artificial intelligence (AI) has very high impact in existing products and markets, while edge computer vision has high impact. In the next year to three years, blockchain, foundational models and digital twins are foreseen to have a very high impact, while hyperautomation in security, digital ethics and multimodal user-machine interfaces are forecasted to have high impact. In the next three to six years, smart spaces, intelligent applications, and tokenisation are envisaged to have a very high impact, while human-centered AI, generative AI, Web3 and neuromorphic computing are predicted to have high impact. In the next six to eight years the “metaverse” is forecasted for very high impact while spatial computing, digital humans, 6G, decentralised identity and self-supervised learning will have high impact⁸.

6 OECD Science, Technology and Innovation Outlook 2023
 7 Gartner (2023). 2023 Gartner Emerging Technologies and Trends Impact Radar
 8 ibid



The World Economic Forum Top 10 Emerging Technologies of 2023 Flagship Report by the Centre for 4IR in collaboration with Frontiers Media, which included inputs of 69 industry and academic experts from 18 countries, indicates the following technologies as areas of competitive advantage⁹: flexible batteries to power wearable technologies for healthcare and e-textiles, generative AI, sustainable aviation fuel to enable the aviation industry to move towards net-zero carbon emissions, designer phages that would be engineered to augment human, animal and plant health, metaverse for mental health providing shared virtual spaces to improve mental health, wearable plant sensors to revolutionise agricultural data collection, spatial omics to enable the molecular-level mapping of biological processes in order to unlock life's mysteries, flexible neural electronics to design and develop better engineered circuits to interface with the nervous system, sustainable computing to enable the design and implementation of net-zero-energy data centres, as well as AI-facilitated healthcare to enable the development of new technologies.

South African context

In October 2022, PricewaterhouseCoopers (PwC) issued a report entitled *Megatrends: Five global shifts reshaping the world we live in* where they discussed trends that are characterised as "...deep and profound...global in scope and long-term in effect, touching everyone on the planet and shaping our world for many years to come"¹⁰. These trends were identified in 2013 but have brought about transformation at a much quicker pace than what was anticipated, and they are constantly interacting and evolving. The five megatrends are climate change, technological disruption, a fracturing world, social instability and demographic shifts. South Africa is in no way immune to these forces, with "...the negative impacts of climate change on food production, technological disruption pressuring job creation, a growing youth population as part of its demographic shifts, disruptions to supply chains in a fracturing world, and social instability"¹¹.

These factors coupled with loadshedding and deteriorating transport infrastructure have placed additional pressure on South Africa's economy. The growth forecast for 2023 and 2024, published in the IMF's April 2023 WEO, albeit positive at 0.1% and 1.8%, respectively, is considerably low compared to the growth projections for the other emerging and developing economies, which stands at an average of 3.9% and 4.2% for the same period¹². PwC, in their South African Economic Outlook for May 2023, has adjusted this year's forecast slightly upwards to a figure of 0.3% but downwards to 0.9% in 2024; a feat they are referring to as a full-year recession seeing as there will be a 0.6% decline in gross domestic profit (GDP)¹³. This bleak outlook is significantly influenced by the structural constraints mentioned above.

Arguably, South Africa is said to be in a polycrisis with multiple, complex interdependencies between challenges^{14,15}. The 10 top risks for South Africa identified in the Institute of Risk Management of South Africa Risk Report – The South Africa Risks 2023/24 include the polycrisis leading to a potential consequence of becoming a failed state; systemic failure of public infrastructure; failure of the national grid; proliferation of illicit economic activity; economic collapse; large scale disruptions of digitally enabled services; impact of climate change and climate action failure; collapse of social security systems; increasing unemployment as well as political instability.

Much can be achieved through science, technology, and innovation to address these complex challenges. However, it requires adequate levels of investment. China spends approximately 2.5% of its Gross Domestic Product (GDP) on science investment, as well as others in Europe. South Africa is in need of further investment, considering the current level of 0.7% of GDP.

9 WEF (2023). Top 10 Emerging Technologies of 2023 – Flagship Report June 2023

10 PwC (2022). *Megatrends: Five global shifts reshaping the world we live in*, p. 2. Accessed via <https://www.pwc.com/gx/en/issues/assets/pdf/pwc-megatrends-october-2022.pdf>

11 PwC (2023). South African Economic Outlook: Building business resilience against long-term socio-economic headwinds (24 April 2023), p. 3. Accessed via <https://www.pwc.co.za/en/assets/pdf/economic-outlook/sa-economic-outlook-building-business-resilience.pdf>

12 IMF (2023). World Economic Outlook: April 2023, p. 9.

13 PwC (2023). South African Economic Outlook: Beyond GDP: Measuring socio-economic progress with companies' nonfinancial data (30 May 2023), p. 3. Accessed via <https://www.pwc.co.za/en/assets/pdf/economic-outlook/sa-economic-outlook-beyond-gdp.pdf>

14 Institute of Risk Management South Africa Risk Report – South African Risks 2023/24. 9th Edition.

15 *ibid*



According to PwC, it was forecasted that 2023 would be a year of greater climate action in the country. Government has shown this commitment, particularly through the national budget for 2023. The budget, tabled by South African Finance Minister, Enoch Godongwana, in February 2023, placed significant emphasis on tackling the energy crisis with plans to incentivise businesses and households to invest in renewable energy. PwC critically noted that “Climate resilience is a powerful source of protection against disruption and value loss”¹⁶ and encouraged organisations to generate their value by reimagining their capabilities in a post-carbon world and to pursue “... decarbonisation of operations and the supply chain; understand climate risk; mobilisation of sustainable capital; and robust reporting and audit”¹⁷ to build this climate resilience.

A landscape report by the University of Johannesburg’s DSI/NRF/Newton Fund Trilateral Chair in Transformative Innovation, the 4th Industrial Revolution and Sustainable Development (UJ-TRCTI) conducted an in-depth literature review and analysis of on the use of multiple emerging technologies from a survey dataset of 262 firms in South Africa, including over 20 key informant interviews across academia, government and the private sectors. The analysis identified 20 emerging technologies being promoted, developed, deployed or used in South Africa. Of these, the top four can be divided between new emerging technologies (AI and next generation health) and waning emerging technologies (mobile applications and e-commerce)¹⁸. The top 10 technologies highlighted by the private sector were (in order) next-generation health technologies (including medical devices), e-commerce, software/mobile apps, AI, energy storage solutions, 3-D printing, biotechnology, water purification solutions, energy generation solutions and automation. Public sector respondents highlighted similar technologies in a different order: 3-D printing, artificial intelligence, biotechnology, next-generation medicine, hydrogen technologies, energy storage solutions, next-generation agroprocessing, water purification solutions, new materials and synthetic biology.

The CSIR, being a multi-disciplinary research organisation, covering a broad range of sectors, is involved in many of the above-mentioned areas. Translational capabilities for the development and delivery of targeted, high-impact solutions for industry and the state remains critical for the success of the CSIR.

INDUSTRY SPECIFIC CONTEXTS

The CSIR priority clusters are aligned to strategic industry sectors with the intention to enhance impact, enable job creation and a subsequent growth in GDP.

The chemicals sector

Disruptive trends for the chemicals sector include topics of sustainability, declining birth rates, increasing life expectancy as well as advances in specific technologies including artificial intelligence, automation and access to real-time information. 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. Strong ESG values offer a competitive advantage and attract investment. The Biorefinery Group within the CSIR Chemicals cluster has capabilities in beneficiation of forestry wastes while the Centre for Nano-structured Materials within the CSIR Chemicals cluster has capabilities in beneficiation of plastic waste. There are different views into biodegradable polymers for packaging, with countries such as Saudi Arabia, and some private companies taking a position to recycle (e.g., Safripol, March 2023) or upcycle (e.g., BASF, Nov 2022) in addition to biodegradable technologies.

16 PwC (2023). South African Economic Outlook: Budget 2023 and green incentives: Investment in renewable energy is now a fundamental business decision. (28 February 2023), p. 3. Accessed via <https://www.pwc.co.za/en/assets/pdf/economic-outlook/sa-economic-outlook-budget-2023-and-green-incentives.pdf>

17 Ibid.

18 UJ-TRCTI (2022). Emerging Technologies in South Africa – A landscape analysis.



Where feedstock is not viewed as a constraint, even when it is non-renewable, the industry approach is to rather invest in small modification of existing plants and accommodate recycling streams than a complete system overhaul (Sipchem, Saudi Arabia, August 2023). It would thus be strategic for the Advanced Functional Polymer group to invest in capability and technology development to bring niche products and processes in plastic recycling for private sector interest. It would be important to work with small and medium-sized enterprises (SMEs) and established industry to benefit from this approach. 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. Strong ESG values offer a competitive advantage and attract investment. Carbon capture technology for greenhouse gas seems to have industry's interest with ExxonMobil and PetroChina expected to have it in their plans already.

Other key trends are as follows:

- Mainland China and North America are the biggest consumers of specialty chemicals, the biggest segments (38% market share) being: specialty polymers, electronic chemicals, industrial and institutional cleaners, water-soluble polymers and construction chemicals. China is said to consume catalysts for petroleum refining/chemical process and emission control, construction chemicals, feed additives, flame retardants, flavours and fragrances, paper chemicals, plastics additives, printed circuit board and packaging chemicals, rubber-processing chemicals, specialty adhesives and sealants, specialty coatings, specialty polymers, textile chemicals, water management chemicals and water-soluble polymers. The cluster's offerings in graphene product and process technology for coatings, polymer additives for plastic packaging, functional or active polymers for packaging, enzymes alternative chemicals in textiles, to name a few, already respond to the market needs. The challenge would be to come up with disruptive and innovative solutions.

North America mostly consumes "biocides, corrosion inhibitors, cosmetic/personal care chemicals, food additives, industrial and institutional cleaners, lubricating oil additives, oil field chemicals, printing inks, surfactants, synthetic lubricants and water management chemicals."¹⁹ The cluster has strong capabilities in product and process development for cosmetics and biocides, including microbial strains for disinfectants and surfactants as well as probiotics for animal and human health. This presents an opportunity to any locally licensed technologies to find uptake in the global space, as well as some import replacement opportunities for some of these chemicals that we still heavily rely on. For example, CSIR has biomanufacturing capabilities to manufacture Vit-B3 and probiotics for which there is no local manufacturing thereof currently.

- Bio-based chemicals and agribiologicals are growing due to legislation towards the use of sustainable raw materials and environmentally friendly technologies that do not pollute the environment. Consumer preferences for "green" and healthy products are supporting this growth. The CSIR has established the Biomanufacturing Industry Development Centre (BIDC) and the industrial biocatalysis hub (IBH) to focus on exploiting these trends to provide industry with a competitive advantage.
- AI capabilities will realise the automation of many processes and data generation, providing real-time monitoring for decision-making, but adoption is generally slower in this sector compared to manufacturing or the automotive industry.
- Animal Health and Food Security – South Africa has recently experienced Avian Influenza. Given that it is not the first occurrence and South Africa's position not to vaccinate chicken, there are opportunities for innovative solutions that include disease preventative feed additives. Antimicrobial resistance is also an issue in animal health. Probiotics play a key role and novel design of strains to combat various ailments in animal health is a driver (insights from recent AFMA forum, September 2023).

19 <https://www.spglobal.com/commodityinsights/en/ci/products/specialty-chemicals-industry-scup.html>



The pharmaceuticals (including biopharmaceuticals) sector will see a shift in current priorities towards addressing other diseases beyond 2031 (e.g., neglected, rare). R&D spend on non-Covid-19 drugs is anticipated to be much higher than previously forecasted with opportunities in active pharmaceutical ingredients (APIs) and small molecules. The recent and biggest recorded acquisition that paints this future outlook is Biogen's acquisition of Reata Pharmaceuticals (\$7.3 bn), a company that focuses on "therapeutics that regulate cellular metabolism and inflammation in serious neurologic diseases, including SKYCLARYS® (omaveloxolone), the first and only FDA approved treatment of Friedreich's ataxia, a rare disease in the USA". Merck is reportedly acquiring Caraway (21 November 2023 report), a start-up that will expand the group's offering in neurodegenerative diseases using targeted protein strategy. These industry moves are a few among many and serve to demonstrate the value and potential impact that our biologics and biosimilars portfolio can make when aligned with big market players' interests – their R&D spend, mergers and acquisitions are indicators in this regard. Low-cost options are required to increase affordability for public healthcare systems. A strong competence in developing biopharmaceutical manufacturing processes has been built within the CSIR Future Production: Chemicals and is being expanded to include cGMP manufacturing to enable local manufacture of biopharmaceuticals. It is our intent to position this capability with multi-nationals that may require ad hoc market sample production for clinical trials locally and in Africa.

Constraints in vaccine availability during the Covid-19 pandemic have led to the growing focus on self-sufficiency in vaccine and pharmaceutical manufacturing in Africa. The Gates Foundation's workforce development that is underway aligns us with a global strategy that will see us contributing to Africa's readiness to disease management. Added to this, is the global increase in antimicrobial resistance and vaccines play a crucial role for a holistic solution (WHO, 2023). There is an Antimicrobial Resistance National Strategy Framework (2018 – 2024) in line with World Health Organisation's (WHO) resolution EB134/37 "Combating antimicrobial resistance including antibiotic resistance". The framework calls for action in "international collaboration, encouraging and supporting research and development, encouraging the development of novel diagnostics and antimicrobial drugs", amongst others. These well align with the chemicals and health offerings that BD&C will use to drive stakeholder engagement across the continent.

The agricultural sector

The megatrends in the agriculture sector include digitisation which involves the integration of advanced technologies such as IoT (Internet of Things), drones for crop monitoring, and the application of data analytics to enhance decision-making. This has implications for precision farming, where data-driven insights optimise crop yields, resource utilisation, and reduce environmental impact. The CSIR Advanced Agriculture and Food (AAF) cluster's capabilities in smart farming technologies, i.e., drone technology, precision agriculture information system and remote sensing capabilities strategically position the cluster to support small, emerging and commercial farmers in precision farming. Additionally, the sector is increasingly affected by climate change, leading to shifts in weather patterns, water scarcity and extreme events. This has necessitated the need for resilient crops, water management strategies and sustainable farming practices. The cluster contributes towards sustainable farming practices, fostering resilience to climate change by promoting resource efficiencies and reducing the ecological footprint of agriculture to mitigate the impact of climate change.

As climate change's effects become progressively pronounced, the need to shift towards sustainable and green practices proves more crucial. This has resulted in the adoption of a framework calling for hazardous pesticides in the agriculture sector to be phased out by 2035. This presents an opportunity for sustainable production and waste reduction methods such as bio-composting of food waste, which reduces the reliance on certain chemical inputs.

There is a growing demand for sustainable and plant-based products, which presents opportunities for the development of plant-based food and cosmetic products and is aligned with the cluster's capabilities in agro-processing. Valorisation of natural products for food, cosmetics and pharmaceuticals products presents opportunities for research and development of value-added products and partnerships with food, pharmaceutical and cosmetic industries.



The health sector

The medical device market segment is expected to reach nearly \$800 bn by 2030 globally and for South Africa, the medical device market was expected to reach \$1.7 bn by 2021 (Source: BMI Research). The CSIR is working on the development of point-of-care (POC) devices for prevalent and emerging diseases in South Africa in support of decentralised healthcare systems in Africa. POC seems to be a much-needed solution to diagnostics challenges across Africa and the CSIR NextGen Health cluster is poised to respond to this challenge. Key areas on medical device development include development of on-site mycotoxin testing kits, Lab-on-Chip POC acute kidney injury due to ARV treatment, multiplexing of HIV/STI testing kit and the thyroid stimulation hormone for newborn screening tests with focus on the public sector.

The national need for diagnostic capacity has become increasingly evident, especially in the context of healthcare and public health. Accurate and timely diagnostics play a pivotal role in disease detection, monitoring, and control. According to the WHO, an estimated 10 million deaths annually are attributed to lack of access to timely and reliable diagnostics. In the wake of the Covid-19 pandemic, the importance of diagnostic capacity has been underscored, with testing being a critical component in identifying and isolating cases. Countries are recognising the urgency of investing in diagnostic infrastructure, with an aim to strengthen healthcare systems. The challenge lies not only in addressing current needs but also in building resilient systems capable of responding to emerging health threats. As an example, given the higher incidences of congenital hypothyroidism in South Africa, early diagnosis and subsequent timely treatment for congenital hypothyroidism in newborns is an important healthcare need. Congenital Hypothyroidism (CH) is one of the most common causes of preventable mental retardation (Ahmad, Irfan and Al Saedi, 2017). Untreated CH leads to intellectual disability if early diagnosis is missed and treatment is not started. The development of strategies for creating a POC diagnostic tool for screening congenital hypothyroidism in newborn babies is planned as a collaborative effort between CSIR, Ampath and North-West University. As nations grapple with the demands of an evolving healthcare landscape, a strategic focus on expanding and sustaining diagnostic capacity is imperative for both national and global health security.

Vaccine development is a crucial part of the CSIR preventative treatment offerings in the health sector, and Covid-19 has highlighted the importance of having localised manufacturing capacity for pandemic response and resilience. WHO reported that the 2019 market value for vaccines (pre-Covid) was approximately \$38 bn²⁰. High income countries account for 68% of global market value, while Africa's market is estimated to represent 5% of the total global market²¹. Pneumococcal conjugate, diphtheria- and tetanus-containing and human papillomavirus vaccines remain top-value vaccines, and the pneumococcal conjugate and human papillomavirus vaccines markets are likely to grow substantially by 2030²². Based on country reported data, WHO estimates that, across 47 vaccines and 94 manufacturers, the 2021 global vaccine market supplied approximately 16 billion vaccine doses (up from 5.8 billion in 2019), with a value of US\$ 141 bn (up from US\$ 38 bn in 2019)²³. This value accounts for 10% of the pharmaceutical market (up from 4% in 2019). Without Covid-19 vaccines, the 2021 vaccine market supplied approximately 5.3 billion doses, with a value of US\$ 42 bn and 4% of the pharmaceutical market – the minor changes compared to 2019 result from decreased volumes of some paediatric vaccines and increased volumes of some (higher price) adult vaccines²⁴. The CSIR's value proposition lies in the development of novel virus-like particles (VLPs) for vaccines targeting for diseases prevalent in Africa. Furthermore, the CSIR has developed biopharming capabilities, offering a cost-effective manufacturing system that can be adopted in Africa.

20 WHO (2020). Global Vaccine Market Report. Accessed via https://cdn.who.int/media/docs/default-source/immunization/mi4a/2020_global-vaccine-market-report.pdf?sfvrsn=48a58ada_1&download=true#:~:text=M14A%20estimates%20global%202019%20market,for%2068%25%20of%20global%20value.

21 ibid

22 ibid

23 WHO (2022). Global Vaccine Market Report. Accessed via <https://iris.who.int/bitstream/handle/10665/367213/9789240062726-eng.pdf?sequence=1>

24 ibid



The CSIR is making efforts to ensure that African genetics are incorporated into global research by enhancing accessibility of diverse preclinical cellular tools in drug development pipelines. It is working with TIA and the Bill and Melinda Gates Foundation to provide pre-clinical stem cell models of African origin for drug pipeline development in the pharmaceutical industry, (i.e., neurotoxic, cardiotoxic assays and so forth), as opposed to relying solely on advanced in vitro models that represent the African genetic diaspora. Furthermore, the CSIR is striving to improve the production process efficiency of biopharmaceuticals using Chinese Hamster Ovarian (CHO) cells by reducing heterogeneity in CHO cell lines.

The National Health Insurance (NHI) initiative in South Africa represents a significant paradigm shift in the country's healthcare system. The NHI aims to achieve universal health coverage, ensuring that all citizens have access to essential healthcare services without financial barriers. The process involves restructuring the healthcare system to promote equity, efficiency, and improved health outcomes. The NHI is expected to address longstanding inequalities in access to quality healthcare and enhance the overall health infrastructure of the nation. CSIR can contribute meaningfully to the developments in the NHI space by focusing on key research areas. Firstly, conducting health systems research to assess the impact of NHI implementation on healthcare delivery, access, and outcomes is crucial. This includes evaluating the effectiveness of various NHI interventions, identifying challenges, and proposing evidence-based solutions, as well as conducting rigorous health system assessments, evaluating the impact of NHI policies on different demographic groups, and proposing evidence-based interventions to enhance the effectiveness of NHI implementation. Additionally, the CSIR can contribute by conducting studies on innovative healthcare delivery models, health workforce planning, the integration of technology for improved healthcare access, health economics research, exploring the financial implication, and sustainability of the NHI model. Moreover, as the NHI relies heavily on information systems and technology, the CSIR can contribute by developing and implementing innovative digital health solutions, including electronic health record systems, telemedicine platforms, and data analytics tools to enhance the efficiency of healthcare delivery and improve patient outcomes.

The defence and security sector

National Defence and Security RD&I budgets remain under pressure. However, the South African National Defence Force (SANDF) continues to be involved in multinational operations, including those in northern Mozambique and the Democratic Republic of Congo. There is a growing concern nationally about the increase in social unrest and critical infrastructure security risks, which negatively impact national departments and institutions such as Transnet, Eskom and others. These factors have led to increased operational demands on the SANDF to assist SAPS and other security institutions to deal with the national security challenges. The SANDF budget is therefore further strained, which has led to the reallocation of budget away from RD&I and defence acquisition. The implementation of the Defence and Aerospace Industry Masterplan has been slower than expected, even in areas with "low-hanging fruit", such as improved permit processes; where many of the export barriers identified during the master plan development process persist.

Few local equipment acquisition programmes are anticipated in the future, and therefore, the defence industry must seek export markets. The ongoing decline of the locally owned defense industry persists. As a result, the CSIR is experiencing little contract RD&I business opportunities within the locally owned defence industry. This industry faces challenges accessing foreign markets, partly due to a limited overseas presence. Foreign-owned defence companies in South Africa, however, have more promising prospects, with some companies seeing improvements in their order books due to increased defence spending in developed countries. Additionally, this sector of the industry has experienced the loss of advanced engineering capabilities and skills, with significant movement to the Middle East. The CSIR has experienced the loss of critical skills to this region over the years. The conflicts in the Ukraine and Gaza have had a very negative impact on the global supply chain within the Defence and Security sector, where most nations have resorted to prioritising their own industries in terms of global military equipment supply.



The Justice Crime, Prevention and Security (JCPS) cluster is currently facing challenges in terms of having the relevant capabilities and skills to combat crime. This has led to a high dependency on the private security sector to supplement the capability and skills gaps that exist within JSCP. The demand for mature, low cost and operationally ready systems means there is very little investment in RD&I from the security sector, where most of their technologies are sourced internationally. It is a labour-intensive industry, with a demand for low-cost intelligent security products.

Cybersecurity risks are expected to grow and will eventually impact all industries, becoming a key issue to address in the digital transformation journey. Cybersecurity professionals are currently in high demand both in the public and private sector. Research reports indicate that even though the global cybersecurity workforce has grown to close to 5 million professionals by 2022, there is a need for more than 3.5 million security professionals, and this number continues to grow year on year. In Africa, it is estimated that this shortage is close to 800 000.

The manufacturing sector

Business conditions in the South African Manufacturing Sector are challenging, being impacted by load shedding, high logistics cost and delays, aging equipment, slow 4IR adoption and low investment levels.

The Automotive Manufacturing Industry globally is transitioning to New Energy Vehicles (NEV) with significant impact on supply chains. New manufacturing capabilities must be created for batteries and for light weighting. Cost reduction innovations include the use of much larger metal castings than was used before, accompanied by parts count reduction. Several national stakeholders are investigating the potential negative impacts on the local automotive manufacturing industry of the NEV transition, as well as new opportunities that might be created. It is already clear that it will become even more challenging to meet local content targets.

The primary and secondary metal casting industry is energy intensive and is severely impacted by the electricity supply situation. There is a growing need for revitalisation in all manufacturing related industries to improve competitiveness and exports, including a growing need for rapid digital transformation.

The local environment is impacted on a policy level by the South African Economic Reconstruction and Recovery Plan (ERRP), DSI Decadal Plan and the various industry sector masterplans by **the dtic**. Priorities of the ERRP and Decadal Plan that are of relevance to the CSIR include:

- Development of new sources of growth: creating and leveraging opportunities around the fourth industrial revolution, green/circular economy and digital transformation;
- Building of a capable and developmental State: contributing towards the improvement of government service delivery within the public healthcare sector, enhancing skills development and training at HEIs and improved operational efficiencies and sustainability of the various SOCs, specifically Eskom, Transnet and the State Diamond Trader;
- Support to the health and energy sectors: localisation of point-of-care medical devices, effective patient data management, skills development across the hydrogen and battery energy storage value chains and localisation of component product manufacturing within the energy sector;
- Supporting the inclusion of SMMEs into the economy: improving operational efficiencies and increasing competitiveness through the implementation of advanced technologies, commercialisation of CSIR IP, incubation of new SMMEs (technology transfer and market development) and improving access to high-end equipment and infrastructure

In addition to the priorities of the ERRP and Decadal Plan, the CSIR is also positioned to support the objectives contained within **the dtic's** masterplans for the following sectors: Metals and machinery, renewable energy, mining, automotive, aerospace and defence, medical devices, and rail.



The mining sector

Global Mining industry has experienced dampened commodity prices with a decreased demand in PGM's due to growing demand in EV electric vehicles. The dampened demand of PGM has had a negative impact on the economy of South Africa, this as PGM production accounts for 23%²⁵ of mining production in South Africa. This has resulted in mining companies announcing restructuring with several mining companies, including Glencore, Seriti, Sibanye-Stillwater and Impala Platinum (Implats), recently issuing section 189 notices leading to job cuts including major mining companies closing unprofitable shafts e.g., Sibanye-Stillwater to close four PGM shafts, affecting 4 000 jobs²⁶. According to Accenture, Digital technologies can help South African mining businesses unlock ZAR153 bn in value by 2026 and this is translating to about 51% of current mining size²⁷.

The mining industry continues to be a significant contributor and a strategic pillar of the South African economy and a major source of employment. In contrast to other commodity-rich countries like Australia, South Africa has a relatively small mining equipment, technology, and services (METS) sector, with limited exports. Currently, South Africa imports over 90% of its mining equipment, technologies and digital services from Europe, Australia, the United States of America (USA) and Canada. However, given the growth potential in the mining industry, South Africa has the opportunity to develop and grow its METS industries further. Achieving this goal will necessitate the revitalisation of manufacturing and technological capabilities, with the CSIR playing a pivotal role in supporting the mining industry in accelerating a People centered digital transformation drive. Key business value drivers in this sector also include ESG as a business risk impacting social license to mine, worker safety, decarbonisation driving the shift towards cleaner and sustainable mining. Digital transformation for the South African mining industry will include unique innovations that will address old mining infrastructure through retrofitting and interoperability.

Smart Government Services, Financial Inclusion and Intelligence, and Smart Digital Services and Operations

With respect to Smart Government Services, several key initiatives and challenges are shaping the landscape. The WHO is advocating for universal health coverage²⁸, while the Presidential Health Compact²⁹ emphasises the need for an integrated and unified health system. Additionally, efforts are underway to implement the National Health Insurance, aligning with the goal of providing high-quality and affordable healthcare access to all South Africans. The CSIR is well-positioned to contribute to these areas. For instance, we can develop foundational digital health components such as electronic medical records and data hosting, to support the National Health Insurance initiative. There is also a growing demand for data sovereignty and improved efficiency in cloud services across organs of state. In the education sector³⁰, there is a disconnect between population migration patterns and school expansion planning. In the field of education, CSIR capabilities could enable future-ready education planning through spatio-temporal digital platforms. The organisation can also provide private cloud infrastructure and services to government entities and SMMEs.

The focus on Financial Inclusion and Intelligence is influenced by various factors, including South Africa's greylisting by the Financial Action Task Force (FATF)^{31,32} the rise of digital assets and associated risks including illicit activity, non-compliance with anti-money laundering, terrorist financing and know-your-client regulations^{33,34}, the risk of blacklisting in the long term,

25 <https://tradingeconomics.com/south-africa/mining-production>.

26 <https://www.nsenerybusiness.com/news/sibanye-stillwater-to-close-four-pgm->

27 Extracting Value with Data-led Mining in South Africa.

28 Accessed via https://www.who.int/health-topics/universal-health-coverage#tab=tab_1

29 Accessed via <https://www.thepresidency.gov.za/content/presidential-health-summit-2018-report>

30 Accessed via https://www.gov.za/sites/default/files/gcis_document/202104/44389gon206.pdf

31 Accessed via <https://www.fatf-gafi.org/en/countries/black-and-grey-lists.html>

32 Accessed via https://www.treasury.gov.za/comm_media/press/2023/2023022501%20FATF%20Grey%20Listing%20Fact%20Sheet.pdf

33 Accessed via <https://www2.deloitte.com/us/en/pages/audit/articles/blockchain-digital-assets-risk-management.html>

34 Accessed via <https://glginsights.com/articles/the-key-risks-in-the-digital-assets-space/>



and the global shift toward digital commerce^{35,36}. Leveraging the organisations expertise in distributed ledger technologies, data science, AI and geospatial modelling, the CSIR can:

- Assist the financial sector in combating fraud and illicit transactions;
- Develop fintech solutions for micropayments to promote financial inclusion;
- Strengthen regulatory enforcement of digital assets, including the detection of money laundering, terrorist financing, sanctions evasion, tax evasion and exchange control violations; and
- Provide better intelligence on natural disasters to inform the accurate pricing of insurance products.

In the domain of Smart Digital Services and Operations, the CSIR aims to address challenges emanating from inadequate information and communication technology (ICT) infrastructure^{37,38}, limited connectivity in rural areas^{39,40}, high access costs⁴¹, language barriers and low literacy levels that hamper universal access to information⁴². Efforts will align with the transition to wireless networks^{43,44}, and the need to prepare society and businesses for a digital^{45,46}, future. The CSIR will focus on enabling access to the digital economy for all and supporting digital transformation by:

- Addressing the cost barrier for connectivity users and providers through innovative networking technologies;
- Expanding network coverage in rural areas;
- Facilitating inter-lingual communication through the development and deployment of language technologies; and
- Fostering foundational digital capabilities that contribute to the establishment of a thriving digital industry in South Africa aligning with the digital economy objectives of the DSI Decadal Plan.

Sustainable development and living sectors

The work of the CSIR is closely aligned with the global 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs). Many of the CSIR projects, conducted in collaboration with international partners, are framed within the context of the SDGs and related international reporting targets. The outputs of the CSIR strive to address societal and institutional challenges using SET solutions that promote sustainable infrastructure, industry and society.

At a national level, these principles are reflected in various policies and strategies led by multiple government departments at the national, provincial and municipal levels. These include, but are not limited to, the National Climate Change Response Policy, National Waste Management Strategy and the Integrated Resource Plan, including the Just Energy Transition. Equipping the government to respond effectively with actionable solutions is at the core of the CSIR's service offerings.

35 Accessed via <https://www.sciencedirect.com/science/article/pii/S0148296319305478>

36 Accessed via <https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/digital%20globalization%20the%20new%20era%20of%20global%20flows/mgi-digital-globalization-full-report.ashx>

37 Brown, C. & Thomas, H. & Merwe, A & Van Dyk, L. (2008). "The Impact of South Africa's ICT Infrastructure on Higher Education." Accessed via https://www.academia.edu/29482346/The_impact_of_South_Africa_s_ICT_infrastructure_on_higher_education

38 Accessed via https://researchictafrica.net/wp/wp-content/uploads/2018/10/after-access-south-africa-state-of-ict-2017-south-africa-report_04.pdf

39 Brown, C. & Thomas, H. & Merwe, A & Van Dyk, L. (2008). "The Impact of South Africa's ICT Infrastructure on Higher Education." Accessed via https://www.academia.edu/29482346/The_impact_of_South_Africa_s_ICT_infrastructure_on_higher_education

40 Accessed via https://researchictafrica.net/wp/wp-content/uploads/2018/10/after-access-south-africa-state-of-ict-2017-south-africa-report_04.pdf

41 Ibid

42 Brown, C. & Thomas, H. & Merwe, A & Van Dyk, L. (2008). "The Impact of South Africa's ICT Infrastructure on Higher Education." Accessed via https://www.academia.edu/29482346/The_impact_of_South_Africa_s_ICT_infrastructure_on_higher_education

43 Accessed via <https://www.sciencedirect.com/science/article/pii/S0148296319305478>

44 Accessed via <https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/digital%20globalization%20the%20new%20era%20of%20global%20flows/mgi-digital-globalization-full-report.ashx>

45 Accessed via <https://www.sciencedirect.com/science/article/pii/S0148296319305478>

46 Accessed via <https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/digital%20globalization%20the%20new%20era%20of%20global%20flows/mgi-digital-globalization-full-report.ashx>



The cross-sectoral work undertaken by the CSIR focuses on sustainable industrial development, the promotion of circular economy practices and the advancement of smarter, more efficient infrastructure and human settlements. The challenges posed by aging public infrastructure and failing utilities are significant priorities on the national agenda, and the CSIR plays a central role in advising and capacitating government and industry as well as empowering communities.

Mobility and logistics sectors

The global mobility sector continues to show strong signs of recovery from the Covid-19 impact on movement of people, freight logistics and the supply chain thereof. Global mobility megatrends driven by technological disruptions, climate change, demographic shifts and urbanisation, e-commerce necessitating a rethinking of end-to-end logistics and supply chain solutions prevail. Africa regional integration has also been a topical issue in the recent past; the signing of the Africa Continental Free Trade Area Agreement (AfCFTA) is seen as a major step towards advancing regional trade. Logistics in the country is extremely fragmented, partly due to its deregulation status. An addition, the South African post-pandemic mobility landscape has seen increased adoption of electric mobility as a solution to sustainable urban mobility challenge; increased activity towards alternative materials for climate adaptation and resilience both for sustainable rural mobility and affordable urban mobility; advances in green hydrogen research as an alternative source of energy for mobility; deployment of technology for protection and security of transport infrastructure; as well as increased effort to resolve logistics and supply chain issues. There has also been a heightened interest in equitable access to mobility; the pandemic has worsened the inequalities that are embedded in the transport systems. The planning, design and operation of transport systems, therefore, must adapt and evolve. The newly gazetted National Land Transport Strategic Framework (NLTSF) for 2023-2028 outlines the government's plan to revitalise and restore South Africa's transportation systems prioritising rail over road infrastructure according to the National Spatial Development Framework⁴⁷. It provides guidance on transport planning and land transport delivery by government and industry. Optimising the logistics of freight delivery is crucial, requiring last-mile delivery planning and a reduction in empty trips⁴⁸.

Leveraging expertise in leading conceptual research, rapid prototype development, and implementation of mobility solutions, the CSIR is able to support strategic initiatives of national interest:

- Through our Smart Logistics Observatory, provide a one-stop reference platform for logistics and supply chain data/information to, first and foremost, empower the state to resolve logistics challenges and create long-term capability in logistics and supply chain for road, rail, port and air.
- Provide systems modelling and analysis, economic modelling, simulation modelling, and optimisation to enable decision-support and planning for national government, local, regional and international partners through the Smart Logistics Observatory.
- Provide data-driven and intelligent transport systems, road safety systems and asset management systems through innovation and decision support tools for long-term sustainability and affordability of urban mobility.
- Through our Road Materials Testing, Pavement Design and Construction and Nanotechnology Centres, provide leading research and prototyping of alternative materials for gravel roads, asphalt additives, bitumen replacement for sustainability and long-term affordability of transport infrastructure.
- Assist transport authorities, provincial and local government in transport planning modelling and simulation for policy development and giving effect to the intent of the NLTSF and related regulations and transport master plans.
- Provide leading research on applicability of green hydrogen in mobility.

47 National Land Transport Strategic Framework (NLTS) for 2023-2028 Accessed via https://www.gov.za/sites/default/files/gcis_document/202303/48176gon3119.pdf

48 Mokoena, R., et al (2021) Facilitating sustainable economic development through circular mobility. Circular Economy Briefing Note No. 6 Accessed via [6.-Mobility-CE-Briefing-Note.pdf](#) (circular-economy.co.za)

- Provide leading research on creation of equitable access to mobility services.
- Develop and harmonise standards and codes of practice, leading research on interoperability of local and regional mobility systems, economic modelling and lifecycle costing of integrated projects for AU member states.

The CSIR is well positioned to identify and support targeted industrial development for local and regional mobility.

A.2.2 ECONOMIC RECONSTRUCTION AND RECOVERY

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)⁴⁹ focuses on the following priority interventions (also see figure A1)⁵⁰:

- Aggressive infrastructure investment;
- Strategic localisation, reindustrialisation 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.

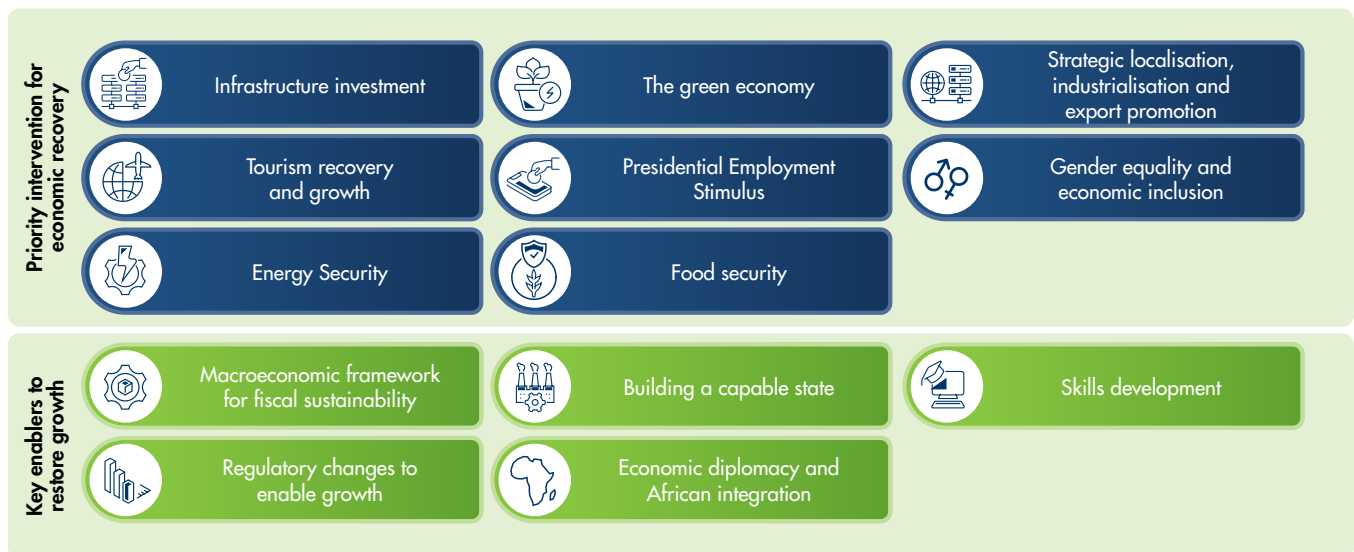


Figure A2: ERRP priority interventions for economic recovery and key enablers to restore growth in South Africa

The CSIR’s operating model and strategic interventions (see Table A2) builds capabilities aligned to the ERRP through scientific and industrial research in areas of energy, agriculture and food, health, chemicals mining, manufacturing and defence as well as and in the application of digital technologies to transport and logistics, e-government, human settlements and spatial planning.

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

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



A.2.3 MEDIUM-TERM STRATEGIC FRAMEWORK

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

- The CSIR supports 'Economic transformation and job creation' through conducting RD&I that is geared towards the 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 HC development. The CSIR ensures continued capacity development and transformation of its SET base. Often, that SET base is absorbed elsewhere in the South African NSI. To demonstrate the CSIR's continued RD&I activities in the health space, the recent development of locally developed ventilators during 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.2.4 NATIONAL SCIENCE POLICY

The CSIR strategy for 2024/25–2028/29 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 three SGCs that capture the core domains for STI priorities and associated interventions. The three SGCs are:

- Climate change and environmental sustainability;
- Future-proof education and skills; 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.

It is envisaged that, over time, the NSI will pivot towards the Decadal Plan’s STI priorities and, consequently, all NSI actors will need to plan for this transition. The following are some of the activities required for the transition:

- Using STI to modernise key sectors of the economy, driving competitiveness and productivity improvements and, ultimately, higher GDP contributions;
- Exploring opportunities presented the emerging circular and digital economies as new sources of growth;
- Harnessing the capabilities built by the NSI to drive innovation across several sectors (e.g., health and energy) to support the development of a capable and entrepreneurial state;
- Using STI to contribute to an STI-enabled, capable state, enabling improved service delivery and decision making;
- Using STI to support social progress, including economic inclusivity and sustainable livelihoods; and
- Using STI to address the SGCs in the areas of climate change and environmental sustainability (SGC 1), future-proof education and skills (SGC 2) and the future of society (SGC 3).

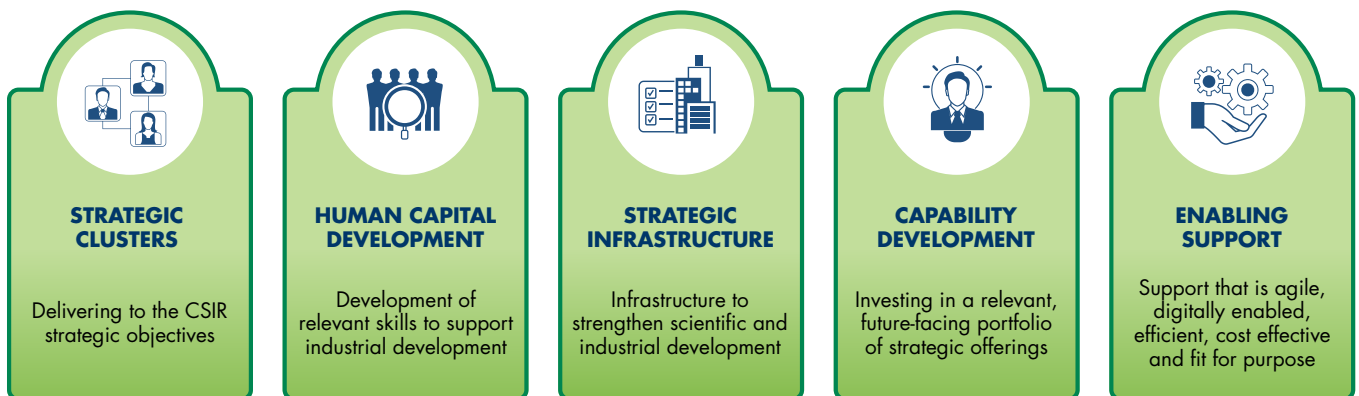
Proposals for large, integrated initiatives in response to the strategic intent of the Decadal Plan are included later in this document.

A.2.5 INTERNAL CONTEXT

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

Pillars of CSIR strategy implementation

In the fourth year of strategy implementation, the CSIR 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 A3 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.



DRIVERS FOR SUCCESSFUL IMPLEMENTATION:

- Business development and commercialisation, technology transfer and diffusion
- Governance, values, ethics, people and culture
- 4IR and emerging technologies

Figure A3: Pillars of CSIR Strategy implementation

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; and (2) could 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 to form the backbone of the strategy and are the RD&I-performing components of the CSIR operating model.

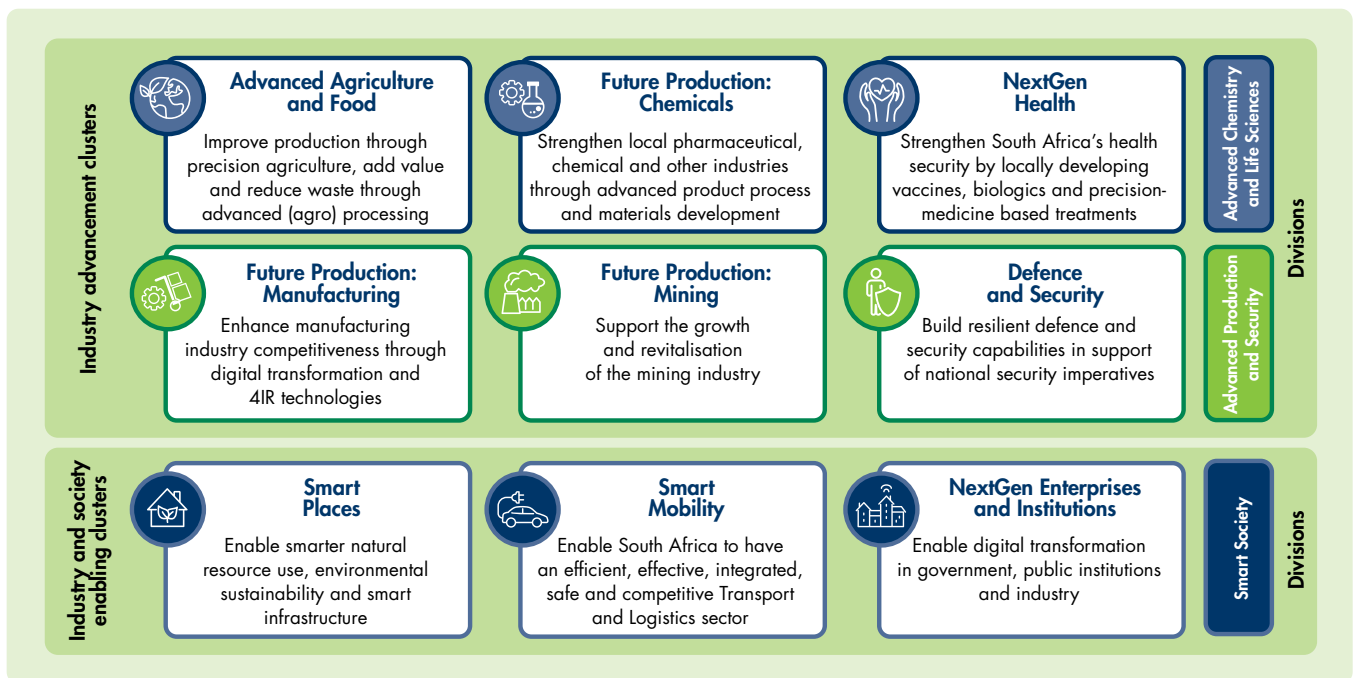


Figure A4: CSIR strategic clusters positioned to drive South Africa’s industrialisation

The nine CSIR clusters are depicted in Figure A4 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; NextGen Health; Defence and Security. The other three clusters (Smart Places, Smart Mobility and NextGen Enterprises and Institutions) are industry and society-enabling clusters.

1. The CSIR Future Production: **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, BIDE and NIDE) together with the newly established Industrial Biocatalysis Hub, Supercritical CO₂ 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 CSIR **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 focus 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 RD&I 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 CSIR **Next-Gen 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. Due to financial sustainability challenges, the research teams in this cluster are being incubated in the Future Production Chemicals and Advanced Agriculture and Food clusters where capabilities are aligned and there is clear scientific leadership. The cluster has a research focus in an impact area in Medical Devices, Diagnostics and Vaccines (MDDV), which encompasses focuses on the Human Diagnostics and Omics, and Veterinary Molecular Diagnostics and Vaccines research groups 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 CSIR **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 in response to the strategic and sovereign needs of the country. 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 CSIR Future Production: **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 Future Production: **Mining cluster** currently has two impact areas, namely Mining Testing and Training and Mining and Minerals Resources (MMR). Mining testing supports the mining zero-harm objective by providing independent annual monitoring and legislated performance acceptance testing, monitoring and training services to the mining industry. While the MMR impact area offers traditional mining technical expertise in the areas of rock engineering, geotechnical solutions, and bespoke mining-related studies and recently added digital capabilities to support people centred modernisation drive. The cluster has also recently developed a fit for purpose technology strategy roadmap carved out a new developmental path that will expand its impact areas into three technology areas, namely i) Mine Digitalisation and Automation (including, but 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); ii) Mining Extraction Processes (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 iii) Mine Environmental Sustainability which is aimed at supporting the mining industry with creating a sustainable mining value chain, with leading topics such as optimised energy and decarbonisation, mining environmental control services, circular economy, and sustainable mining innovations.
7. The CSIR **Next-Gen 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 CSIR **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, the NFTN (National Foundry Technology Network) and the NCPC (National Cleaner Production Centre) that are managed on behalf of **the dtic** (Department of Trade and Competition). The cluster's impact covers *inter alia* the following sectors: Utilities (electricity, gas, and water); Business and Financial Services; Education; Health; Agriculture; Mining and Quarrying; Manufacturing (Waste, including plastics); Human Settlements; Safety and Security (from a planning approach) and Construction; sustainable environment and global change; marine and coastal systems; industrial development.
9. The CSIR **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 2024/25–2028/29 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 CSIR Future Production: **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 three years. The cluster did not, however, reach its headline income target and the SET staff levels as per the annual plans. This is due to (i) lack of income in a few areas and (ii) a slow increase in private sector funding. Future growth needs to come from international, as well as private sector funding, which are traditionally difficult to secure funding given the current environment and therefore require collaborative work with Business Development and Commercialisation (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.

In the Biomanufacturing Impact Area, the B IDC programme was fortunate to secure substantial funding from the DSI and National Treasury (Jobs Fund) to establish a strong competency in development and scale-up of bio-based manufacturing processes.

In the Biopharming Area we have secured funding from National Treasury to establish large scale cGMP facilities for clinical trial manufacture. Implementation of this FuturePharma facility is in progress as is training of staff in operation of cGMP facilities. We are in the process of raising further funding for this facility from the DSI. In the biocatalysis area we have been awarded the Industrial Biocatalysis Hub by the DSI. This is allowing the organisation to strengthen our biocatalysis capabilities and has allowed us to strengthen industry partnerships. In the biorefinery area funding secured from the DSI (through the General Budget Support programme of the National Treasury) allowed the CSIR to expand scale up capabilities and infrastructure, and construction of a pilot facility has been finalised. Skills in process and product development and scale up need to be strengthened and this is in progress. To address the industry development drive of the organisation we are supporting a number of local SMMEs and the relevant industry, as is shown through contracts with Omnia, AECL, Salamax, Tautomer, 3Sixty and SAPPI. We are also engaging with companies like Verigrreen Polymers, NTP, Simeka, Croda and Avantium.

The Biomanufacturing area is taking advantage of a requirement for workforce development training on the African continent. Training courses that were previously developed through the B IDC programme have been rejuvenated with a focus on vaccine and biomanufacturing skills development. These courses that offer a mix of theoretical and hands on training are currently being supported by the Gates Foundation, with other funders in the pipeline.

The Centre has received extensive support from the DSI, enabling it to set up world class capabilities in Advanced Polymers and Composites, Advanced Delivery systems, and Nanomaterials Synthesis and Characterisation. This has assisted the Centre in investing in extensive infrastructure to underpin these capabilities. The DSI's industry support programme has further enhanced the Centre's capability on scaling-up and product development, through the Nanomaterials Industrial Development Facility. This facility is predominantly industry-facing and looks to support SMEs and industry in product development. Additional facilities coming on line during 2023/24 include the Nano Micro Manufacturing Facility and the Supercritical CO₂ Encapsulation Facility, and will add significantly to the industry support capability of the Centre in terms of product development. A clear business plan for the Supercritical CO₂ encapsulation facility has been put together in collaboration with BD&C. The intent to collaborate and support industry is articulated in our contracts with Wonderstone, Sasol, Engen, Tautomer, 3Sixty, LHC and El Passo. Private sector engagements are taking place with for example Steamboat, PepsiCo, PlasticColour, Reliance, BASF, RMB Beauty, Labat, and SAPPI. International funding on hydrogen storage from Horizon EU and EPCM, HIPS-Germany on drug delivery, and agricultural biodegradable plastics from FRESHPACT.



There are still a few areas that have not achieved targets and have been supported in moving forward over the last year. The Gqeberha site has been closed during 2022/23, and a joint biofibre facility has been set up in the Coega DC. The breath analyser technology for diabetes has been licensed in 23/24, bringing industry support to the sensor group. However, the sensor platform requires further attention and improvements going forward. The Characterisation capability has been discontinued and the capabilities and employees have been absorbed by the research teams.

The intent is to grow our collaborative work with the local industry, and especially with large companies in our sectors, like Sasol, Safripol, Engen, SAPPI, AECL, Labat and the sugarcane industry. There is also a focus on international funding, both from international government programs and industry players.

The cluster aims to ensure that the industry-facing facilities will have attracted significant funding by 24/25 to continue with the SMME support work. The work of the BD&C team to bring in Enterprise and Supplier Development (ESD) funding from external parties like banks has started and have shown its first fruits already. The plan is to expand on this approach. In addition, DSI is supporting some of our facilities as well through SME focused portions of DSI programmes.

2. The **Advanced Agriculture and Food (AAF) cluster** is strategically well positioned for growth through public sector support. However, to further grow its contract R&D income, capabilities that respond to private sector needs to be developed. There is need to deepen scientific capability in product and process development in agroprocessing and align cluster's offerings to industry needs.

The cluster continued its positive financial performance following a profitable 2022/23 FY. It managed to reach more than 100% sales secured in the 2023/24 FY. This has been enabled by the cluster's ability to position itself to respond to national priorities – as evident from public sector contracts secured for Indigenous Knowledge Systems (IKS) (IDC and TIA), Cannabis (DSI and DSBD), Food Safety (TIA) and Precision Agriculture (DSI). These are strategic growth areas of this cluster. Furthermore, there has been growing regional interest in AAF cluster's offering, e.g., SADC, Namibia and Madagascar. Despite this, the cluster still needs to broaden its client base in private sector.

The cluster demonstrates pockets of excellence in precision agriculture and agroprocessing. However, it still requires stronger senior scientific leadership to drive specific areas. Recruitment of Impact Area Manager and an Executive Cluster Manager is expected to provide this leadership in the cluster. AAF's SET base is expected to grow in the next five years to support its technological growth.

Cannabis extraction equipment will anchor the cluster in the short to medium term. Supercritical extraction equipment will support extraction of oils mainly in support of Cannabis market growth as well as other indigenous plants. The cluster is in the process of acquiring and localising a microwave food processing technology for processing of fresh fruits and vegetables into highly nutritious foods. In the medium term, efforts are being made to obtain Hazard Analysis Critical Control Points (HACCP) accredited facilities.

Indigenous Knowledge system provides new opportunities for the cluster in the short to medium term and long term. These opportunities will be enabled by the current national legislative framework which comprised of the National Environmental Management: Biodiversity Act of 2004 (subsequently, linked to this Act, various regulations have been published, Bioprospecting, Access and Benefit Sharing Regulations, 2015), IKS policy of 2004 and The Protection, Promotion, Development and Management of Indigenous Knowledge Act of 2019, as well as strategic initiatives such as the bioeconomy strategy of 2014, biodiversity economy strategy (2014 – 2023), coupled to the Nagoya protocol on access and benefit sharing. The IKS programme will undertake bioprospecting research and develop technologies from South Africa's indigenous biodiversity of plant species linked to indigenous knowledge that are ready for industry to commercialise. Thus, IKS growth is envisioned to be driven by both local demand and regional market demand for indigenous herbal foods and medicines. The cluster's interventions will support South African Government bio-manufacturing and entrepreneurship initiatives, in order to contribute to job creation and poverty alleviation, as well as the wider continental initiatives. IKS platform will enable communities to obtain economic benefits from the use of their indigenous knowledge and associate biodiversity, this will be through benefit sharing agreements and agroprocessing enterprises supported by innovative technologies in the 4IR such as computational modelling to accelerate the impact of IKS especially in the health sector, thereby enabling the growth of the rural economy.



Precision Agriculture supports digitisation of the Agri sector (food crop, livestock, forestry) through innovative and adaptive earth observation technologies (RS & GIS), Climate Services, TV white space, Artificial Intelligence, Augmented Reality, Internet of Things (IoT), and Distributed Ledger Technologies (DLT) technologies. The PAIS (Precision Agriculture Information System) platform was developed by the team to support commercial farmers, small-scale and emerging farmers. In the short-term PAIS will be trialed through commercial farmers in the North-West Province and has been endorsed by DALRRD to be trailed in the provinces. Software development expertise will be recruited to assist with further development of the system to enhance its user interface. In the medium to long term, the platform will be positioned for commercial farmers, small and emerging farmers through government departments and will be expanded across the continent.

3. The **Next-Generation Health cluster** is heavily dependent on internal funding sources emanating from PG. It made a loss during the 2022/23 FY which was primarily due to lack of public sector and private sector funding (contract R&D), with specific groups showing lack of external sales and idle capacity. It intends to diversify its income over the next five years through increasing public sector, private and international income. Through targeted BD&C initiatives, R7 million funding was secured from DSI to support the development of VLPs. Furthermore, discussions between CSIR and DSI have been initiated for funding to drive the Synthetic Biology and Precision Medicine Centre.

The cluster will build on its strong base of senior scientists. However, stronger translational scientific leadership is required to drive key strategic focus areas, put together research programs that attract funding and drive research towards commercialisation. Hence, the cluster is in the process of recruiting a Chief Scientist to bring translational scientific leadership. Transformation of top SET remains critical. The cluster's SET base growth will be guided by its financial performance during the five years with relatively subdued growth being expected with subdued performance.

Support from Diplomics will enable the cluster to acquire a R15 million Mass Spectrometer needed for screening services in proteomics. The equipment will be utilised for identification and verification of novel diagnostic and prognostic biomarkers as well as therapeutic targets for drug development. Furthermore, discussions are progressing with the DSI to establish a Biofoundry hub at the CSIR, which will assist to anchor technology development in the precision medicine area.

The cluster has over the years accumulated highly valuable knowledge assets in genomics and precision medicine, disease diagnostics and precision cancer treatments. The genomics and precision medicine team is focusing on building an integrated, digital platform that will bring intelligence (through AI, large data mining) to large genetic, protein and microbiome data recovered from all the assays that the team develops. The following are the focus areas:

- Cellular models which recapitulate efficacy and safety data that may be difficult to extract from a clinical trial
- Digital Precision Medicine – omics solutions (microbiome, genome, metabolome)
- Providing physiologically relevant cell models for African centric research (CRISPR and stem cell)
- Developing new bioengineered stem cell products

Significant work has been done on developing fit-for purpose point-of-care rapid tests for the screening of acute kidney injury in HIV patients on tenofovir-based treatment. Approximately ten percent of people undergoing first line anti-retroviral therapy suffer from acute kidney injury resulting in acute kidney disease. The development of such a test will enable timely intervention, thereby preventing progression of chronic kidney diseases. The work will be proceeding to clinical testing to evaluate the performance of the rapid test against appropriate gold standard testing before submitting for regulatory approval.

Precision cancer treatments team aims to establish cost-effective synthetic biotechnology expression platform that would enable cancer precision medicine platform and address the unmet medical need in Sub-Saharan Africa, including:



- Designer cell lines for efficient biomanufacturing production. This will include a simple consumable synthetic biology kit which biomanufacturers will use to carry out high level target production;
- Development of designer bugs for industrial biotech applications. This will result in minimal and synthetic microbes and synthetic microbial expression systems; and
- Development drugs for blood and ovarian cancer.

The cluster is currently consolidating its work and leveraging on complementary areas in the Future Production Chemicals cluster, and will require significant public sector funding to realise the potential of the high value work that has been established in this space.

4. The **Defence and Security cluster** has over the years, built world class capabilities, which has resulted in technologies and products that have attracted attention from many international clients. The cluster has also produced several innovative technology 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 processes within the cluster. The cluster has made a significant effort to realise the commercialisation potential within the cluster. The commercialisation drive has not taken off at the expected pace due to the need for major change management needed within the cluster to align staff to the commercialisation strategy. The loss of critical skills remains a significant challenge for the cluster as it continues to lose skilled staff to the international and private sector markets. The cluster is unable to compete with the large salaries offered by the international and private sector markets. The cluster has specifically struggled to retain software development capabilities, as these skills are in high demand globally. To ensure that it achieves its key strategic objectives the cluster will continue to 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.

The Information and Cybersecurity Centre is prioritising several RD&I infrastructure initiatives including the Virtual Security Operations Centre (VSOC), a testing and compliance Laboratory, a cyber range, a certified Computer Security Incident Response Team (CSIRT) capability that may support government and private sector constituencies responding to cyber security incidents, a Cybersecurity Learning Factory and a digital forensics laboratory to aid in the development of forensic investigations skills to support law enforcement agencies. To execute these RD&I infrastructure initiatives, a sizeable investment, from a mixture of funding sources required is estimated to be R28 700 000 (2024/25 at annual increase of 10%). Additionally, it is expected that the Centre will need to grow its SET human capital base by an average of 10% year-on-year to be able to deliver on these initiatives and other core impact projects.

The cluster has positioned itself as an enabling partner to the Justice, Crime Prevention and Security (JCPS) cluster departments in their fight against crime. The Defence and Security cluster has a diverse, relevant portfolio of capabilities including ground and airborne sensor systems, command and control capabilities as well as integrative systems. The cluster also has a comprehensive suite of wind tunnels to perform aerodynamics testing and design of structures, guidance and control capabilities, capabilities in sensor payloads (Radar Imaging, RF and Optical Imaging), systems engineering and programme management of complex systems as that provide a pivotal role in the integration of cluster offerings into client solutions.

In line with the CSIR strategy the cluster has identified commercialisation of its strong technology base as a key priority going forward. The cluster has a significant number of technologies that are ready to enter the commercialisation stage of development. Over the past few years, the cluster has been working with both international and local industry partners to commercialise some of its technologies. There are a few technologies that are currently in advanced stages of commercialisation negotiations. The cluster will also position to secure commercialisation funding from the private sector to mature those technologies ready for the market.



5. The **Manufacturing cluster's** strategy is centered around applying capabilities to the sector masterplans' localisation priorities and industry focus as well as increasing the scope and accessibility of training and development content. Implementation of this strategy will be effected through the application of digital transformation and other 4IR capabilities that the cluster will continue to develop. The cluster is in a process of:

- Transitioning from a research culture towards one that combines research, technology development, and technology impact;
- Shifting from being internally focused to being more industry aligned and having frequent industry engagement; and
- Creating seamless integration across teams to provide collaborative solution/s in effectively addressing challenges faced by the manufacturing industry.

The cluster's strengths lie in the areas of photonics for additive manufacturing, laser engineering services, medical point-of care devices; advanced manufacturing processes and equipment for casting, metal injection and other powder metallurgy processes; sonar, UV and thermal inspection and monitoring sensor systems 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. However, the following capability gaps within the cluster exist:

- Manufacturing process optimisation, manufacturing process capability engineering;
- Machine design optimisation, engineering design optimisation; and
- Industrial engineering, as integrator across cluster.

The manufacturing cluster's medium-long term ambition is to have an integrated industry focused, industry specific programs that tap into skills and capabilities across the cluster and across CSIR; understand why target industries are not exporting more and work across the NSI to remove these constraints; and drive the localisation of technologies and products in target industries, first localisation and then exportation of previously localised and enhanced technologies.

Critical concerns are the cluster's loss of skilled team members over the past few years 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 the cluster can develop. This is a longer-term strategy. However, the cluster needs to find alternative interventions for the short and immediate term. The intention is to secure maintenance funding in the medium to long-term through industry partnerships and improved 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 margins. Internal process improvements within the project and programme management space will be implemented to improve project delivery.

6. The CSIR's **Mining** RD&I capability has experienced a regressive period over the past two decades characterised by a sharp decline in size of staff complement, and a devastating loss of skilled and experienced resources with operational knowledge in the mining value chain. The Mining cluster has recently launched the CSIR for Mining Innovation Roadmap Strategy focused on developing bespoke modernised solutions in partnership with the mining industry. At the heart of this strategy is fostering strategic partnerships, development and deployment of relevant technologies in support of people-centred modernisation for industry to achieve a safe and sustainable mining industry.

The cluster is in the process of building niche capabilities in specific areas, which support the development of bespoke solutions for the mining industry. These innovative technological solutions are developed in collaboration with industry stakeholders including 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 a sufficient pipeline of projects to ensure that the cluster meets its strategic objectives.

The Mining cluster is shifting away from the predominately time and materials-based contracting to a higher value business models offerings based on value sharing and economies of scale. These include performance-based and profit-sharing, licensing IP and software as license service and current efforts are focused on transitioning to these business models with emphasis on new innovations to support the growth and revitalisation of the mining industry. The cluster is focusing on the following strategic initiatives aligned to the fit for purpose strategy:

- Competency based training using 4IR technologies, driving zero harm in the mining industry;
- Collision prevention digital twin: supporting safer, modernised mining operations;
- Integrated Geosensing tools and risk-based mapping platform, supporting efficient and safer modernised mining;
- Decarbonising mining value chain through accelerating Hydrogen mobility with mining as the first case study application; and
- Towards a globally competitive critical minerals mining industry in South Africa aimed mapping RD&I opportunities that would give rise to the establishment of Large integrated programmes. The outcome of this initiative is to support South African mining companies to become globally competitive.

The mining cluster has had over 60% revenue income coming from the private sector, over the past four years and following the recent decline in the mining production data it is evaluating expanding business opportunities across the African continent including sourcing funding in new markets such as the middle east.

7. The **Next-Generation Enterprises and Institutions cluster'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 cross-cutting evidence-based analysis and broadband access in the private sector. According to a recent SWOT analysis conducted, the two primary challenges faced by the cluster centre 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 skills in high demand.

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; and
- A concerted effort to increase private sector business over the next five years.

8. The **Smart Places cluster** consists of two Research Centres (Energy and Water), impact areas in Functional Buildings and Infrastructure, Inclusive Smart Settlements and Regions, Sustainable Ecosystems and Holistic Climate Change; as well as Industry Support Programmes managed on behalf of **the dtic**. It is the largest cluster in the CSIR, both in terms of SET staff numbers and income, and has the challenges and opportunities associated with addressing a wide sectoral focus.



The Impact Areas and Centres within Smart Places 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 4IR, and/or to contribute to sustainable industrial development. Turnaround strategies in some areas have been completed and the implementation only recently initiated, with some way to progress in other areas.

Due to the wide application of energy and green economy skills in industry, Smart Places has also experienced significant staff turnover, particularly in scarce and critical skills. With the new PG allocation approach and reducing PG in the MTEF period, the cluster is adjusting its priorities and focus. Such adjustments will include a strong focus on areas of strength, such as support for a capable state, whilst leveraging these strengths to address historical weaknesses in commercialisation and technology development. It is clear that the cluster needs to determine new ways of supporting the development and maintenance of capabilities to fill the void left by the PG reduction.

The **Smart Mobility cluster** represents the confluence of various key elements and key expertise in transport planning and policy development, research, and development of technology for smart mobility systems and operations, research and sustainable development for mobility infrastructure, intelligent customer-centric transport systems and solutions 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 cluster has also experienced a high attrition of the senior, more experienced, and highly skilled staff resulting in challenges in delivering on the sales order book, as well as attracting and winning new work in some research groups. This has further been exacerbated by the protracted recruitment process due to unavailability of the necessary expertise in the market. The loss of key staff has resulted in a number of challenges including:

- Limited capability and capacity to attract new work, diversify markets and exploit commercialisation opportunities;
- Negative impact on mentorship and development of junior staff for succession planning;
- Limited capability and capacity in the laboratories resulting from lack of senior research capability and ageing equipment; and
- Weakening of the cluster's financial position.

The cluster intends to address these challenges through the following:

- Broadening local, regional, and continental collaboration through strategic partnerships to supplement the shortfall in capabilities, enable technology development and facilitate the dissemination of knowledge and innovations;
- Further deployment of the DSI/National Treasury Infrastructure Funding to renew and reposition cluster facilities;
- Development of turnaround plans for areas that are in distress;
- Development of a Smart Mobility Targeted Development Programme for SET base in the C3-4 and D1-2 career ladders, focusing on individual growth, aligned with the CSIR development programmes and with cluster management oversight;
- Continued focus on strengthening the HR complement, through the appointment of particularly at a principal researcher level; and
- A strategy of growth focused on the strengthening of resources (people and equipment) of new areas, namely, Transport Safety Laboratory, Technology Innovation Centre and Smart Logistics Management.

Table A1: Strategic RD&I Initiatives (2024/25–2028/29)

No.	Strategic Initiative Description	Envisaged Impacts	^a MTSF Apex Priorities	^b ERRP Priority Interventions	^c Decadal Plan – Key Economic Sectors
1. Chemicals cluster					
1.1	Biochemical Conversion (including bioprocessing) 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, such as Salamax and Omnia.	Economic transformation and job creation; education skills and health	Infrastructure investment and delivery; industrialisation through localisation	Innovation for a healthy society; A re-industrialised modern economy; The future of society; Environmental Sustainability
1.2	Local production of pharmaceuticals Support the local production of critical and modern drugs through the provision of fully automated, integrated, continuous flow-based processing technologies as well as the establishment of the FuturePHARMA open innovation facility for translational process development.	Support the development of a local biopharmaceutical industry. Potential local private sector clients include Virogen, Liselo, NBI. Support the CSIR commercialisation vehicle through for e.g., monoclonal antibody technologies.	Economic transformation and job creation; Education skills and health; A better Africa and World	Infrastructure investment and delivery; Industrialisation through localisation	Innovation for a healthy society; A reindustrialised modern economy; Environmental sustainability
1.3	Bioplastics Developing (biodegradable) bioplastics for industry applications, including biodegradability testing for industry	Supporting the development of green materials for re-industrialisation and localisation. A number of SMMEs are being targeted such as Plasticolours and Sandplast to take up these materials.	Economic transformation and job creation; A better Africa and World	Aligned to green economy interventions, and helps fulfil DSI's green economy strategy	Climate change and environmental sustainability, through development of alternative materials with better carbon footprint



No.	Strategic Initiative Description	Envisaged Impacts	^a MTSF Apex Priorities	^b ERRP Priority Interventions	^c Decadal Plan – Key Economic Sectors
2. Advanced Agriculture and Food cluster					
2.1	Cannabis beneficiation Extraction cannabinoids and formulation of cannabis related products. Development of extraction technologies to demonstrate local applicability of such technologies and formulation of innovative product types with SMMEs and big companies	Establish two distinct value-chains for cannabis industrialisation, e.g., hemp and medicinal cannabis industries. Develop and promote uniform (international) standards for production and processing to ensure compliance to health standards, quality products and commercialisation. Support evidence-based decision making, e.g., Clinical Trials for new, high quality medicinal cannabis products.	Economic Transformation and Job Creation	Industrialisation through localisation; Gender equality and economic inclusion of women and youth	Health Innovation
2.2	Indigenous Knowledge Systems Development of complementary medicines, cosmetics and food products	Introduction of IKS based products into the market and the development of the rural economy. Assist local communities to take african ginger products to market and navigate the IKS regulatory framework and benefit sharing regulations to ensure compliance and that communities benefit from the commercialisation of the plant. Develop IKS based products for SMMEs and Traditional Practitioners (e.g., Mashaba Herb) sponsored by DSI and IDC.	Economic Transformation and Job Creation	Strengthening agriculture and food security; Gender equality and economic inclusion of women and youth	Health Innovation
2.3	Precision Agriculture Development of a Precision Agriculture Information System (PAIS)	Provide soil and crop status information to various sectors involved in crop production, starting with the farmers, the input providers, financing institutes, and the managers. PAIS will be trialed with NWK commercial farmers and was endorsed by DALRRD for use across the country provide an opportunity to support emerging farmers. Software developer with be recruited to develop the front end of the system.	Economic Transformation and Job Creation	Strengthening agriculture and food security	Modernising Agriculture



No.	Strategic Initiative Description	Envisaged Impacts	^a MTSF Apex Priorities	^b ERRP Priority Interventions	^c Decadal Plan – Key Economic Sectors
3. Next-Generation Health cluster					
3.1	Point-of-care diagnostics Develop a fit-for purpose point-of-care rapid tests for screening of Acute Kidney injury.	Will create capabilities for testing for Acute Kidney Injury, particularly for HIV patients on tenofovir-based treatment, enabling early diagnosis and prevention of progression to chronic kidney disease and associated complications requiring expensive treatment.	Education, skills and health, A better Africa and World, Consolidating the social wage through reliable and quality basic services.	Industrialisation through localisation	Innovation for a healthy society; A re-industrialised modern economy
3.2	Digital precision medicine Establishment of digital precision medicine platform using genomics, proteomics and microbiome.	Stem cell derived models of 3D liver ‘in-a-dish used to assess African genetic variants that affect liver metabolism of imported drugs. This will help reduce costs of treatment due to ADR and improve the quality of lives of patients.	Economic Transformation and Job Creation; Education, Skills and Health	Industrialisation through localisation	Innovation for a healthy society; A re-industrialised modern economy
3.3	Vaccine Innovation and Manufacturing Strategy Development of a technology localisation strategy for vaccines.	Focus of this strategy will be on localising and commercialising vaccine manufacture in South Africa, with CSIR being the contract development and manufacturing (CDMO) hub.	Economic Transformation and Job Creation; Education, Skills and Health	Industrialisation through localisation	Innovation for a healthy society; A re-industrialised modern economy



No.	Strategic Initiative Description	Envisaged Impacts	^a MTSF Apex Priorities	^b ERRP Priority Interventions	^c Decadal Plan – Key Economic Sectors
4. Defence and Security cluster					
4.1	Information and Cyber Security Capabilities Establishing a world class National Information and Cyber Security capability	Established capability for gathering cyber threat intelligence using data analytics.	Building of a capable, ethical, and developmental state; Social cohesion and safe communities	Industrialisation through localisation	Health innovation, Innovation-enabled Capable State
4.2	Crime Prevention Capabilities Strengthening Crime Prevention Capabilities. Conduct R&D for enabling a safe, secure, and capable state through integrated capability management. Improving situational awareness, decision support and organisational performance through Integrated Capability	Reduction of the following crime related challenges: (i) Cash-in-transit crimes; (ii) Cyber/digital crimes; (iii) Illegal border crossings; (iv) Illicit mining; (v) Infrastructure related crimes; (vi) Social unrest; (vii) Threats to community safety; and wildlife crimes (viii) Increased interoperability within the security cluster Integration of the CMORE situational awareness platform into SOE and other government department’s operational environment. (ix) Developed a security operational concept to address this risk to lead to a Reference Security Architecture to be used nationally for crime intelligence protection.	Building of a capable, ethical, and developmental state; Social cohesion and safe communities	Infrastructure investment and delivery	Increase public safety and security
4.3	Commercialisation of Niche Defence Technologies Technology commercialisation with Defence and Security Industry. Conduct joint development and commercialisation of technologies	Improve the competitiveness of the local Defence and Security industry through joint product innovation. Increased royalty income	Building of a capable, ethical, and developmental state; Social cohesion and safe communities	Industrialisation through localisation	Innovation-enabled Capable State



No.	Strategic Initiative Description	Envisaged Impacts	MTSF Apex Priorities	ERRP Priority Interventions	Decadal Plan – Key Economic Sectors
5. Manufacturing cluster					
5.1	Medical Devices and Health Sector	<ul style="list-style-type: none"> (i) Healthcare that is affordable, accessible and effective for patients (ii) Improved health and quality of life of citizens (iii) Growth of the medical device sector (iv) Reduced imports / increased exports (v) Local manufacturing, more jobs (vi) Sector sustainability and strategic independence (vii) Reduced public healthcare costs for Government 	Economic transformation and job creation, health	Infrastructure investment and delivery	Innovation-enabled Capable State; Economic Transformation and job creation
5.2	Metals and Advanced Materials Sector Development	<ul style="list-style-type: none"> (i) Modern and smart foundry (ii) Decline in foundry industry arrested. (iii) Increased adoption of new technology (iv) Reduced imports/increased exports (v) New powder metallurgy industry in South Africa (vi) Available and suitable powder at optimal cost (vii) World-class high-end infrastructure for local MIM industry (viii) Reduced imports and increased exports of parts/ componen (ix) Foundry industry roadmap used to inform government policy, R&D etc for Government and the circular economy (x) Green technologies/circularity embedded in the manufacturing value chain. (xi) Powder production based on needs of high-power laser repair and additive manufacturing equipment offerings. 	Economic transformation and job creation	Infrastructure investment and delivery	Modernising Manufacturing, Economic transformation and job creation; Innovation-enabled Capable State



No.	Strategic Initiative Description	Envisaged Impacts	°MTSF Apex Priorities	^b ERRP Priority Interventions	°Decadal Plan – Key Economic Sectors
5.3	Automotive Industry Development	<ul style="list-style-type: none"> (i) Increase local content through localisation (ii) Import replacement/New products (iii) Increased capability development (iv) Improved competitiveness (v) Increased production volumes (vi) Development of a national roadmap for the new energy vehicle (NEV) transition, together with key stakeholders (vii) Upgrading of industry capabilities for NEV (viii) Future skills development for the NEV value chain (ix) Job creation and retention in automotive sector (x) Micro-mobility Industry Development (xi) Attracting Investments and Collaboration (xii) Provide individuals a pathway from the informal economy to the formal economy. (xiii) Increase production volumes for heavy vehicle industry (xiv) Increase exports 	Economic transformation and job creation. Building of a capable state	Industrialisation through localisation; Macro-economic policy interventions	Modernising Manufacturing, Economic transformation and job creation; Digital Economy; Energy Innovation



No.	Strategic Initiative Description	Envisaged Impacts	^a MTSF Apex Priorities	^b ERRP Priority Interventions	^c Decadal Plan – Key Economic Sectors
6. Mining cluster					
6.1	<p>Technologies for enhancing mine safety Competency based training using 4IR technologies, driving zero harm in the mining industry;</p>	<p>Improves safety and health through enhanced behavioural responses across the mining industry.</p> <ul style="list-style-type: none"> (i) Providing a competency based reskilling method for mining workers. (ii) Promotes the application and adoption of 4IR solutions in the mining industry. (iii) Contribute towards increased mine safety locally and in the SADC region through skills development. 	Education, Skills and Health Economic transformation and job creation	Industrialisation through localisation Skills development. Infrastructure investment and delivery	A re-industrialised modern economy; Future Proof Education and Skills; Modernising mining, Innovation-enabled Capable state
6.2	<p>Mining digitally enabled and intelligent decision support</p> <ul style="list-style-type: none"> (i) Collision prevention digital twin: supporting safer, modernised mining operations. (ii) Integrated Geosensing tools and risk-based mapping platform, supporting efficient and safer modernised mining. 	<p>Improves the safety of mining operations in compliance with Chapter 8 of the regulations of the Mine Health and Safety Act, 1996 (Act 29 of 1996).</p> <ul style="list-style-type: none"> (i) Provides data-driven insights to enable the continuous improvement of TMM safety, productivity and cost reduction for existing operations and life of mine planning. 	Building of a capable, ethical and developmental state	Industrialisation through localisation,	Re-industrialised modern economy; Digital Economy, Innovation-enabled capable state
6.3	<p>Mining decarbonisation technologies Development of a decarbonisation programme for mining houses, which focuses on retrofitting decarbonisation solutions using hydrogen and battery technologies.</p>	<ul style="list-style-type: none"> (i) Contribute to the decarbonisation of the mining industry. (ii) Supporting local SMMEs to participate in the decarbonisation economy. 	Economic transformation and job creation	Green economy interventions, Energy security	Modernising Mining; Energy Innovation



No.	Strategic Initiative Description	Envisaged Impacts	°MTSF Apex Priorities	°ERRP Priority Interventions	°Decadal Plan – Key Economic Sectors
7. Next-Generation Enterprises and Institutions cluster					
7.1	<p>Smart Government Services Development and Implementation of foundational digital health components for implementation of the National Health Insurance; Enable future-ready education planning through spatio-temporal digital analytic capabilities; Provide private cloud infrastructure and services to organs of state and SMMEs</p>	<p>National Electronic Medical Record for TB and HIV; Core Information systems for NHI; Enablement of efficient planning and resource utilisation in education sector; Affordable private cloud offering to organs of state and SMMEs.</p>	<p>Building of a capable, ethical and developmental state; Education, skills and health; Spatial integration, human settlements and local government</p>	<p>Infrastructure investment and delivery; Industrialisation through localisation; Reduced cost and increased quality of digital communications</p>	<p>Health Innovation; Innovation-enabled Capable State; Digital Economy; Future of society; Climate change and environmental sustainability; Future-proof education and skills</p>
7.2	<p>Financial Inclusion and Intelligence Empower financial sector to counteract fraud and illicit dealings; Develop micropayment fintech solutions to bolster financial inclusion; Strengthen regulatory enforcement to digital assets (detect money laundering, terrorist financing, sanctions evasion, tax evasion and exchange control violations); Address lack of appropriate intelligence on natural disasters to inform accurate pricing of insurance products.</p>	<p>Enablement of the financial industry and law enforcement agencies to fulfil the Financial Action Task Force (FATF) standards; Promote financial inclusion; Enablement of the insurance industry to improve pricing for natural disasters.</p>	<p>Economic transformation and job creation; Building of a capable, ethical and developmental state</p>	<p>Industrialisation through localisation; Macro-economic policy interventions</p>	<p>A reindustrialised modern economy</p>



No.	Strategic Initiative Description	Envisaged Impacts	MTSF Apex Priorities	ERRP Priority Interventions	Decadal Plan – Key Economic Sectors
7.3	<p>Smart Digital Services and Operations Developing foundational digital capabilities for South Africa’s digital economy. Enabling access to the digital economy for all and supporting digital transformation by addressing the cost barrier for connectivity users and providers, improving network coverage in rural areas and enabling inter-lingual communication.</p>	<p>Localised digital technologies/capabilities as the foundational pillars of the digital economy; Reduction in ICT imports and cost of ownership through open RAN solutions; Energy efficient 5G applications; Networking technical know-how; Evidence-based regulatory development support for intelligent and dynamic radio frequency spectrum management and utilisation; Addressing language barriers and low literacy levels that hamper universal access to information; Increasing economic participation and local economic development.</p>	<p>Economic transformation and job creation; Building of a capable, ethical and developmental state; Social cohesion and safe communities; Spatial integration, human settlements and local government.</p>	<p>Economic inclusion of marginalised; Infrastructure investment and delivery; Energy security; Gender equality and economic inclusion of women and youth; Industrialisation through localisation; Reduced cost and increased quality of digital communications</p>	<p>The future of society; Future-proof education and skills; A reindustrialised modern economy; Innovation for energy security</p>



No.	Strategic Initiative Description	Envisaged Impacts	^a MTSF Apex Priorities	^b ERRP Priority Interventions	^c Decadal Plan – Key Economic Sectors
8. Smart Places cluster					
8.1	Human Settlements, Utilities and Services Support the building of a capable state in the provisioning of end-to-end service solutions.	(i) Energy and water security; (ii) Just transition; (iii) Sustainable and smart human settlements; (iv) Green infrastructure; (v) Disaster mitigation and management; (vi) Climate change adaptation and mitigation; (vii) Net-zero drive; (viii) Carbon trading.	Building of a capable, ethical and developmental state; Spatial integration, human settlements and local government; A better Africa and World; Social cohesion and safe communities; Consolidating the social wage through reliable and quality basic services	Infrastructure investment and delivery; Energy security; Gender equality and economic inclusion of women and youth; Green economy interventions	Digital Economy; Circular Economy; Energy Innovation; Innovation-enabled Capable State
8.2	Industrial Revitalisation Programme Support industrial revitalisation and the transition to a low-carbon, climate resilient, and globally competitive industry.	(i) Revitalisation of industrial parks and economic development zones; (ii) Infusing of eco-industrial methodologies including sustainable energy, water and waste management. (iii) Promoting Just (Energy) Transition. (iv) Carbon accounting and trading for global competitiveness and transition to a net-zero economy. (v) Industrial competitiveness.	Economic transformation and job creation; Education, skills and health; A better Africa and World; Social cohesion and safe communities; Consolidating the social wage through reliable and quality basic services	Industrialisation through localisation; Energy security; Infrastructure investment and delivery; Gender equality and economic inclusion of women and youth; Green economy interventions; Support for the recovery and growth of the tourism industry	Modernising Manufacturing; Modernising Mining; Digital Economy; Circular Economy; Energy Innovation
8.3	Ocean, Coastal and Marine Science and Ports Operations Leading Southern Ocean science, technology, socio-economic livelihoods and efficient green port operations and industries	(i) Sustainable Shores- coastal erosion, flood risk, pollution. (ii) Restoration and sustainability – blue carbon, fisheries and ecosystem services. (iii) Efficient green ports – integrated ports management, eco-greening technologies, bio-enhancement. (iv) Coastal industries – energy and fuel.	Building of a capable, ethical and developmental state; Spatial integration, human settlements and local government; Education, skills and health; A better Africa and World; Social cohesion and safe communities; Consolidating the social wage through reliable and quality basic services	Infrastructure investment and delivery; Gender equality and economic inclusion of women and youth; Support for the recovery and growth of the tourism, cultural and creative industries; Green economy interventions; Strengthening agriculture and food security	Modernising Manufacturing, Modernising; Agriculture, Modernising Mining, Digital Economy, Circular Economy, Health Innovation, Energy Innovation, Innovation-enabled Capable State

No.	Strategic Initiative Description	Envisaged Impacts	^a MTSF Apex Priorities	^b ERRP Priority Interventions	^c Decadal Plan – Key Economic Sectors
9. Smart Mobility cluster					
9.1	Intelligent Transport Systems and Operations Development of methods, systems, models, and technologies to advance the sustainable transport agenda, utilising the core disciplines of transport and traffic engineering, transport economics, structural engineering, ICT, data science, computer engineering, and software development	A safe, accessible and efficient transport network.	Building of a capable, ethical and developmental state	Industrialisation through localisation;	Innovation-enabled Capable State
9.2	Sustainable Transport Infrastructure Development of engineering and technological solutions for efficient and effective design, construction, maintenance and management of mobility infrastructure for operational sustainability, climate adaptation and resilience, while endorsing of circular economy principles throughout the sector.	Improved safety and efficiency of ports and protected coastal zones; smart and resilient road and rail infrastructure.	Building of a capable, ethical and developmental state	Green economy interventions; Industrialisation through localisation; Infrastructure Investment and delivery	Innovation-enabled Capable State; Climate change and environmental sustainability; Circular economy
9.3	National Logistics System Enhanced functioning of the national logistics system, which is critical for industrialisation and competitive local and international trade.	Measurable and predictable logistics performance across industry sectors critical for economic growth at macro and micro levels.	A better Africa and World	Macro-economic policy interventions; Strengthening agriculture and food security	Circular economy

a MTSF Apex Priorities – Economic transformation and job creation; Building of a capable, ethical and developmental state; Education, skills and health; Spatial integration, human settlements and local government; A better Africa and World; Social cohesion and safe communities; Consolidating the social wage through reliable and quality basic services.

b 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.

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

Large and integrated RD&I initiatives in response to the Decadal Plan STI priorities

Beyond the strategic initiatives planned in table A1, given its heritage, track record and wealth of cross-cutting STI capabilities as well as the strategic intent of the Decadal Plan, the CSIR can make a significant contribution to the conceptualisation, co-ordination and implementation partner for programmes and initiatives aligned to intent of the Decadal Plan. The grand challenges of climate change and sustainability, future-proofing education and skills, a healthy population, energy security, a re-industrialised modern economy and the future of society are far-reaching and complex and therefore need a multi-faceted, whole of society, collaborative approach. While the solution to these grand challenges lies beyond the remit of any single actor in the system, it is without a doubt within reach through a collective, co-ordinated and persistent effort across public and private institutions. Given the economic constraints within the country, region, continent and world, our joint, collaborative efforts are needed more than ever. With this in mind, in addition to the initiatives documented in earlier sections of this document, the CSIR proposes the following large, enabling and catalysing initiatives, for which resources and partnerships needed are yet to be secured. There are persistent themes of “digital” and “circularity” underpinning all these initiatives as per the intent of the Decadal Plan requiring a “whole of society approach”, including “strategic local and international partnerships” with public and private sector.

Innovation for a healthy population

Initiative #1: To develop a national strategic capability for the production of active pharmaceutical ingredients and biopharmaceuticals.

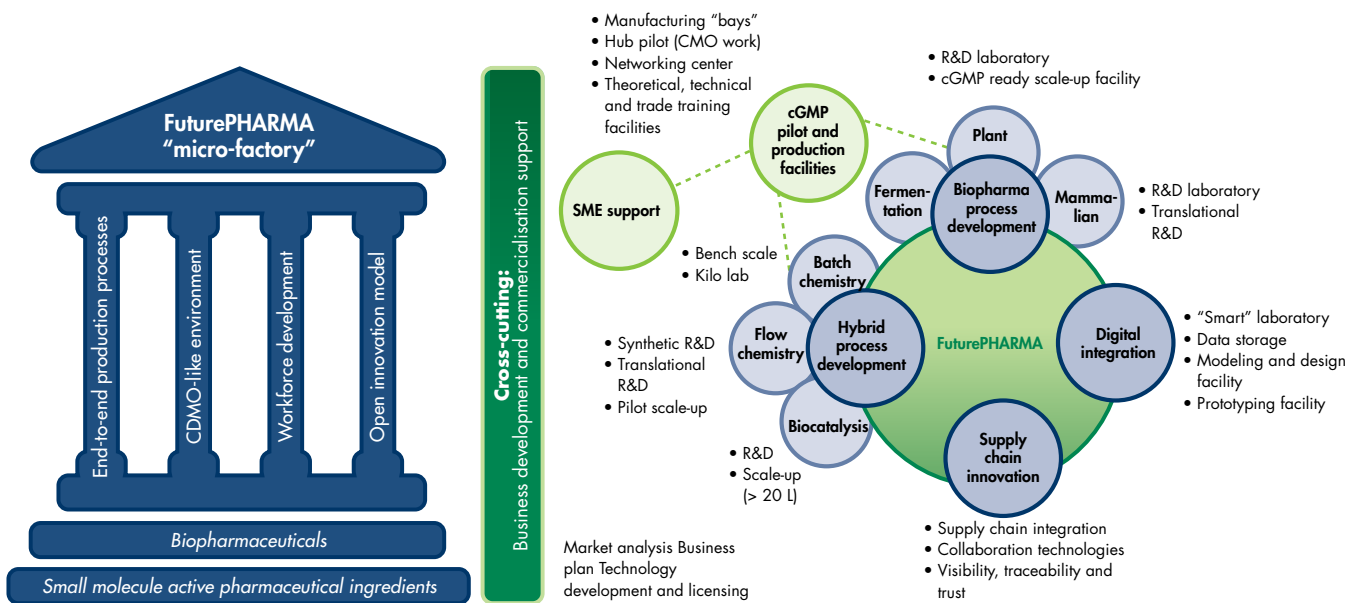


Figure A5: Proposed establishment of a FuturePharma “micro-factory”



External drivers

The *local health system* operates a two-tier health system, where the public health sector serves 84% of the population with only 16% of pharma expenditure directed to it. Plans to increase local production and distribution of generic drugs are gathering pace.

South Africa continues to run a *large negative pharmaceutical trade balance*, with pharmaceuticals providing the fifth largest trade deficit across all sectors in the country. Pharmaceutical imports were estimated to be ZAR33.7 bn (USD2.3 bn) in 2021 and are forecast to reach ZAR50.3 bn (USD2.8 bn) by 2026, posting a local currency compound annual growth rate (CAGR) of 8.3%.

One of the most profound lessons from the Covid-19 pandemic has been the intricacy of the global pharmaceutical network and how disruptions can contribute to *dangerous supply shortages* in all regions – as such, self-sufficiency of African pharmaceutical manufacturing has become a key focus.

The pharmaceutical sector is responsible for 4.4% of global emissions and its CO₂ footprint is forecast to triple by 2050 if left unchecked. In 2019, the pharma industry produced 48.55 tons of CO₂ equivalent for every \$1m it generated (55% more than the automotive industry). Hence the need to focus on *sustainable and responsible manufacturing*.

In parallel, we are currently at an inflection point for the healthcare industry, as *rapid developments in 4IR technology* drive the use of data to deliver faster production, more flexible processes, reduced lead times, and “on demand” and precision medicines. Recently there has been an international shift from multi-step, batch manufacturing to faster, and relatively more efficient continuous flow manufacturing.

The external drivers are a clear opportunity for South African industry to capture value and to mitigate the worsening trade and social imbalances as a result of this context.

Motivation

Despite the exciting recent developments in the pharmaceuticals sector and the strategic importance of local pharmaceutical manufacturing, the local industry is still in a nascent phase. The lack of private sector investment in local manufacturing capacity offers a leap-frogging opportunity over established international manufacturing destinations tied to traditional production methodologies. In parallel, Industry 4.0 technologies are expected to have transformative impact and pave the way for the creation of the medicine supply chain of the future.

For API manufacturing to be viable and sustainable in South Africa, the country needs to develop and maintain world-class commercial pharmaceutical manufacturing technologies with supporting skills. These are required both to produce APIs and finished drugs competitively against imports, and to provide sufficient capacity to support the regional export market to ensure that appropriate drugs for local and regional populations can be supplied on-demand and at reasonable price.

A critical gap highlighted in the national value-chain is a broadly accessible innovative multi-modal production facility that is geared toward the development and scale-up of API manufacturing processes and; the production of clinical grade batches, with a focus on the pilot scale production of investigational biologics (vaccines and biopharmaceuticals), and small molecule materials under current Good Manufacturing Practices (cGMP) conditions.

Such a facility will support the National System of Innovation (NSI) in taking the basic science of drug prototypes through clinical development and streamlining the successful candidates for commercial manufacture, while also developing the much-needed pharmaceutical manufacturing skills to support the nascent industry in parallel.



Strategic Objectives

- Apply internationally cutting-edge process technologies to create a world-leading African research and development track record in quality driven pharmaceutical process development.
- Develop a niche offering in continuous pharmaceutical manufacturing and cGMP investigational biologics production. Facilitate the development of a strong business case for full scale local API and drug product manufacturing.
- Transfer pharmaceutical product manufacturing technology to established local industry for scale-up and commercialisation. Support the establishment of new SMEs across the pharmaceutical value chain.
- Support the security of supply of strategic medicines within the region by providing affordable high-quality APIs and biopharmaceuticals.

Proposed CSIR response

Offering: To support the transformation of the local manufacturing industry, the CSIR proposes the provision of a digitally enabled, integrated, end-to-end continuous API production technology with a supporting “micro-factory” environment for the production of clinical grade API and biopharmaceutical material and hands-on training to develop critical skills in the production workforce.

CSIR Investment to date: R 36 million

CSIR investment for 2024/25: R 6 million

NT Investment to date: R 75 million

Phase 2 investment required: R 250 million



Initiative #2: A collaborative programme for MedTech Localisation, Innovation and Growth

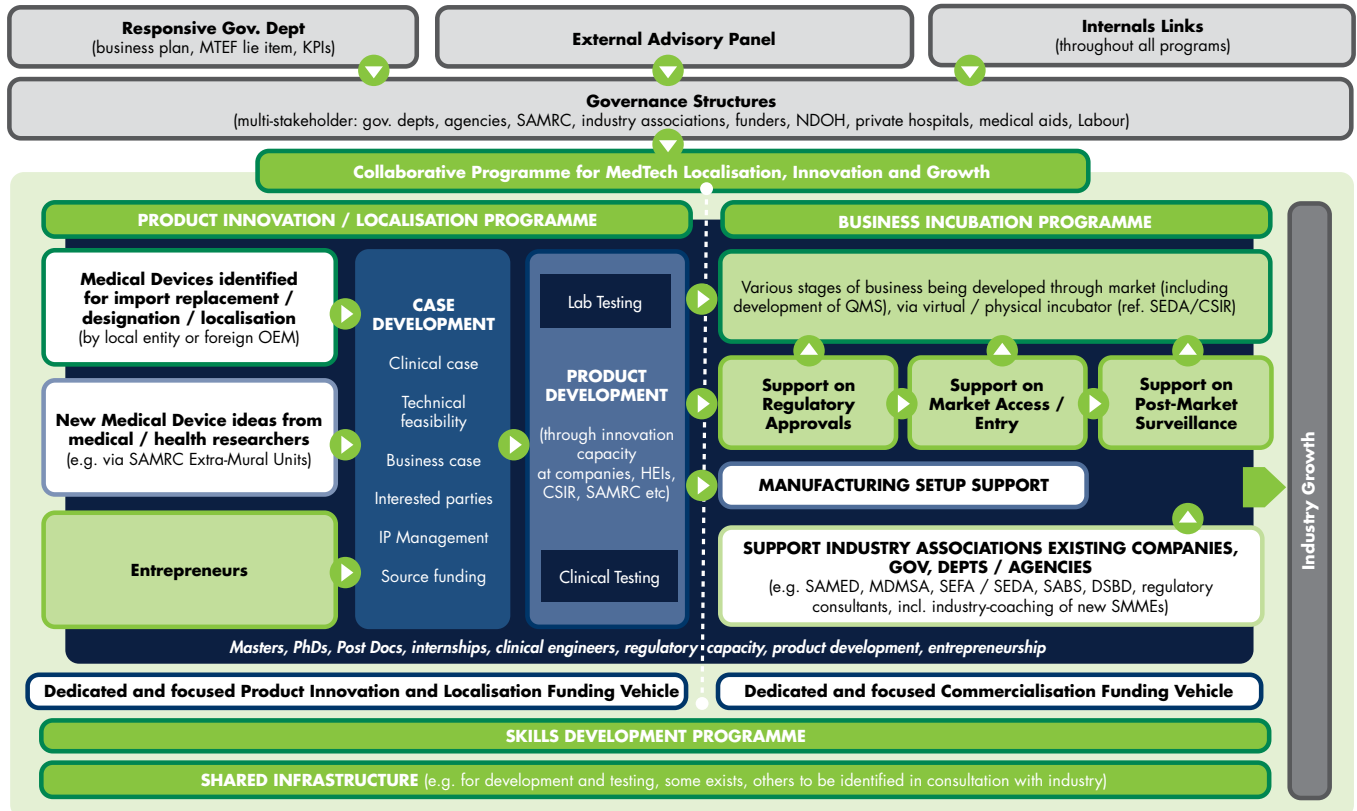


Figure A6: A national collaborative programme for MedTech localisation, innovation and growth aligned to the national Medical Device Master Plan led by the dtic

External drivers:

There is an *escalating burden of disease* locally and globally across communicable and chronic diseases. Healthcare costs globally are escalating as a percentage of GDP and therefore not sustainable for major economies. Chronic diseases are estimated to consume approximately 75% of global healthcare costs. In the USA, 90% of the \$4.1 trillion health care expenditure addresses chronic patients (CDC). In South Africa there is a confluence of needs including maternal, newborn and child healthcare needs, HIV/AIDS, TB, as well as other chronic diseases.

There is a rising and urgent need for *lower healthcare costs*. South Africa has approximately 83% of its population under public healthcare. The WHO is driving the focus on availability, accessibility, appropriateness and affordability of healthcare. Populations in many countries are increasingly moving to a larger percentage of elderly people who need more care.

South Africa has a significant and *large trade imbalance in medical devices* with 90% of devices imported. There is a national need for localisation and the need for support and stimulus in this sector.

The need to ensure *equitable access to quality healthcare* in South Africa is increasing with growing disparities between rural and urban communities.

At the same time *technological advances* enable innovation that could address national needs in a strategic way including



convergence of technological frontiers such as “nano” and “bio” with digital technologies; opportunity to use mobile / digital technologies throughout the value chain; increasing use of AI in healthcare; need for rapid innovation as the medical device market moves quickly is global in nature as well as the developing field of epigenetics.

Motivation:

With the significant burden of disease in the country, in the region and on the continent, rising healthcare needs, coupled with the country’s large trade imbalances in medical devices, a collaborative programme for MedTech localisation, innovation and growth would be a critical catalyst in the local medical device industry.

Strategic Objectives

- Increasing local innovation and manufacturing through the development of new products targetting national health priorities, major export opportunities, import replacement and licensing from global Original Equipment Manufacturers.
- Serve as an incubator for new medical device SMMEs including the achievement of quality and regulatory compliance.
- Support for government policy, regulatory interventions including designation of medical devices as well as support for SABS in the establishment of testing labs for international standards.

Proposed CSIR response

To support local innovation, localisation, strategic independence and growth of the Medical Technology Sector as well as reduction on imports, the CSIR proposes the establishment of a collaborative programme for MedTech Localisation, Innovation and Growth housing capabilities for prototyping, testing, business case development as well as enabling support for regulatory approvals, market access, manufacturing setup, industry associations and post-market surveillance underpinned by skills development programmes and shared infrastructure.

Approximate CSIR investment to date: R 25 million

Estimated investment required: R 100 million over three years

Modernising agriculture

Initiative #3: The development of an Agriculture Catalyst Platform making accessible leapfrog agricultural production technologies, agroprocessing technologies and agribusiness technologies for small and emerging farmers.

External drivers

There is a commitment and urgent obligation for nations *to create a world without hunger* as per Sustainable Development Goal 2. Global hunger and food insecurity has increased drastically over the years, made more severe by multiple factors including, but not limited to, the global pandemic, conflict, climate change and deepening inequalities. According to the United Nations, more than 700 million people were found in a state of chronic hunger with an estimated 2.4 billion people facing moderate to severe food insecurity.

As it stands there is *low participation of black farmers and entrepreneurs* in the agricultural value chain. The amended Broad-based black economic empowerment in agricultural sector requires the implementation of initiatives to include black South Africans at all levels of the agricultural activities.

The *impact of climate change* on the poorest in our societies is most severe and therefore there is an urgent need to develop adaptation and resilience strategies. At the same time, farming practices need to be mindful of the fragility of our environment and hence mitigate impact of operations on their respective ecosystems.

The *rising cost of agricultural production* presents a high entry barrier to the emerging farmer sector.



The current *low levels of beneficiation* of agricultural products, presents an opportunity for value added agricultural products.

Matters of *food safety and related risks* have a direct impact on the ability of small and emerging farmers to export, e.g., mycotoxins, animal diseases (e.g., foot and mouth) and so forth.

There is a significant opportunity to exploit *Indigenous Knowledge Systems (IKS)* given the current under valorisation of IKS in agriculture.

Motivation

To be competitive with the national, regional and international primary and secondary agricultural production sectors, small and emerging farmers need to adopt leapfrog technologies to bypass traditional developmental stages and accelerate “catch up” with well-developed farming and agri-business systems. New solutions must be faster, more efficient, and cost-effective.

Strategic Objectives

- To increase the number of local and national decision-support tools for precision agriculture, weather/climate early warning systems, agronomy forecasting, disease surveillance and monitoring.
- To increase the number of small-scale, emerging commercial farmers and knowledge hubs with access to decision-support tools for precision agriculture, weather/climate early warning systems, agronomy forecasting, disease surveillance and monitoring.
- To capacitate agripreneurs on the use of leapfrog technologies e.g., drone and other in-situ sensors and digital platforms.
- To increase the number of new productive crop and animal value chains enhanced by bio-innovation and contributing to sector productivity and competitiveness, e.g. new plant/animal protein bio-products to support South Africa’s bioeconomy; cannabinoid products; quality compliant products (medicinal, cosmetics and food products) based on valorisation of IKS.
- increase the number of SMMEs supported in the agroprocessing and bio-economy industry.
- To increase the number of black farmers accessing formal domestic and international markets through the provision of regulatory, phytosanitary, food safety and quality and accreditation support.
- To enhance trade through the use of digital platforms (digital connected supply chain and digital marketplace).

Proposed CSIR response

The CSIR proposes the establishment of an Agriculture Catalyst Platform making accessible leapfrog agricultural production technologies, agroprocessing technologies and agribusiness technologies for small and emerging farmers. Investment in leapfrog technologies should create new business opportunities, drive economic growth, and improve the overall quality of life for people in South Africa. They necessarily have the potential to address poverty and environmental degradation in rural areas.

Leapfrog *agricultural production technologies* include, but are not limited to digital technologies for decision-support systems for farmers, biosecurity, early warning systems and precision agriculture; use of drones and sensors to monitor and optimise crop growth, reduce waste, and improve yields enabling farmers to use resources more efficiently and improve crop quality while reducing environmental impact; mobile applications that provide farmers with real-time information on weather patterns, pest control and market prices; smart irrigation system. Use of sensors and real-time data to optimise water usage in agriculture, e.g., by providing the right amount of water to crops at the right time; genetic engineering techniques to develop crops that are more resistant to pest, diseases and environmental stressors.



Leapfrog *agroprocessing technologies* include value added and new agro-processing value chains for local food products and indigenous biodiversity, that fetch higher prices in the market; precision fermentation that uses microorganisms to produce high value proteins, flavours and fragrances to produce sustainable and cost-effective alternatives to traditional animal and plant-based products; development of solar dryers and solar-powered cold storage systems, automated processing equipment e.g. threshers, graders and sorters can help farmers process their crops more quickly and efficiently, reducing labour costs and improving quality as well as point-of-care food safety technologies e.g., mobile food safety laboratories.

Leapfrog *agribusiness technologies* include blockchain – providing transparency and traceability in the agribusiness supply chain, from farm to consumer; E-commerce platforms – enabling farmers to sell their products directly to consumers; mobile payment systems.

Approximate CSIR investment to date: R 25 million

Investment estimate required: R 200 million over three to four years

Modernising mining

Initiative #4: Establishing national capabilities for digital, automation and decarbonisation technologies as well as establishing a centre for the future proofing of mining skills.

External drivers

Digital transformation is imperative for the future sustainability and growth of mining. It has significant potential to impact the entire mining value chain including safety, health, matters of environmental social and governance as well as production. At the same time this must be done in a responsible, people-centric manner. It is estimated that digital technologies have the potential to unlock more than R 150 bn in value by 2026, increasing the contribution of mining to the GDP. South African companies are lagging in digital transformation with a proliferation of legacy systems, the need for more investment in mining RD&I and capability building on the continent, lack of investment in mining equipment, technology and services and lack of the skills to support the mining digital drive.

The mining sector has an obligation and significant opportunity to *decarbonise its operations*, creating opportunities for innovation, localisation, job creation and a positive impact to the environment. The mining industry is responsible for 4-7% of global greenhouse gas emissions. Trackless mobile machines contribute approximately 90 million tons of CO₂ per annum on diesel consumption alone.

While there have been sizable and strategic investments in the development of mining RD&I capabilities through initiatives such as the Mandela Mining Precinct, funded by the DSI and the Minerals Council, there remains a *gap in the level of skills and capabilities needed by the industry*.

The topic of *critical minerals* is increasingly topical in the world. Africa possesses significant endowments of critical minerals making it an attractive destination for investors. The African continent has the majority of the world's known resources of platinum, chromium, and diamonds, as well as a large share of the world's bauxite, cobalt, gold, phosphate, and uranium deposits. The continent has 30% of the world's mineral reserves, including many minerals essential to the green transition. It is important that the continent positions itself to benefit optimally from this endowment. South Africa has a significant contribution to make in this regard given its technical expertise and institutional knowledge in open pit, and deep level underground mining operations; its technical knowledge in mine safety, health and environmental control as well as knowledge in minerals beneficiation.



Motivation

To accelerate the adoption of a people-centred modernisation drive and achieve an integrated value chain, there is a significant need to further develop and deepen the RD&I capability base in order to localise digital and automation technologies; futureproof the mining workforce with digital skills as well as position capabilities for decarbonisation.

Strategic Objectives

- Digital and automation capabilities are needed to enhance safety and eliminate transport related fatalities, identify and respond to opportunities for enhancing productivity as well as localise automation technology for mining moving machinery.
- Futureproofing of mining skills will support reskilling, retraining and upskilling for establishing relevant competencies and capabilities for shifts in skills requirements and job creation.
- Decarbonisation initiatives aim to reduce carbon emissions, minimise capital expenses through retrofitting and relevant skills development for adoption and maintenance of new technology whilst supporting job creation.

Proposed CSIR response

To enable the sustainability and growth of the local mining sector and support efforts of government and industry by growing capabilities in digital, automation and decarbonisation as well as establishing a centre for the future proofing of mining skills.

Approximate CSIR investment to date: R 20 million

Investment estimate required: R 200 million over three to four

Manufacturing for the local space sector

Initiative #5: Commercialisation of space-based radar and optical sensor technologies for a vibrant, local space industry.

External drivers

Space is one of the *fastest growing industries* in the world. The sector grew 55% over the past decade and is projected to grow another 127% to 2030. It is estimated that more than 12 000 satellites will be launched between now and 2030. The growing investment in the space sector is making revolutionary new technologies and applications possible in telecommunications, agriculture, mining, manufacturing, energy and transportation amongst others. Utilising space is therefore a critical enabler for many of the thematic priorities of the Decadal Plan.

There are *growing economic opportunities in services and products*. Derived services from space assets are growing rapidly and are disrupting a wide range of industries. The space supply chain including launch vehicles, satellites, components, and ground systems are a significant and rapidly growing, high-technology industry sector.

South Africa currently has a small but *competitive upstream local space industry* developing components, payloads, and small satellites with a growing track record of securing exports in global supply chains. This small, but established supply chain is growing, and keenly interested in the advancement and commercialisation of the portfolio of CSIR sensor technologies.

South Africa is currently a *significant net importer* of space services and products.

There is a need for local assets to address the *sovereign and strategic needs* for the region. Southern Africa suffers from being at similar longitudes to Europe resulting in foreign-owned satellites prioritising limited satellite resources towards acquiring data over Europe and is currently a net importer of space services and products. Southern Africa competes with Europe for airtime on satellites, incurring significant costs to access data from the USA and European satellites.



Access to space is cheaper due to the combination of significantly lower launch costs, resulting from rapid innovation in the launcher sector, including reusable rockets, as well as rapid technology development, miniaturisation, and cost reduction in satellite technology. More countries are aspiring to enter this industry, including many African countries.

Motivation

As a national RD&I institute, with its rich endowment of capabilities, the CSIR is a critical actor in the local space sector required to support and enable various national initiatives in collaboration with public and private partners. CSIR has an attractive portfolio of novel, high value, sensor technologies that could serve the sovereign and strategic needs of government stakeholders as well as the commercial interests of the local space industry given its significant potential for technology localisation, development of spin-out companies and export opportunities. There has been significant interest.

Strategic Objectives

- Industrial engineering, as integrator across cluster.
- To support the strategic and sovereign independence needs of the state and the region by ensuring the availability of data to all sectors, data security, frequency of information, national disaster management as well as customised solutions to national challenges.
- Support strategic government programmes and initiatives.
- Harness opportunities for economic growth through public-private partnerships and export opportunities in space systems and components including sensors and satellites.
- Enable technology localisation and job creation.

Proposed CSIR response

The CSIR proposes the accelerated development and commercialisation of its portfolio of space-based radar and imaging sensor technologies, given its high-value, competitiveness, contribution to sovereign and strategic independence, the lack of ITAR restrictions, the significant potential for spin-out companies and exports as well as the complementarity with competitive local offerings.

Approximate CSIR investment to date: R 80 million

Investment estimate required: R 300 million over three years

Smart logistics and supply chain

Initiative #6: Establishing a national capability for smart logistics and digital platforms for supply chains

External drivers

The *performance of the national logistics system* is reflected in port and other cross-border delays, use of road for rail-friendly transport, increasing logistics costs, and underperformance on benchmarks such as the Logistics Performance Index relative to main trading partners. Similarly, the economic divide is reflected in poor integration of underserved supply chains, such as rural, smallholder farms, and peri-urban supply chains. Further, the opportunity exists to improve the functioning of public service supply chains (health, education, and others) at different levels of government. Underserved supply chains, public sector supply chains, and the national logistics system do not have the benefit of comprehensive and consistent improvement processes.

The reliability of South Africa's freight rail network has deteriorated sharply, threatening the competitiveness of exports. This underperformance in the export of coal, iron ore and the general freight volumes has left South Africa unable to fully participate in recent commodity price booms. Consequently, South Africa has forfeited an estimated USD 26.7 bn in iron ore and coal export trade.



Container terminals at the Ports of Durban and Ngqura having been ranked 365th and 361st respectively out of 370 ports worldwide by the World Bank in 2022. The latest indications are that the 6-day delays in berthing space in the Port of Durban may have direct costs of 98 million rand (\$5.2 million) a day when congestion surcharges are added, according to The South African Association of Freight Forwarders.

Policy Direction – during August 2023, the President of South Africa reported that the National Logistics Crisis Committee (NLCC) has formally been constituted with participation from relevant government departments, Transnet and business. Four Corridor Recovery Teams have been established focusing on strategic commodity export supply chains in coal, iron ore, manganese, chrome and magnetite to jointly address performance constraints. The CSIR Smart Logistics Management (SLM) initiative had already been under development for just under three years prior to the NLCC being constituted. Through this initiative, CSIR is supporting prioritisation of interventions by the N4 Corridor Recovery Team and has been invited to make presentations to the team and its stakeholders.

The National Department of Transport, in 2022, has a vision to position rail as an affordable, competitive, effective, integrated, reliable, safe, sustainable, and valued mode that provides the backbone of South Africa's freight logistics and passenger mobility systems and strengthens its economic growth and social development by 2050. The Minister furthermore established a ministerial task team to oversee the establishment of Interim Rail Economic Regulatory Capacity (IRERC) within the Department of Transport. Specifically, the main objectives of the IRER are to develop skills and capacity in the area of rail regulation, to collect data and information on the structure and performance of the rail industry, and to research and make concrete recommendations on the future scope and design of economic regulation and enforcement in the rail transport sector. This initiative forms part of a wider process that will lead to the establishment of a comprehensive Single Transport Economic Regulator (STER), with a legislative mandate.

Decarbonisation of the transport sector – Transport has been identified as the fastest growing source of greenhouse gas emissions, accounting for around 10.8% of National GHG emissions. It is imperative, therefore, that for future sustainability of its contribution to economic growth, the mobility sector must contribute its fair share to the national effort to combat climate change across all modes of transport.

Digital transformation – the topic of digital transformation and how it has revolutionised the mobility sector has reached maturity; enabling a more complex digital mobility ecosystem that is able to integrate seemingly unrelated data through complex algorithms that enable data-driven investments and decision making (e.g. complex network modelling of Origin-Destination Commuting Flows for the Covid-19 Epidemic Spread Analysis).

Motivation

The development of the CSIR's Smart Logistics Management (SLM) capability is aimed at establishing a capability to support government and industry in addressing the increasing inadequacies of the national logistics system. The capability incorporates systems modelling and analysis, economic modelling, simulation modelling, and optimisation. It develops key national information bases, such as the Logistics Observatory, as national assets in support of improved logistics performance. With this capability, improvements of 20-30% in efficiencies in corridor performance have been simulated.

CSIR is also proposing the further development, through this SLM initiative, of a blockchain-based supply chain platform to enhance the integration of agricultural SMMEs into larger supply chains. Supply chain performance data will allow investors, insurers, and development partners to gain visibility of enterprise performance to guide investment decisions and as well enable discerning consumers to have a garden-to-fork line of sight and traceability of the products they are consuming.



Strategic Objectives

- To increase the capability of the state through providing an integrated end-to-end, one-stop reference platform and data portal for decision support towards increasing the efficiency of the logistics and supply chains value chains in the country.
- To enable data-driven oversight, contractual and commercial management including operational support for the Transport Economic Regulator, private sector partners, and public sector. This should ease potential challenges with regulation of access, fare setting, management of customer accounts, etc.
- To enable evidence-informed decision-making of critical supply chains and logistics operations, through the application of 4IR technologies (e.g., blockchain), simulation models, and optimisation techniques. The Ilima platform aligns with work supported by the FDCR through SANBA, in its aim to implement blockchain technology in under-resourced environments.
- Aim to reduce carbon emissions in support of the National Department of Transport's Green Transport Strategy as we as the White Paper on Rail Policy. Rail transport has a major impact in reducing carbon emissions, improving logistics, and stimulating industrialisation for local and regional markets.
- To support capacity building, training and upskilling for establishing relevant competencies and capabilities now and into the future.

Proposed CSIR response

To enable a capable state in logistics and supply chain and for economic growth in this sector, CSIR proposes further investment into the development of the Smart Logistics Observatory capability and Supply Chain initiatives to enhance data-driven decision support for enhanced national logistics performance.

CSIR Investment to date: R 18 million

Phase 2 investment required: R 90 million over a three year period.

Capability development

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, a smart logistics management capability, digital precision medicine, mining, a mobility research chair and the circular economy. Implementing these initiatives directly supports the CSIR's strategic objectives to improve the competitiveness of high-impact industries and enabling a capable state.

The precision agriculture initiative 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. The product concept makes precision agriculture data or information accessed via the IoT on desktop and mobile platforms. The initiative has finalised the development of the tool on a commercial cloud computing platform with the first deployment for customer use in December 2023.

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 lies in 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. A total of R178 million was leveraged from the National Treasury (infrastructure), Technology Innovation Agency (hosting the Active Pharmaceutical Ingredient cluster) as well as the Bill and Belinda Gates Foundation in support of the development of the biopharmaceutical technology innovation platform.

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. No capability for the development of bioprocesses for Platform Chemicals (Green Chemicals – lactic acid, ethanol, and succinic acid) existed prior to the CSIR strategic investments. Currently the CSIR has been able to develop process technology for lactic acid for commercialisation in the sugar industry, antimicrobial technologies (advanced therapeutics) – as a response to Covid-19, and a biopolymer modification technology platform, the only of its kind in South Africa, specialising in chemically modified biopolymers. This initiative has been finalised and upscaling for commercial agricultural applications (biopolymer-based antimicrobials to replace conventional chemical pesticides) is underway.

Mining capability development initiatives include 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 also supported targeted investment in new research centres, including investment in the Information and Cybersecurity Research Centre targeting skills development, RD&I of home-grown cyber and information security technologies and industry support through commercialisation and technology transfer. The Emerging Digital Technologies for the Fourth Industrial Revolution Research Centre seeks to 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 to support the building of a local innovation ecosystem and local service providers. The drive has been to enable digital disruption in government and industry to keep South Africa competitive. These capabilities have been deployed in support of initiatives for various government departments.

The CSIR Water Research Centre focuses on 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 centre. This research centre seeks to establish a centralised Water Data Repository at the CSIR, with improved information monitoring, handling and management that will enable effective water management & planning, against different stressors.



The Centres for Synthetic Biology and Precision Medicine, Nanostructures and Advanced Material, and Robotics and Future Production are renewed investments built on previous investments in the previous Emerging Research Areas (ERAs) programme of the CSIR.

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 technology development outputs thus far include the (i) Bioengineered liver that is currently explored for commercialisation of the liver toxicity (TRL6); (ii) drug repurposing platform for cancer (TRL4+), (iii) Directed evolution of CHO cells (TRL5), and the (iv) Microarray platform (TRL4) and High throughput platform for Bioassay (TRL6+)

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 CO₂ capturing and utilisation through green hydrogen. This facility is predominantly industry-facing and supports SMMEs and the full spectrum of the industry in product development. Additional facilities coming online during 2023 include the Nano-Micro Manufacturing Facility and the Supercritical CO₂ Encapsulation Facility.

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. The investment in these capabilities has resulted in the establishment of industry-specific Learning Factories for Anglo American in Limpopo, as well as for the Eastcape Midlands TVET College. A Smart Factory is currently under construction to provide a low-volume production facility for industry to de-risking technologies.

Human Capital Development

The continued strategic 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 CSIRs SO4 – Build and transform human capital and infrastructure – drives the organisation to develop 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 SDG; 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. The CSIR strategy for 2024/25–2028/29 considers this context and is aligned with the national policy on STI.

The CSIR has adopted five strategic pillars to achieve the CSIR SO4: Build and Transform Human Capital and Infrastructure. The five strategic pillars aim to align Human Capital strategy and operational planning with the CSIR’s new strategy, vision, mission and values and create synergy with Human Capital functions and strategic leadership role to achieve and implement cultural change initiatives. The figure below shows the alignment between the five strategic pillars and the CSIR’s mandate, mission, vision and values.

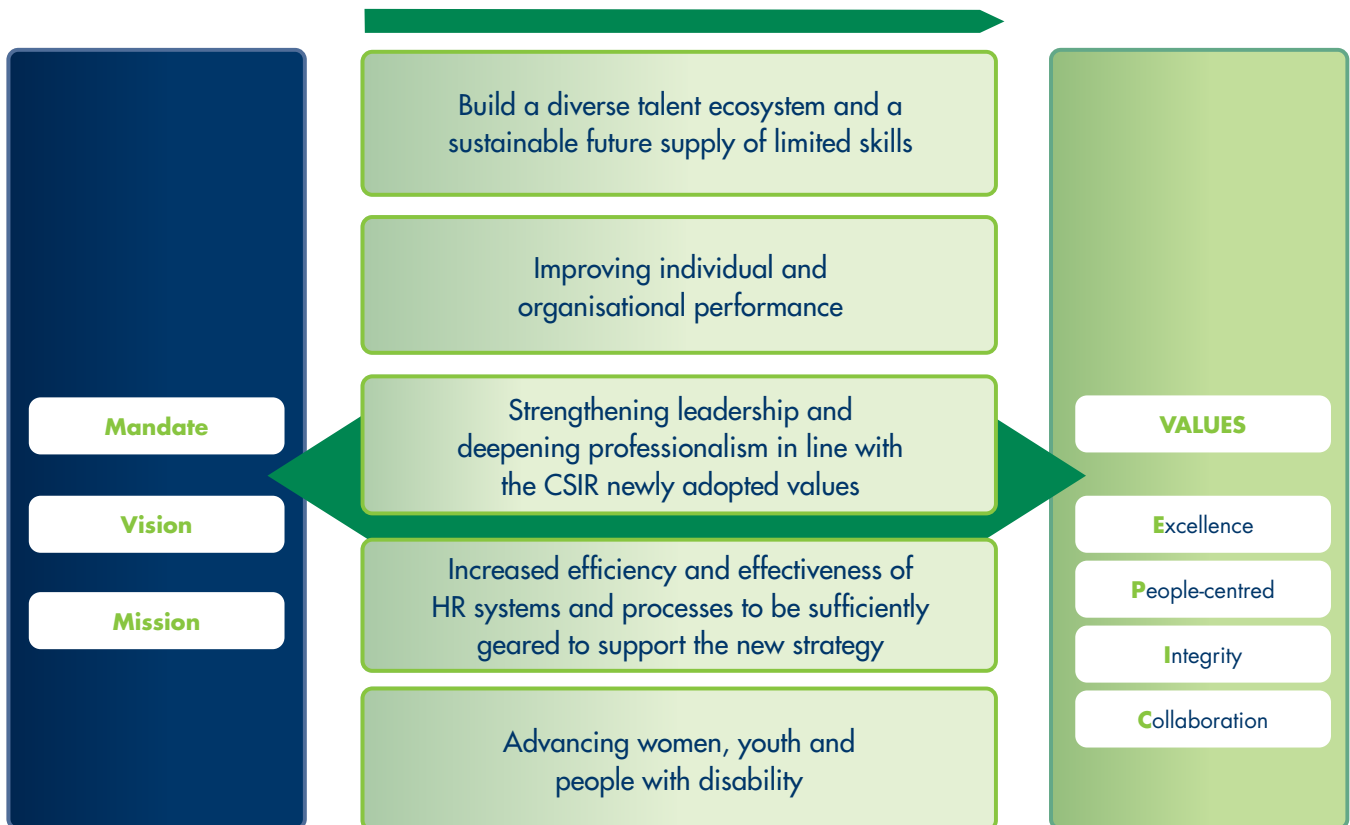


Figure A7: The CSIR Human Capital Strategic Objectives

Building a diverse talent ecosystem and a sustainable future supply of limited skills

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, a CSIR 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 (excellence, people-centered, integrity and collaboration) 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 a 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, as well as 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 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 2.4% with a target of 2%. The emphasis is on the employment of unemployed youth with disabilities in SET through the Youth Employment Services programme.

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 A8: Key needs to renew CSIR infrastructure



National Treasury (NT) through the DSI has recently approved funding (R155.2 million) for the establishment of strategic research infrastructure at the CSIR, by means of performing upgrades and/or enhancement of capabilities in existing facilities in support of the growth and sustainability of various economic sectors in South Africa. The current portfolio of four NT 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. The CAPEX equipment has been procured and Contractor appointment is in progress. The expected completion date for the facility is early 2025.

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). Currently, the appointment of the contract is ongoing and the expected completion will be within 8 months of appointment of contractor.

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 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 a mechanical workshop and a smart technology and prototyping area. The regulatory approvals are impacting the progress of the facility. The expected completion date is December 2024, pending council approvals.

Model Hall

The laboratory was constructed in the late 1960s and is 11 000 m² 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. The CAPEX procurement and regulatory approvals have been completed and site preparation for site construction works is underway. The expected completion date is December 2024.



Capital projects across CSIR campuses

As part of the 2024 Budget Facility for Infrastructure (BFI), the CSIR submitted proposals to the National Treasury for investment required for the financial years 2024/25 to 2026/27, which was unsuccessful. Based on current estimates, the total investment required by CSIR over the next three financial years amounts to approximately R 3.0 bn and remains.

Drivers of successful strategy implementation

Business Development and Commercialisation, Strategic Partnerships and Marketing

BD&C function's primary focus is to undertake business development and lead the commercialisation of CSIR IP 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.

CSIR Internationalisation Strategy

The CSIR has also embarked on the development of an Internationalisation Strategy. As per the Decadal Plan, international R&D Co-operation is seen as enabling a competitive advantage in knowledge creation, exploitation and technological innovation and hence South Africa's economic competitiveness. The country's endowments, both "natural" and "developed", our posture on international relations as South Africa, as well as our track record and heritage of capabilities as the CSIR, position the organisation as a partner and implementer of choice on the continent. It has significant capabilities for skills development, R&D, solution development and decision support while providing access to niche capabilities which ultimately benefit the industry, country, region and continent. In addition, given its status as a premier research institute on the continent, it is well suited to support capacity-building programs that enhance the scientific and technological capabilities of African researchers, professionals, and institutions, particularly in areas aligned with CSIR's expertise.

Overall, CSIR international income has grown over the past four years, from R111 million in 2019 to R243 million in 2023, an 119% increase during the period and international income as a percentage (%) of total CSIR revenue increased from 5% to 9% during the same time. There are several current business development efforts that draw on the organisations reputation, track record, portfolio of capabilities and IP, as well as its status as an entity of state in order to expand its global footprint.

Clusters with mature, niche capabilities and a strong track record are best positioned to establish and expand international programmes using the current international footprint for the benefit of industry, government, the region and continent. There are several partnerships and relationships that are being leveraged for positioning and growth across the organisation through the various business development and commercialisation teams. At the same time, the CSIR is continuously expanding its relationships through active engagement with embassies, bi-lateral platforms, international companies and other stakeholders. The organisation is also driving the prioritisation of investment in niche and relevant capabilities and technologies to attract further investment. The establishment and funding of the commercialisation vehicle will also play an important role in attracting international partners and investors.

CSIR Communication and Marketing Strategy

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 A9: New CSIR Communication and Marketing Strategy

Technology Commercialisation

CSIR Technology Commercialisation Enterprise

The CSIR is in the fourth year of implementation of its industrial development strategy, which has seen the organisation elevating its 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 from 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.



The CSIR has officially launched its commercialisation enterprise, named **CSIR C3** (pronounced as CSIR C-Cubed) to accelerate the pace and increase the scale of the commercialisation of its technologies and IP. CSIR C3, a company fully owned by the CSIR, will have dedicated capacity to drive all aspects of technology commercialisation, providing adequate financial resources along the technology de-risking process through to commercialisation. The standalone enterprise will hold all CSIR IP and act as an incubator for start-up enterprises underpinned by strong technical and non-financial support. It will enable the commercialisation of CSIR IP through the development of a network of investors and entrepreneurs. The CSIR aims to accelerate the pace and expand the scope of commercialising the intellectual property assets generated by the organisation by:

Creating **dedicated capacity** to **drive** all aspects of technology **commercialisation**



Collaboration with suitable entrepreneurs and investment partners to transform CSIR technologies into marketable products and services



The **provision of adequate financial resources** along the **technology de-risking** process through to **commercialisation**



The CSIR, on its part, will maintain an evergreen pipeline of intellectual property and provide support to the enterprise in resource mobilisation. It will offer access to a diverse pool of highly technical, multi-disciplinary skills and infrastructure, creating an environment conducive to incubating and accelerating innovative businesses. The CSIR will ensure that this special purpose vehicle is deeply immersed into a vibrant ecosystem comprising start-ups, corporates, innovators, financiers, entrepreneurs, government departments and others. Furthermore, the CSIR has evaluated and prioritised its extensive portfolio of knowledge assets, constructing a prospectus that will be launched along with the technology commercialisation enterprise. In addition to the prioritised assets, the CSIR already has a substantial pipeline of intellectual property and will continue to foster innovate, setting the stage for rapid progress.

To achieve this goal, the CSIR will invest R100 million to support the de-risking and enhancement of our technologies over the next three to five years for better market readiness through CSIR C3. The CSIR will consolidate this funding along with other resources dedicated to technology commercialisation, aiming to secure additional funding for incubating and accelerating technologies, both from the public sector and other institutions. This would include the commercialisation of CSIR technologies for social impact and support for grassroots innovation.



A.2.2 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.

High-level budget targeting assumptions at CSIR level

In the 2024 Medium Term Expenditure Framework issued by National Treasury, the following was included as part of the economic outlook:

"The 2023 economic outlook has worsened, fiscal revenues are weaker than expected, and the financing of the government borrowing requirement is under renewed pressure. Several key factors are contributing to ongoing uncertainty and volatility. The country continues to grapple with a high unemployment rate, slow economic growth, and persistent structural challenges, including inefficiency in key sectors such as energy and transportation. Moreover, persistent power cuts, deteriorating rail and port infrastructure, have contributed to a weaker domestic outlook"

Rental income growth considers agreed increases in existing rental agreements with tenants, vacant space that is and may become available as well as increases in underlying costs such as increases in electricity costs recovered from tenants.

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 a single source.

The indicative Parliamentary grant allocation for 2024/25 per the latest update MTEF allocation letter and used in the budget estimates for 2024/25 decreases by 4.80% from the 2023/24 reduced allocation. This indicative allocation is subject to confirmation of the final 2024/25 MTEF allocation to CSIR by DSI.

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

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.

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 Executive Committee on strategic investment of PG, including on annual PG investment planning.



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
Commercialisation and technology transfer	Accelerator Fund
	Apex Fund
	Commercialisation Vehicle
CSIR Board and CSIR governance structures	CSIR Board and other CSIR governance committees

A2.3 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 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.



A3 KPI TARGETS

Table A3: Five-year KPI targets

Indicator	Target 2023/24	Target 2024/25	Target 2025/26	Target 2026/27	Target 2027/28	Target 2028/29	
SO1:	Conduct RD&I of transformative technologies and accelerate their diffusion						
KPI 1:	Publication equivalents	408	298	312	323	336	342
KPI 2:	New priority patent applications filed	8	6	8	10	12	12
KPI 3:	New patents granted	8	12	14	14	16	18
KPI 4:	New technology demonstrators	54	49	53	57	63	65
KPI 5:	Number of technology licence agreements signed	18	12	16	20	24	25
SO2:	Improve the competitiveness of high-impact industries to support South Africa's re-industrialisation						
KPI 6:	Number of localised technologies	14	13	14	16	18	19
KPI 7:	Number of joint technology development agreements being implemented for industry	29	27	34	37	39	41
KPI 8:	Number of SMMEs supported	86	97	95	100	106	115
SO3:	Drive socioeconomic transformation through RD&I that supports the development of a capable state						
KPI 9:	Number of reports contributing to national policy development	21	14	19	21	23	25
KPI 10:	Number of standards delivered or contributed in support of the state	9	9	10	12	12	13
KPI 11:	Number of projects implemented to increase the capability of the state	60	79	87	94	101	106
SO4:	Build and transform HC and infrastructure						
KPI 12:	Total SET staff	1 598	1 642	1 676	1 710	1 749	1 781
KPI 13:	Percentage of SET staff who are black	67%	69%	70%	70%	70%	71%
KPI 14:	Percentage of SET staff who are female	38%	38%	38%	38%	38%	39%
KPI 15:	Percentage of SET staff with PhDs	21%	19%	20%	20%	20%	21%



Indicator	Target 2023/24	Target 2024/25	Target 2025/26	Target 2026/27	Target 2027/28	Target 2028/29
KPI 16: Total chief researchers	16	18	20	23	27	31
KPI 17: Percentage of chief researchers who are black	19%	28%	30%	26%	33%	39%
KPI 18: Percentage of chief researchers who are female	13%	28%	30%	30%	29%	29%
KPI 19: Total principal researchers	189	195	201	208	215	223
KPI 20: Percentage of principal researchers who are black	35%	37%	38%	39%	40%	41%
KPI 21: Percentage of principal researchers who are female	20%	24%	26%	28%	28%	31%
KPI 22: Number of staff involved in exchange programmes with industry	31	32	38	43	48	54
KPI 23: PPE investment (Rm)	148	160	165	170	174	178
SO5: Diversify income, maintain financial sustainability and good governance						
KPI 24: Total income (Rm)	3 054	3 121	3 228	3 349	3 433	3 496
KPI 25: Net profit (Rm)	-38.1	-67.6	-58.7	-48.5	-46.8	-10.5
KPI 26: South African public sector income (% total income)	57%	58%	58%	57%	57%	56%
KPI 27: South African private sector income (% total income)	11%	8%	9%	9%	9%	10%
KPI 28: International contract income (% total income)	9%	11%	12%	12%	13%	13%
KPI 29: B-BBEE rating	1	1	1	1	1	1
KPI 30: RIR	≤0.6	≤0.4	≤0.3	≤0.2	≤0.1	0
KPI 31: Audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion	Unqualified audit opinion



A3.1 PROGRESS TOWARDS THE IMPLEMENTATION OF CSIR STRATEGY

Overall, the CSIR has achieved 90% of its key performance indicators for 2022/23. Over the past four years, there have been several achievements against the CSIR Strategy to exploit knowledge generated, support industry and enable a capable state, namely:

- Significant increase (68%) in the number of technology development activities;
- Double the number of priority patent activities and licensing activities;
- More than double the effort to localise technology solutions;
- Significant increase in (61%) joint technology development activities with industry partners;
- An increase (94%) in the number of projects implemented by the CSIR on behalf of the government; and
- A 40% increase in the number of standards delivered on behalf of the state, which is a testament to the organisation's position as a trusted science partner to government.

Over the past four years, there has been an overall reduction in publication outputs (-9%) due to the Parliamentary Grant that has not increased in par with inflation over the years and a reduction in the CSIR's contribution to national policy development (-40%) due to the reduced demand for policy development support in a constrained fiscal environment.



A4 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.
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 and 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	<ul style="list-style-type: none"> 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 and so forth 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 and Technology Transfer

Method of calculation	<ul style="list-style-type: none"> • 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.
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 dechnology 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 RD&I 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.
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 and Technology Transfer
Method of calculation	<ul style="list-style-type: none"> • 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 granted. • 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: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> Evidence for localised technologies is reviewed by the Planning, Reporting, Monitoring and Evaluation sub-committee of the CSIR 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.
Method of calculation	Number of technologies localised.
Limitations	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 and so forth); 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	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	<ul style="list-style-type: none"> 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.
Limitations	The KPI as defined here does not account for: <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.
Data source/eligible evidence	<ul style="list-style-type: none"> • An active agreement with a government department/SOE/South African university; or • An active agreement with a third party for work intended to increase the capability of the state; 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	<ul style="list-style-type: none"> • 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 HC.
Method of calculation	Head count of SET staff at the end of the financial year.
Limitations	HC 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
Definition	<p>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:</p> <ul style="list-style-type: none"> • 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	<p>These indicators measure the degree of demographic transformation within the RD&I capacity of the organisation.</p>
Performance assessment	<ul style="list-style-type: none"> • 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.
Data source/eligible evidence	<p>Number of employees who are classified as black, as a percentage of the total SET staff extracted from PeopleSoft system.</p>
Data responsibility	<p>CSIR HC.</p>
Method of calculation	<p>The percentages of black South African and female South African staff of total SET staff at the end of the financial year.</p>
Limitations	<p>None – HC ensures the correct classification of staff on the Human Capital database.</p>
Type of indicator	<p>Output.</p>
Exclusions	<p>None.</p>

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	<ul style="list-style-type: none"> 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	CSIRHC.
Method of calculation	The percentage of SET staff with doctoral level qualifications at the end of the financial year.
Limitations	None – HC 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	<ul style="list-style-type: none"> 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 HC .
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 – HC 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
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: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 HC.
Method of calculation	The percentage of black South African and female South African chief researchers at the end of the financial year.
Limitations	None – HC 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	<ul style="list-style-type: none"> • 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.
Data source/eligible evidence	Employees who have been appointed as principal researchers, as indicated on extracted from the PeopleSoft system.
Data responsibility	CSIR HC.
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. HC 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
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: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 HC database.
Data responsibility	CSIR HC.
Method of calculation	The percentage of black South African and female South African principal researchers at the end of the financial year.
Limitations	None – HC 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	Percentage of principal researchers who are black and female
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.
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	<ul style="list-style-type: none"> • 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 and so forth. 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 – HC ensures relevant data are captured.
Type of indicator	Output.
Exclusions	Exchange programmes with government departments.



KPI 23: INVESTMENT (RM) IN PPE

Indicator title	Investment in PPE
Definition	PPE investment is the amount invested in CSIR and 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 provision); 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	<ul style="list-style-type: none"> • 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. • Exceeding 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	<ul style="list-style-type: none"> • The CSIR annual trial balance from the financial system is updated for audit adjustments and the final figures are incorporated in the CSIR annual financial statements. • The annual financial statements are audited and the KPI results are derived from these audited annual financial statements.
Limitations	None.
Type of indicator	Output.
Exclusions	None.

KPI 26: SOUTH AFRICAN PUBLIC SECTOR INCOME (% TOTAL INCOME)

Indicator title	South African 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> 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: SOUTH AFRICAN PRIVATE SECTOR INCOME (% TOTAL INCOME)

Indicator title	South African 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 PFMA and the MFMA). 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	<ul style="list-style-type: none"> 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 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.
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	Legal and Compliance – Privacy 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: <ul style="list-style-type: none"> • 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

Indicator title	RIR
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: <ul style="list-style-type: none"> • Death; • Loss of consciousness; • Restricted work or transfer to another job; • Days away from work; and/or • Medical treatment beyond first aid.
Purpose	<ul style="list-style-type: none"> • 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 0.4 (equivalent to 10 recordable incidents/ cases) through identifying health and safety risks and implementing proactive health and safety interventions to reduce the number of recordable incidents/ cases.
Data source/eligible evidence	<ul style="list-style-type: none"> • 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.

B

**OPERATIONAL
PLAN**

2024/25



B1 OPERATIONAL PLAN OVERVIEW

The CSIR is committed to delivering on key strategic initiatives, programmes and projects that address needs of industry partners, government and society. For the 2024/25 financial year, the following programmes are highlighted in table B1 below. The programmes and projects highlighted are a sub-set of a vast array of initiatives for 2024/25.

Table B1: RD&I initiatives and Projects 2024/25

No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
1. Chemicals cluster				
1.1	Biochemical Conversions (including bioprocessing) Production of lactic acid	TRL 6	<ul style="list-style-type: none"> (i) Detailed feasibility assessment on the current CSIR technology for commercial implementation even at a 1000L scale (ii) Business case for the localisation of local bio-LA (iii) Commercial partner identification for pilot scale demonstration 	Collaborations currently international and with local universities but will develop with local industries. Looking particularly for partner in the local sugar industry, and are talking to South African Farmers Development Association, Unilever and Verigrreen Polymers
1.2	Local production of pharmaceuticals Development of continuous flow-based processes for the production of small molecule active pharmaceutical ingredients	<ul style="list-style-type: none"> (i) FuturePharma Facility build to be completed during the 2024/25 year. (ii) One neuroprotective agent to be advanced from TRL3 – 5. (iii) Bupropion to be advanced from TRL 5 – 6. (iv) Treatments for idiopathic pulmonary fibrosis treatment to TRL 4 	<ul style="list-style-type: none"> (i) Publications x 3 (ii) Technology demonstrators x 2 (iii) Expression of Interest calls for co-development of processes x 2 (iv) Completed facility 	Collaboration with local and international universities (UP, SU, Wits, ICL and so forth), Ezintsha (joint proposal), API cluster for TIA
1.3	Bioplastics Biodegradable Mulch Films	(i) Three (3) minimum viable products demonstrated at TRL 8	<ul style="list-style-type: none"> (i) Completion of field trials for the product for 1yr crops signed licence agreement (ii) Presentation of product at trade fairs and through popular articles (iii) Test reports of feasibility of a re-use model (iv) Prepare for commercialisation of products 	<ul style="list-style-type: none"> (i) Collaboration with Biodegradable Future Pty Ltd. (ii) Funding from the DSI for this phase of the project, as the UK's FCDO funding and collaboration with Elizade University will be wrapped up.



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
2. Advanced Agriculture and Food cluster				
2.1	Cannabis beneficiation Extraction of cannabinoids and formulation of cannabis related products	TRL 6	Two tech demos Eight SMMEs supported	Private – Labat, Wits, UFS Public – DSI, TIA, DBSB, GDARD International
2.2	Indigenous Knowledge Systems Development of complementary medicines, cosmetics and food products	TRL 4	Two publications	Private – THPs, Mashaba Herbs, Conoche, UFS, UKZN, Univ of Limpopo Public – DSI, TIA, IDC International
2.3	Precision Agriculture Development of tool actionable farm-level data or intelligence to enable precision agriculture and cost-effective business decisions (yield predictions, climate impact modelling, etc.)	TRL 7	Two tech demos five publications two SMMEs supported.	Private – FarmSol, InnovBiz, Wits, UKZN Public – DSI, TIA



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
3. Next-Generation Health cluster				
3.1	<p>Point-of-care Diagnostics Developing fit-for-purpose rapid screening tests for Acute Kidney Injury:</p> <ul style="list-style-type: none"> (i) Proteomics (biomarker identification) (ii) Development of point-of-care diagnostic test 	<ul style="list-style-type: none"> (i) Proteomics: The commercialisation strategy will dictate how this technology moves forward. (ii) Point-of-Care Diagnostic test: Currently at level 4/5 to progress to 6/7 through testing against selected established standards. 	<ul style="list-style-type: none"> (i) Test reports for Point-of-Care Diagnostics: to evaluate the sensitivity, specificity, and accuracy of this technology against selected established standard in detecting TDF-induced AKI in PLHIV in Ethiopia, South Africa and Zambia (ii) Funding secured for project through EDCTP 3 or other potential funders: TIA, SAMRC, SADC 	<p>External performance evaluations: Wits Diagnostic Health Clinical Trial partners: CRISMO (SA), AHRI (Ethiopia), UTH (Zambia)</p>
3.2	<p>Digital precision medicine Bioengineered micro-liver screening platform: establishment of digital precision medicine platform using genomics, proteomics and microbiome</p>	TRL 8	<p>Three publications per year One Tech demo</p>	<p>Private: Discovery Public: DSI, MRC, NRF, TIA International: Gates Foundation, Pharma (e.g., Novartis, Merck, Pfizer)</p>
3.3	<p>Vaccine Innovation and Manufacturing Strategy</p>	<p>The project is in a very early phase, and funding will need to be achieved for work to be initiated.</p>	<p>Submission of proposals relating to VIMS, in view of the initial projects to be addressed: HepB and HPV vaccines. If possible, work will be initiated on developing and localising the USA technology for these vaccines.</p>	<p>Private: Grayson Jockey Club Research Foundation (GJCRF), TIA, GALVmed (iVacBio) Public: SA MRC, DSI, TIA International: B&M Gates, EU, US, UK The CSIR is earmarked to be the contract development and manufacturing (CDMO) hub for the initiative, and will work with the DSI to identify and bring other partners on board</p>



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
4. Defence and Security cluster				
4.1	Information and Cyber Security Capabilities (i) Project Honeynet – Cost-effective solution for managing honeypots (ii) Project OSINT – Capability to support in solving cyber and crypto/blockchain crimes.	(i) TRL 6 (ii) TRL 4	(i) Tech demo and patent (ii) Tech demo	(i) SMME, HEIs, CHPC (ii) SAPS, SIU, Private Investigators
4.2	Crime Prevention Capabilities (i) Cerberus/CMOREV2 command and control collaborative platform in support of security inclusive of crime prevention (ii) TYTO camera is a medium range camera designed for intelligence gathering operations. The objective is to improve its reliability, availability, and maintainability. (iii) Develop and deploy computer vision for Integrated Face, Body, and Number plate recognition (FBNR) for access control and CCTV based security management	TRL 4 – 8	(i) Cerberus – Technology demonstrator(s) for Situation Awareness/Command and Control, Fusion Centre Support, Intelligence Support, Investigation Support, and large-scale information gathering, processing, and sharing. (ii) TYTO Camera – Technology demonstrator, joint technology development, Licence agreement(s), a Commercialisation candidate, while supporting the capability of the state. (iii) Smart CCTV FBNR – Technology demonstrator for Uniform Recognition, Conference Papers, Licence agreement(s), a Commercialisation candidate, while supporting the capability of the state.	JCPS cluster departments and Private security sector

No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
4. Defence and Security cluster				
4.3	<p>Commercialisation of Niche Defence Capabilities</p> <ul style="list-style-type: none"> (i) EW Mission Support System Development (ii) Integrated airborne, surface and lab-based test, evaluation, and training solutions (iii) Quadome radar development with Hensoldt (iv) UAV SAR product family development 	<ul style="list-style-type: none"> (i) Illovane TRL 7 (ii) Inundu: TRL 4 (iv) EWMSS TRL 7 (v) UAV SAR TRL 6 	<ul style="list-style-type: none"> (i) WMSS – Technology demonstrator(s), joint technology development, SMME support, supporting the capability of the state. (ii) Inundu – Demonstration of Inundu air-to-air combat training solution components/ sub systems, Joint tech development. (iii) ILOVANE – Initiate production of prototype for launch with customer and transfer of the technology, SMME support (iii) UAV SAR – System prototype for low altitude UAVs, Initiate industrialisation effort with Hensoldt, enhancing the State’s Air borne SAR capability which is related to our Cessna based Airborne SAR facility and SAR measurement campaigns. 	Industry



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
5. Manufacturing cluster				
5.1	<p>Medical Devices and Health Sector Medical device development and direct industry support (MeDDIC programme):</p> <ul style="list-style-type: none"> (i) Supporting medical device entrepreneurs to become regulatory compliant. (ii) Undertaking medical device development for entrepreneurs (localisation / local innovation) (iii) Targeting POC medical devices in low-middle income countries. (iv) Doing contract manufacturing of medical devices. (v) Develop our own medical devices to commercialise. (vi) Medical software (PC and Apps), including application of machine learning principles. 	Multiple projects across the TRLs from TRL 4 to TRL 7	<ul style="list-style-type: none"> (i) TRL 7 cardiology probe for point of care testing (Cardiflo) (ii) Machine learning algorithm for signal quality implemented on commercialised fetal system (Umbiflow) (iii) Use of Optical coherence tomography for medical applications (iv) Development of an ICU bed for local manufacture (v) Value chain analysis of additive manufacturing for medical implants (vi) Six (6) medical device SMMEs supported in the regulatory space (vii) Targeting new mobile app development opportunities 	Medical device and diagnostics innovation cluster programme (MeDDIC, funded by TIA), SA Medical Research Council, SEDA, DSBD, SABS, UP, UCT, Lodox, medical SMMEs, Gates Foundation, EU Horizon Programme
5.2	<p>Metals and Advanced Materials Sector Development Metal Injection Molding (MIM) Industry Development</p>	TRL 4 – 7	<ul style="list-style-type: none"> (i) Core elements of the first MIM demonstration factory in place (ii) First production runs for demonstration parts completed 	Industry, Industry Associations, OEMs and the dtic .
5.3	<p>Automotive Industry Development</p> <ul style="list-style-type: none"> (i) New Energy Vehicle (NEV) Roadmap and Strategy (ii) Micro-mobility modular manufacturing platform (iii) Heavy vehicle Industry value chain analysis 	TRL 3 – 4	<ul style="list-style-type: none"> (i) NEV Value Chain with Roadmap and Strategy. Implementation Plan (ii) Micro-mobility Platform that covers Design, Manufacturing, Standards and testing First modular prototype (iii) Value chain analysis of sector together with an opportunity map for South Africa and the CSIR. 	<ul style="list-style-type: none"> (i) AIDC GP, AIDC -EC, NAAMSA, NAACAM, MEMSA, IDC, (ii) AIDC GP, AIDC -EC, MEMSA, IDC, ELEKSA (iii) AIDC GP, AIDC -EC, NAAMSA, NAAMCAM, MEMSA, IDC, Bell Equipment, Dezzi, Rham, Fermel, AARD, Man Truck +Bus, Iveco



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
6. Mining cluster				
6.1	<p>Technologies for enhancing mine safety Competency based training using 4IR technologies, driving zero harm in the mining industry;</p>	TRL 6	<ul style="list-style-type: none"> (i) Rollout of Phase 1 and 2 modules at Kloppersbos facility. (ii) Mining operational demonstration using a high-risk emergency preparedness situation, training of mining employees and monitoring behavioral changes over a period, (iii) Commercialisation of the Training framework including development of a process to protect of competency-based framework Know-how. 	<p>Collaboration with various Mining companies including Serite, Sasol, Fraser Alexander Technology Innovation Agency TIA Expanding the offering to SADC mining companies e.g., Zambia, Botswana, Lesotho</p>
6.2.1	<p>Mining digitally enabled and intelligent decision support</p> <ul style="list-style-type: none"> (i) Integrated Geosensing tools and risk-based mapping platform (ii) Improve BHR and ERT service offering. (iii) Develop UAV-GPR and GPR-LIDAR system. (iv) Geosensing data platform utilising various Geophysical datasets (ERT, GPR, BHR...etc) and interpreting the data for decision support. 	TRL 6	<ul style="list-style-type: none"> (i) Operational demonstration testing for an improved BHR, (ii) ERT survey service offering (iii) Development of a UAV-GPR platform and an integrated GPR-LIDAR capability 	<p>Mining companies Mintek Department of Defence</p>



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
6. Mining cluster				
6.2.2	<p>Mining digitally enabled and intelligent decision support TMM Digital Twin – A digital risk profiling tool for Open Pit and UG Mines.</p>	TRL 6	<ul style="list-style-type: none"> (i) Additional operational pilots. (ii) Additional modules e.g., Optimisation, Digital product documentation, fleet management logic to support predictive function, and so forth. (iii) Noise monitoring digital twin component. (iv) Technical optimisation and advancement of (existing) modules. (v) Additional/alternative simulation ecosystems, especially for vehicle interaction. (vi) Commercialisation related modules/ functionalities – including subscription framework, etc. (vii) Achieve TRL 7 and 8 (pursue commercialisation preparation process) 	Mining Industry
6.3	<p>Mining Decarbonisation Technologies</p> <ul style="list-style-type: none"> (i) Study that investigates the infrastructure requirements, H2 demand, required regulations and economic impact for implementing the use of H2 at mining sites. (ii) Pre-feasibility study for National H2 ICE Lab. 	TRL 2	<ul style="list-style-type: none"> (i) Complete H2 laboratory pre-feasibility study. (ii) H2 Regulatory framework for mining industry. (iii) Complete H2 infrastructure study wherein H2 demand for the mining industry will be established. 	Mining Industry



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
7. Next-Generation Enterprises and Institutions cluster				
7.1	Smart Government Services (i) Digital Health (ii) Oceans and Coasts Monitoring (iii) Localised cloud platform solutions for government (iv) Electronic monitoring (v) Science Engagement Information (vi) Management System (SEIMS)	(i) TRL 6 – 9 (ii) TRL 6 – 9 (iii) TRL 5 – 7 (iv) TRL 4 (v) TRL 6	(i) Electronic medical record for HIV/TB and the Master Health Facility List (ii) Delivery of national systems and five decision support tools (iii) Development towards a Local Open Stack Cloud Platform (iv) Electronic monitoring system (low risk bracelet) (v) SEIM system	(i) Centre for Disease Control (CDC); National Department of Health (NdoH); National Health Laboratory Service (NHLS) (ii) DFFE; African Union Commission (iii) SITA, Local SMMEs (Pelara and Kakanyo), Govt Depts (users), OEMs, Data Centre Infrastructure Facilities; SADC, SKA Operations and BRICS Countries (iv) Integrated Justice System (v) DSI
7.2	Financial Inclusion and Intelligence (i) Financial fraud detection tools (ii) Digital asset management and tax software (iii) Insurance risk and pricing tools	(i) TRL 5 – 6 (ii) TRL 6 (iii) TRL 6	(i) Software applications (ii) Web applications and browser plugins (iii) Software applications	(i) Financial industry and regulators (local and global), Digital Assets industry; Banking industry (ii) Retail and eCommerce Industries; SARS; Accounting Industry (iii) Insurance Industry
7.3	Smart Digital Services and Operations (i) Foundational Digital Capabilities Research Platform (i) Connectivity and language technologies (i) 4IR Platform to enable small business entrepreneurship (FIRBY)	(i) TRL 2 – 6 (ii) TRL 4 – 9 (iii) TRL 1	(i) A range of deliverables that strengthen foundational digital capabilities in five areas of focus (domains): AI, Robotics and Cybernetics; Cloud Computing, Networking and Advanced IoT; Blockchain and Cybersecurity; Augmented-, Mixed- and Virtual Reality; Modelling and Simulation (ii) Open 5G testbed for mobile networks; Framework architectures and models for language technology development (iii) FIRBY 0.1 (early-stage subset of platform components)	(i) DSI and range of other Govt Depts; various HEIs; ICT SMMEs; Regulators; Relevant industry stakeholders; International, Continental and BRICS countries (ii) DSI, SADiLaR, AHRI and other government departments; Relevant industry stakeholders (e.g. ATNS); international clients; CSIR sits on the Steering Committee of SADiLaR; DSAC; DBE (iii) Over time AfCFTA



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
8. Smart Places cluster				
8.1	<p>Human Settlements, Utilities and Services Alternative water sources programme</p> <ul style="list-style-type: none"> (i) Valorisation of Acid mine water. (ii) Development of advanced technologies for the desalination of seawater to recover drinking water and valorisation of brine to industrial salts. 	<ul style="list-style-type: none"> (i) TRL 6 (ii) TRL 4 	<ul style="list-style-type: none"> (i) TRL 7 Publication Equivalents, Mobile and modular Pilot Plant (ii) TR 5-6 Mobile and modular pilot plants, Publication Equivalents, Technology demonstrators 	<ul style="list-style-type: none"> (i) Mines (Exxaro Resources, South 32, Sibanye Stillwater) (ii) UCT, Wits University Nafasi Water, Memcon, Sartorius
8.2	<p>Industrial Revitalisation Programme Developing systems and techno-economic analysis, capabilities and local skills to support green hydrogen development in South Africa.</p> <ul style="list-style-type: none"> (i) Development of advanced decision-support tools needed to enable sustainable Green Hydrogen development in South Africa. (ii) PtX derivatives development and techno-economic feasibility tool – a Python-based tool which will automatically sweep through user-defined ranges in relevant parameters to determine optimum Green Hydrogen and PtX plant designs. (iii) Adaptation and presentation of training courses in green hydrogen, as well as the identification of a skills roadmap to support green hydrogen development in South Africa. 	<ul style="list-style-type: none"> (i) TRL 6 (ii) TRL 6 (iii) N/A 	<ul style="list-style-type: none"> (i) Extend prototype CLD models and integrated spatial layers tested in pilot study. (ii) Extend the green hydrogen techno-economic feasibility tool to include Ammonia and Methanol production. (iii) Training course material developed and presented. 	<ul style="list-style-type: none"> (i)(ii) The Presidency, DFFE; Department of Transport, the dtic; DMRE, Industry: GFA consulting, International: German Development Corporation (GIZ), Energy and Water SETA HySA (iii) GIZ, the dtic, Chemical Industry SETA.

No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
8. Smart Places cluster				
8.3	<p>Oceans, Coastal and Marine Science and Port Operations</p> <ul style="list-style-type: none"> (i) Understanding the mechanisms that explain climate sensitivity of CO₂ fluxes in the Southern Ocean. (ii) High precision VeGAS-pCO₂ sensor: Providing high precision autonomous ocean observations of CO₂. (iii) Polar adapted Wave Gliders – Extend the seasonal range of the Wave Glider by overcoming the challenge of low/no light in winter, with locally designed and built hydro generators. (iv) Machine learning based product CSIR-ML6 – One of 6 global machine learning models used to reconstruct the global ocean CO₂ fluxes for the IPCC and the Global Carbon Budget for the period 1985 to 2019. 	TRL 5	Publication equivalents; TD; technology license agreement; HCD outputs	DSI, University of Cape Town



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
9. Smart Mobility cluster				
9.1	Intelligent Transport Systems and Operations Passenger Transport 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	(i) Scoping of new technologies to localise as part of the operationalisation of the Transport Safety Lab. (ii) Propose new national standards: Mobility data; Road safety.	National Taxi Alliance (data collection, industry needs mapping) South African National Taxi Council (data collection, industry needs mapping) SA Taxi (future studies) International Association on Public Transport (information exchange) South African Roads Federation (contributor) Committee of Transport Officials (invited as and when) Centre for High Performance Computing and (Internal)
9.2	Sustainable Transport Infrastructure Pavement Design and construction Provide sustainable road infrastructure solutions that effectively address the accessibility and mobility needs in support of socio-economic development.	TRL 4 – 8	(i) Road design technologies, standards and specifications (alternative materials e.g. plastic waste, low and high-volume roads, urban and rural, inclusive of rehabilitation) through geotechnical and structural engineering (ii) Performance assessments (APT, LTPP) (iii) Forensic investigations (iii) Performance modelling and analysis; big data sciences (AI and machine learning) (iv) PADS/GAMES suite of software products, linked to SaaS (v) Advanced road construction and maintenance technologies (vi) Climate Change adaptation and mitigation (vii) Smart road technologies (Data capturing instruments/sensors; Longer lasting, “maintenance free” road designs)	SOE: SANRAL Local Industry, e.g., consultants, material suppliers and contractors. Sasol Industry associations, e.g., Sabita, CCSA and ASPASA International: IT Transport, ICS Engineering and Environment Universities: UP, SU, UKZN, University of New Hampshire



No.	Programme/Project Description	Planned Technology Readiness Level by 31 March 2025	Planned Outputs for 2024/25	Collaborations: Industry, HEIs, other State Entities, International, Continental and BRICS Countries
9. Smart Mobility cluster				
9.3	National Logistics System Smart Logistics Management Enhanced functioning of the national logistics system	TRL 4	(i) Operationalise the Logistics Observatory. – Formulate and implement marketing strategy for the Logistics Observatory. – Development of Corridor improvement tools: corridor simulation and similar models (ii) Ilima: test and deploy in poultry sector; design adaptations for another sector (e.g., Cannabis)	National Logistics Crisis Committee (contributor) National Association of Automotive Manufacturers of South Africa (new energy vehicles policies) SMME: ThinkNinjas, Crickmay, Mogan Bros GIZ: co-funding PtX pathways project



B1.1 COLLABORATIVE WORK WITH OTHER DSI ENTITIES

The CSIR has collaborated with DSI in many system-level initiatives but also at programme and project levels. One of the recent system-level initiatives of the DSI and CSIR was the launch of the Science Diplomacy Capital for Africa (SDCfA). The SDCfA aims to promote multilateral collaboration to address the challenges facing humanity through the promotion of science collaboration across Africa and beyond, leveraging and connecting technology innovation with humanity. It also seeks to put science diplomacy at the heart of Africa's socioeconomic development and growth.

CSIR does collaborate with other entities DSI as well, in the 2024/25 strategic plans, various programmes and projects will be undertaken together with the Technology Innovation Agency (TIA), the National Research Foundation (NRF), Human Sciences Research Council (HSRC) and the South African Space Agency (SANSA). Amongst others, we highlight the following projects:

- Development of a roadmap to deploy innovations and technology to achieve green, smart and sustainable human settlements in the context of 4th Industrial Revolution. DSI and TIA one of the partners in this development.
- Identification of markers for Adverse Kidney Injury (e.g., ARV – induced damage). This work will also include the identification of proteomic signatures for early detection of chronic kidney disease and the verification of protein signatures for gall bladder and pancreatic cancers. DSI, NRF and TIA are the partners in this programme.
- Develop plant produced vaccines and therapeutics for viruses and other infectious microorganisms (e.g., SARS-CoV-2 and others). DSI and TIA are the partners in this programme.
- Development of a bioengineered micro-liver screening platform. DSI, NRF and TIA are the partners in this platform.
- Extraction cannabinoids and formulation of cannabis related products. DSI and TIA are the partners in this programme.
- 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 and so forth.) at all levels of the value chain. DSI and TIA are the partners in this programme.
- Development of diagnostic tools and vaccines to support animal health. DSI and TIA are the partners in this programme.
- Development of a strategic plan for the medical devices and health sector. DSI is the partner in this development.
- Development of industrial inspection systems, including sensors and specialised cameras (e.g GasCam a camera that detects gas leaks on electrical power transmission and distribution lines) TIA is the partner in this programme.
- Identification of opportunities to re-purpose existing defence technology solutions to be used during national safety and security interventions. DSI is the partner in this exploration.
- The establishment and maintenance of a data processing ecosystem to support national safety and security interventions. DSI is the partner in this programme.
- Training of early career engineers to the full scope of aircraft systems (and product lifecycles) in an integrated product development team (IPDT) as part of the Aerospace Engineering Development Programme (AEDP). DSI and SANSA are the partners in this training programme.
- Pilot training and demonstration of Inundu air-to-air combat training solution components/sub systems. TIA and SANSA are partners in this training.
- Development of passive radar technology for air traffic control. TIA is a partner in this development.
- Hosting of the National Space Conference for 2024. DSI and SANSA are co-hosts.
- CSIR and SANSA entered into a memorandum of understanding related to development of a Space Roadmap for South Africa, satellite payload and launch capabilities, amongst others.



- CSIR and HSRC entered in a memorandum of understanding for collaborative work in the following areas:
- Advanced Agriculture and Food, Pharmaceutical Manufacturing, and Mining;
- 4IR, Science in Society and Artificial Intelligence;
- Science Diplomacy;
- Defence and Security;
- Energy Transition; and
- Waste Research, Development, and Innovation (Waste RD&I).

B1.2 CSIR SUPPORT OF THE DISTRICT DEVELOPMENT MODEL

The CSIR work supports the District Development Model (DDM), soon after the DDM was approved by Cabinet in 2019/20 the CSIR was involved in the establishment of the Spatial and Temporal Evidence for Planning in South Africa (StepSA), a collaborative initiative aimed at building the capability and evidence base to support high impact and transformative investment decisions in South Africa's cities, towns, and settlements. One of the key outputs of this platform, amongst others, is the DDM Simulation tool, which analyses and models the impact likely to be realised in a particular district through different intervention commitments.

The development of the DDM Simulation tool is an ongoing project, with two main components combined in a web portal:

- Profiler which is a web-based geo-spatial dashboard providing socioeconomic profiles down to ward level for the whole country and;
- The model (simulator) which is a multi-regional input-output economic model where the user can model the impact on the economy of catalytic projects.

The GreenBook MetroView is another tool developed by the CSIR specifically to support local government to adapt to climate change by providing evidence around climate change, population growth, risk and vulnerability for metropolitan municipalities.

The Regional Economic Development Planning Support tool, InvestMap, is also a product of the CSIR that supports the DDM. InvestMap supports all spheres of government with a regional approach to planning. Regional development planning typically covers aspects of economic development, the environment, social facilities and amenities, provision of basic services, and health-related issues.

In the 2024/25, the CSIR will be involved in several projects in support of various municipalities in areas of passenger transport, e-government, wildfire monitoring, waterworks, service delivery in mining towns, industrial parks, just to name a few. The following are examples of some of the work that supports municipalities:

- **Digital enablement of public institutions** to facilitate electronic government service solutions. Examples include ongoing projects:
 - (1) Development of a Digital Solution for improved law enforcement in the minibus taxi industry including an Online Reporting Tool: This web platform will assist the department to manage and monitor membership registrations of public transport operations in one platform. This will merge almost all modes which include buses, taxis, e-hailing services;
 - (2) The development of a Gauteng Integrated Public Transport Administration System (GIPTAS); and
 - (3) Provision of comprehensive support on Road Asset Management for the Gauteng Province. Future planning is focused on the initiation of an opensource software programme to support local government transport functions.
- **Decision-support for smart city initiatives and innovation for service delivery.** The purpose of this initiative is to support 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. The initiative also has a focus



on the integration of innovation in the municipal environment to improve service delivery, and the development of an online database of appropriate, innovative technologies for human settlements and service delivery. Part of this work is linked to the Viability and Validations of Innovations for Service Delivery (VVISD) Programme; the VVISD is a programme implemented by the implemented by the Department of Science and Innovation (DSI) in partnership with the South African Local Government Association (SALGA) and the Department of Cooperative Governance and Traditional Affairs (CoGTA), with funding from the European Union Sector Budget Support Programme and the National Treasury to help municipalities pilot technology and innovations that could assist in improving basic service delivery.

- **Municipal Capability and Partnership Programme**, a collaborative effort in addressing service delivery challenges in mining towns. This programme support partners to improve service delivery by strengthening and aligning strategic plans and processes and accessing resources that are critical in facilitating a development vision for municipalities. Eight municipalities are supported in collaboratively solving pressing service delivery and infrastructure challenges and to facilitate meaningful and effective ways to contribute to economic transition and diversification in preparation for eventual mine closure. Anglo American (including its Kumba Iron Ore, Anglo Platinum, and De Beers) together with CoGTA are partners in this programme.
- **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. The online repository is designed to accommodate the varying needs of a number of distinct user groups that were identified during the early research phase. These include, for example, assisting and supporting 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.
- **Eco-Industrial Parks (EIP) Programme**, a culmination of years of work on the United Nations Industrial Development Organization (UNIDO) Global EIP Programme and the Industrial Revitalisation Programme of the Department of Trade, Industry and Competition (**the dtic**). Led by the The National Cleaner Production Centre South Africa (NCPC-SA), it involves the implementation of the UNIDO EIP toolkit in selected industrial parks, as well as implementation of energy, water and industrial symbiosis improvements in parks. Between 2024 and 2029, it will involve the two international-funded projects delivered in partnership with UNIDO and the establishment of a national project management hub for **the dtic**. UNIDO, **the dtic**, Swiss State Secretariat for Economic Affairs (SECO), German Development Cooperation (GIZ), selected industrial parks management, provincial governments, affected municipalities, local community representatives and civil society.
- **Smart ecosystem-based solutions for sustainable African coastal cities** and industries in a changing world. The key focus areas comprising both RD&I and Commercialisation components include:
 - (1) Safe shores: Protection of coasts using green (including natural) infrastructure.
 - (2) Optimising estuarine value: Optimisation of estuarine resource allocation and restoration
 - (3) Green ports: Enhancement of the role of natural infrastructure in multi-purpose port management
 - (4) Pollution risk management: Management of ecological risks of complex effluent stream.
- Establishment of a world class **National Information and Cyber Security capability to support government, municipalities, and private sector**, in improving their information and cyber security governance, privacy and trust.
- **Planning Support to Cities on Climate Adaptation**. This is to support the development of climate resilient cities and towns, to develop and disseminate a unique combination of planning support tools, models, guidelines and strategies aimed at creating climate resilient, hazard resistant settlements. Support to eThekweni Metro and the Buffalo City is planned.



B2 HUMAN CAPITAL DEVELOPMENT PLAN

The CSIR has commenced to implement the pillars of CSIR’s Human Capital Development Strategic objectives 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.

PILLAR 1: BUILDING A DIVERSE TALENT ECOSYSTEM AND A SUSTAINABLE FUTURE SUPPLY OF LIMITED SKILLS

The following key interventions in Table B2 are planned and included in Human Capital plan for 2024/25 in support of this objective.

Table B2: Building a diverse talent ecosystem and a sustainable future supply of limited skills

Talent acquisition	The strengthening of internal capabilities for attraction of talent, continue to be priority for the next year and this includes optimisation of recruitment sourcing strategies, including joint appointments, to achieve a competitive advantage in the attraction of new talent with skills and competencies which match the diverse internal demand of skills and competencies, required by divisions, clusters, impact areas and research groups.
Talent management and Succession Planning	Talent review of the following: CEO succession plan for Board approval; CEO’s direct reports succession plans for HRSEC and Board noting; ECM and GM succession plans; IAM and RGL succession plans; and Critical positions succession plans.
Enhancing pipeline development programmes	Enhancing relationships with academic institutions such as University of Pretoria, University of Stellenbosch, Sefako Makgatho University, etc. Conclude MoU with NSA and NSF.
Learning and development (L&D) programmes	Continue LMDP programme partnerships with business schools and the eLearning platform service provider. Work towards the accreditation of the CSIR as a training service provider through the QTCO and relevant SETAs. Secure workplace approval for technical training through relevant SETAs. Partner with NSA in 2024 skills of the future conference.
CSI programme	Partnership with relevant stakeholders to upgrade school facilities in offering conducive learning environment as well as providing tutoring.
CSIR Alumni programme	In 2024/25, the focus will be on rolling out the planned activities and delivering impact through the CSIR alumni programme initiatives. The planned initiatives include mentorship of the Entrepreneurship Development Programme candidates, the alumni newsletter and the establishment of the alumni committee.



B2.1 PARTNERSHIPS WITH SETAS, NSA, NEMISA TO CONTRIBUTE TO SKILLS DEVELOPMENT

The CSIR continues to strengthen the established relationship with SETAs that have been mapped against all 8 research clusters and portfolios in the organisation. Several initiatives that will continue / rolled-out in FY 2024/25 include:

- Piloting a Work Integrated Learning Programme with the industry;
- Piloting the Apprenticeship and Learnership Programme as well as the ECSA Academies Programme;
- Co-development and accreditation of new learning programmes that support development of emerging skills;
- The establishment of a mining academy in Limpopo; and
- The enhanced CSIR Industry-Partnered Learning Factory.

Other partnerships include the co-development of digital learning programmes with the National Electronic Media Institute of South Africa (NEMISA), as well as the collaboration with National Skills Authority (NSA) on the National Conference on Future Skills targeted at industry and educational institutions. All skills development programmes prioritise women, youth and people with disability.

PILLAR 2: STRENGTHENING LEADERSHIP AND DEEPENING PROFESSIONALISM

The following key interventions in Table B3 are planned and included in Human Capital plan for 2024/25 in support of this objective.

Table B3: Strengthening leadership and deepening professionalism

Embedding the CSIR people strategy	The implementation of a CSIR People Strategy is a key priority for 2024/25 FY.
Targeted development programmes for critical staff	The implementation of these programmes will be continued in 2024/25, to strengthen the capacity at this level and focus on transformation, these include accelerated researcher development programmes, mentorship, staff bursaries.
Development of an experience navigator for support staff	The development and automation of an “experience navigator” to guide learning and development interventions for support staff.
Develop exchange programmes with universities and industry	Continue to incorporate exchange programmes with the existing partnerships and stakeholders of the CSIR to ensure sharing and transferring of skills.
Employee relations	Continue with employee relations capability building initiative, empowering line managers and employees to understand and handle employee relations-related legislation, policies, procedures, guidelines, and processes. Some of the topics to be covered include unpacking conditions of service, probation process, grievance procedure, the CSIR cases as well as case and etc.
Employment equity	The focus is on the implementation of sectoral EE targets.



PILLAR 3: IMPROVING INDIVIDUAL AND ORGANISATIONAL PERFORMANCE

The following key interventions in Table B4 are planned and included in Human Capital plan for 2024/25 in support of this objective.

Table B4: Improving individual and organisational performance

Employee value proposition	A compelling Employee Value Proposition is implemented. Rolling out of the EVP through various talent acquisition platforms. The implementation of a solution for Total Reward Statements is planned for next year.
Performance management	Refinement of the 360 feedback questions to create a clear link to the CSIR's values is currently in progress.
Employee engagement	Focus on increasing employee engagements as a key driver for increased performance, productivity, and collaboration towards excellence will continue in the next year. Rolling out of the second climate survey for the CSIR.
Reward and recognition	The implementation of the job and pay parity out comes as approved by Exco.
Employee benefits	Implementation of the new funeral scheme cover as negotiated with the service provider.

PILLAR 4: INCREASED EFFICIENCY AND EFFECTIVENESS OF HC SYSTEMS AND PROCESSES

The following key interventions in Table B5 are planned and included in Human Capital plan for 2024/25 in support of this objective.

Table B5: Increased efficiency and effectiveness of HC systems and processes

Develop and implement workforce planning and recruitment planning capabilities.	The implementation of position management in order to plan, manage and track filled and vacant positions and enable workforce planning in a structured manner will be implemented.
Enhance and automate HC processes	Continue with the automation of key processes. <ul style="list-style-type: none"> • 360° assessment (performance management); • Interview Scoring App; • Recruitment planning tool; • BIS – consolidated KPI report; and • Support portfolios career ladder.
Rewards and recognition system	Procurement and implementation of the Total Reward Statement.



PILLAR 5: ADVANCING WOMEN, YOUTH AND PEOPLE WITH DISABILITY

The following key interventions in Table B6 are planned and included in Human Capital plan for 2024/25 in support of this objective.

Table B6: Advancing women, youth and people with disability

Attraction and retention of female researchers	Approval and implementation of the attraction and retention framework concepts with the intention of reducing turnover of critical staff, including black and female researchers.
Advancement of people with disabilities	Continuing to focus on the advancement of people with disability as per the CSIR's Employment Equity Plan. Youth outreach with focus on PWD schools/associations, priority for YES programme.
Women, men and youth forums	Continue leveraging on the women's forum to support women's development agenda and implementing initiatives developed by women for a conducive working environment. Continue with men's forum to address GBV issues, attitudes and psychosocial issues.



B3

FINANCIAL PLAN

The CSIR current strategy 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.

Financial sustainability is a considerable challenge amid the current global and local economic climate. Specific recent events, such as the deterioration of South Africa's fiscal metrics, the lingering effects of the Covid-19 pandemic (with concerns about potential future pandemics), the Ukraine-Russia War, unrest in the Middle East, and the national energy crisis, have had profound and ongoing consequences on the global economic and societal landscape. These factors contribute to the potential for an economic recession, global fuel shortages, and soaring inflation rates in certain regions.

Fiscal revenues are weaker than expected, and the financing of the government borrowing requirement is under renewed pressure. Several key factors are contributing to ongoing uncertainty and volatility. The country continues to grapple with a high unemployment rate, slow economic growth, and persistent structural challenges, including inefficiency in key sectors such as energy and transportation. Moreover, persistent power cuts, and deteriorating rail and port infrastructure, have contributed to a weaker domestic outlook.

The indicative baseline Parliamentary Grant (baseline PG) allocation for 2024/25 has been reduced by a further 4.80% in comparison to the 2023/24 amount, which was a reduction of 4% against the 2022/23 allocation. The 2024/25 figure of R679.2 million excluding VAT (R781.7 million including VAT) is lower than the allocation for the 2018/19 financial year of R760.1 million (R874.1 million including VAT). In real terms this has decreased even further due to inflation and the numerous budget cuts that were effected by DSI/NT over the past few years. This decline in real terms in the baseline PG allocation 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.

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 an increase of 2.2% in total operating revenue on the 2023/24 forecast (see Table G1). Contract income increases by 5.1% and baseline grant funding decreases by 4.8% on a comparative basis (i.e., budget 2024/25 vs 2023/24 forecast).

Income from the South African public and private sectors as well as international contract income are budgeted to increase by 3%, 9% and 12.5% respectively when compared to the 2023/24 forecast.

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 2024/25 by 3.1% on the 2023/24 forecast. Employee remuneration costs and operating expenses are expected to increase by 6.6% and 1.7% respectively, while depreciation is expected to decrease by 22.6%.

The increase in employee-related costs is determined by taking into consideration the human capital development costs, annual cost of living adjustment, as well as the growth projections on contract income. All planned recruitment will be dependent on the securing of contracts, and resource planning of critical required skills within the CSIR that would enable delivery against the CSIR mandate.

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

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

B.3.3 ROYALTY INCOME

Royalty income is budgeted at R1.9 million and is based on current registered license agreements and is expected to increase by 0.7% against the 2023/24 forecast.

B.3.4 FINANCIAL SUSTAINABILITY

The CSIR is budgeting for a net loss of R67.6 million for the 2024/25 financial year. Given the envisaged further reductions in the PG over the Medium-Term Expenditure Framework (MTEF) period, the organisation has budgeted losses of R58.7 million and R48.5 million in 2025/26 and 2026/27 respectively. Given the significant reductions, the organisation cannot be expected to be profitable over the MTEF period.

Table G1 in Appendix G. provides the high-level CSIR statement of comprehensive income reflecting the forecast for 2023/24, the budget for 2024/25 and estimates for 2025/26 as well as 2026/27. 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

The CSIR Statement of Financial Position for the MTEF period is provided in Table G2 in Appendix G.

One needs to consider the budgeted current assets of R1.79 bn, cash balance of R1.10 bn in conjunction with the current liabilities of R1.41 billion. The current ratio (current assets/current liabilities) 1.27.



B.3.6 INVESTMENT IN PROPERTY, PLANT AND EQUIPMENT

The budgeted investment in property, plant and equipment for the 2024/25 financial year is R159.8 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 wholly owned subsidiary (CSIR C3 SOC LTD, previously known as Technifin SOC Ltd) which was dormant and accounted for an insignificant portion of the total Group's budget to date.

In October 2023, the CSIR C3 SOC LTD was launched as a stand-alone special purpose technology commercialisation vehicle to commercialise and industrialise technologies and the intellectual property (IP) that the organisation generates. The enterprise is a wholly owned CSIR company that holds, trades and commercialises CSIR-developed technology. It is a dedicated capability to commercialise CSIR technologies at pace and scale, acting as an accelerator to license and help incubate high-tech start-ups developed from CSIR intellectual property.

The CSIR current approval to issue guarantee instruments will expire at the end of March 2024 and the CSIR Board recently approved limits to issue guarantee instruments for the 5 year period to end March 2029. The Board approved limits are provided in Table G8 in Appendix G. These limits are pending concurrence by the Minister of Higher Education Science and Technology and subsequent approval by the Minister of Finance.

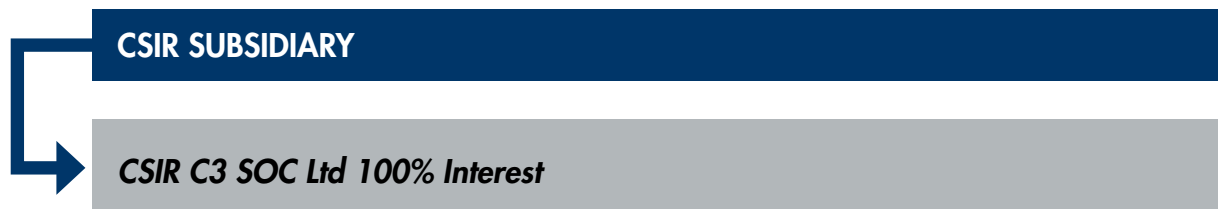


Figure B1: CSIR Subsidiary



B4

ANNUAL AND QUARTERLY TARGETS 2024/25

Table B7: Phased quarterly KPI targets for 2024/25

KPI	Q1 2024/25	Q2 2024/25	Q3 2024/25	Q4 2024/25
SO1: Conduct RD&I of transformative technologies and accelerate their diffusion.				
KPI 01: Publication equivalents	61	122	208	298
KPI 02: New priority patent applications filed	0	0	2	6
KPI 03: New patents granted	0	1	5	12
KPI 04: New technology demonstrators	3	11	16	49
KPI 05: Number of technology licence agreements signed	0	0	3	12
SO2: Improve the competitiveness of high-impact industries to support South Africa’s re-industrialisation.				
KPI 06: Number of localised technologies	0	2	3	13
KPI 07: Number of joint technology development agreements being implemented for industry	1	8	18	27
KPI 08: Number of SMMEs supported	10	20	39	97
SO3: Drive the socioeconomic transformation through RD&I, which supports the development of a capable state.				
KPI 09: Number of reports contributing to national policy development	0	1	3	14
KPI 10: Number of standards delivered or contributed to support the state	0	0	2	9
KPI 11: Number of projects implemented to increase the capability of the state	10	20	30	60
SO4: Build and transform HC and infrastructure.				
KPI 12: Total SET staff	1 577	1 588	1 609	1 642
KPI 13: Percentage of SET staff who are black	69%	69%	69%	69%



KPI	Q1 2024/25 Actual 2021/22	Q2 2024/25 Actual 2022/23	Q3 2024/25 Target 2023/24	Q4 2024/25 Target 2024/25
KPI 14: Percentage of SET staff who are female	38%	38%	38%	38%
KPI 15: Percentage of SET staff with PhDs	19%	19%	19%	19%
KPI 16: Total Chief Researchers	14	14	15	18
KPI 17: Percentage of chief researchers who are black	21%	21%	27%	28%
KPI 18: Percentage of chief researchers who are female	21%	21%	27%	28%
KPI 19: Total principal researchers	186	186	190	195
KPI 20: Percentage of principal researchers who are black	35%	35%	36%	37%
KPI 21: Percentage of principal researchers who are female	18%	21%	24%	24%
KPI 22: Number of staff involved in exchange programmes with industry	18	21	24	32
KPI 23: PPE investment (Rm)	39	114	141	160
SO5: Diversify income, maintain financial sustainability and good governance				
KPI 24: Total income (Rm)	614	1 413	2 172	3 121
KPI 25: Net profit/(loss) (Rm)	-134	-115	-170	-68
KPI 26: South African public sector income (% total income)	56%	56%	57%	58%
KPI 27: South African private sector income (% total income)	7%	8%	8%	8%
KPI 28: International contract income (% total income)	12%	12%	12%	11%
KPI 29: B-BBEE rating	1	1	1	1
KPI 30: Recordable incident rate	<0.4	<0.4	<0.4	<0.4
KPI 31: Audit opinion	N/A	N/A	N/A	Unqualified audit opinion

C

GOVERNANCE STRUCTURES





C1

THE CSIR BOARD AND COMMITTEES

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 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:

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

The CSIR Board has three sub-committees, namely, Research, Development and Industrialisation Committee, ARC and HRSEC. The members of these committees are as follows:

Research, Development, and Industrialisation Committee

- Prof. Arnold van Zyl (Chairperson)
- Dr Christine Render
- Prof Yunus Ballim
- Mr Mahesh Fakir
- Ms Jules Newton
- Ms Michelle Govender

Audit and Risk Management Committee

- Mr Mike Mulcahy (Chairperson)
- Mr Mahesh Fakir
- Mr Maleke Matolong
- Prof. Arnold van Zyl
- Ms Michelle Govender

HR and Remuneration Committee

- Dr Vuyo Mthethwa (Chairperson)
- Ms Jules Newton
- Prof Yunus Ballim
- Prof. Arnold van Zyl

Additional details on each Board member are provided in Table C1 below.



Table C1: Details of CSIR Board members

Age	Gender	Race	Qualifications	Years	Position(s) on other Boards
Mr Vuyani Jarana (Chairperson)					
53	Male	Black	<p>University of Stellenbosch: Masters in Business Administration Hons in Business Administration</p> <p>University of Transkei (Walter Sisulu University): Bcom Economics Business Commercial Law</p> <p>University of South Africa Advanced Executive Programme</p> <p>Olifantsfontein College Diploma in Telecommunications Institution</p>	1	<p>Non-Executive Director: ECDC Teconica Telecommunications</p> <p>Executive Director: Ilitha Telecommunications Ilitha Infrastructure Pty Ltd Jarana Investment Holdings</p> <p>Council Member: Walter Sisulu University</p> <p>Related party company (Spouse) JBV Consulting Agency</p>
Dr Thulani Dlamini (CEO)					
53	Male	Black	<p>University of the Witwatersrand: BSc Chemistry BSc (Hons) Chemistry PhD Chemistry, Catalysis</p> <p>University of South Africa: Master of Business Leadership</p>	7	<p>Council Member: National Advisory Council on Innovation</p> <p>Board Member: Industry Advisory Board of the Faculty of Engineering and Built Environment: Wits University United Nations Development Programme South Africa</p> <p>Director Stellar Ventures</p>
Prof. Arnold van Zyl					
64	Male	White	<p>University of Cape Town: PhD (Engineering) MSc (Engineering) BSc (Engineering)</p>	1	None
Prof. Yunus Ballim					
67	Male	Indian	<p>University of the Witwatersrand: PhD MSc (Eng.) BSc (Civil Eng.)</p>	1	<p>Trustee Chair: ABB Education Trust</p> <p>Trustee: Gallagher Foundation Trust</p>



Age	Gender	Race	Qualifications	Years	Position(s) on other Boards
Dr Christine Render					
66	Female	White	Leeds University (England): PhD (Chemical Engineering) BSc Hons. (Chemical Engineering)	5	Partner: Owner Team Consultation Pty (Ltd)
Dr Vuyo Mihethwa					
55	Female	Black	University of KwaZulu-Natal: Doctor of Philosophy – Student Governance Master of Social Sciences (Industrial and Labour Studies) Bachelor of Social Science (Honors) Bachelor of Social Science Stellenbosch University: Certificate Programme in Labour Dispute Resolution Practice <i>Cum Laude</i>	5	Deputy Vice-Chancellor: People and Operations Durban University of Technology
Mr Mahesh Fakir					
62	Male	South African Indian	University of London: MSc (Development Finance) University of Durban – Westville: Master of Business Administration MSc (Civil Engineering) University of Natal: Post Graduate Diploma in Civil Engineering BSc (Civil Engineering) ML Sultan Technikon: National Diploma (Electrical Engineering) Professional Registration Engineering Council of South Africa (ECSA) Registered Professional – Engineer	1	Non-Executive Director: Chairperson: South African Maritime Safety Authority (SAMSA)
Ms Jules Newton					
56	Female	White	University of the Witwatersrand: BA (Education)	1	Non-Executive Director: Inhlabathi Pty (Ltd) Trustee: Jeppe Trust Executive Director, Shareholder: Newton van Rensburg Properties



Age	Gender	Race	Qualifications	Years	Position(s) on other Boards
Mr Maleke Matolong					
45	Male	Black	<p>University of North West Master of Business Administration Bcom Accounting</p> <p>University of South Africa Short learning programme in Project Management Programme in Entrepreneur and Small Business Management</p> <p>Professional Registrations Southern African Institute of Business Accountant (SAIBA) BAP (SA) The Chartered Institute of Government Finance, Audit and Risk Officers (CIGFARO) Associate member</p>	1	<p>North West Cricket Board – Board Member</p> <p>Chairperson Finance Committee and (2) Member of Audit and Risk (3) Member of Remuneration Committee.</p> <p>Rustenburg Municipality – Audit Performance Committee (APC)</p>
Mr Mike Mulcahy					
40	Male	White	<p>University of Cape Town Graduate School of Business: MPhil (Development Finance)</p> <p>University of Cape Town Bachelor of Business Science with Honours in Economics</p>	1	<p>Non-Executive Director The International Cleantech Network</p> <p>Executive Director The GreenCape Sector Development Agency</p>
Ms Michelle Govender					
37	Female	South African Indian	<p>University of KwaZulu Natal: BSc (Electrical Engineering)</p> <p>University of South Africa: Post Graduate Diploma: Applied Risk Management</p> <p>Professional Certifications Engineering Council of South Africa Professional Engineer</p> <p>Gordon Institute of Business (GIBS) Leaders of Entrepreneurship Networks</p>	1	<p>Non-Executive Director: Circle of Global Business Women (Pro Bono)</p> <p>Executive Director Octarity Pty (Ltd) (Managing Director and Chief Executive Officer</p>



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: Ms Estee Opperman
- 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	Qualifications	Years	Position(s) on other Boards
Dr Thulani Dlamini (CEO)					
53	Male	Black	<p>University of the Witwatersrand: BSc Chemistry BSc (Hons) Chemistry PhD Chemistry, Catalysis</p> <p>University of South Africa: Master of Business Leadership</p>	10 years 3 months	<p>Council Member: National Advisory Council on Innovation</p> <p>Board Member: Industry Advisory Board of the Faculty of Engineering and Built Environment: Wits University United Nations Development Programme South Africa</p> <p>Director Stellar Ventures</p>



Age	Gender	Race	Qualifications	Years	Position(s) on other Boards
Adv. Esmé Kennedy – Group Executive: LCBE					
46	Female	White	<p>University of Pretoria: B.Proc</p> <p>Potchefstroom University: LLB LLM (Import and Export Law)</p> <p>High Court of South Africa: Admitted as an Advocate</p> <p>General Council Bar of South Africa: Admitted as a member of the Johannesburg Bar</p> <p>North-West University: Potchefstroom Business School: Master of Business Administration</p>	5 years 6 months	<p>Trustee: CSIR Pension Fund (Chairperson)</p> <p>Non-Executive Director: CSIR C3</p> <p>Professional Membership: Institute of Directors S.A.</p>
Mr Andile Mabindisa – Group Executive: Human Capital and Strategic Communications					
53	Male	Black	<p>University of Natal: Bachelor of Social Sciences University of Natal B Soc Sc (Hons) Postgraduate Diploma in IR</p>	5 years 2 months	None
Dr Motodi Maserumule – Divisional Group Executive: Advanced Production and Security					
56	Male	Black	<p>Rensselaer Polytechnic Institute (USA) PhD Mathematics</p> <p>Clark Atlanta University MSc Mathematics. Applied Math</p> <p>Morris Brown College BSc Mathematics</p> <p>IMD, Lausanne, Switzerland Mastering Technology Enterprise</p> <p>SA National Defence College Executive National Security Programme</p>	4 years 11 months	<p>Director: Akubra Trading</p> <p>Director: Mogoma Le Tihako Group</p> <p>Director: Dimo wa Bauba</p> <p>Professional Membership: Institute of Directors S.A. Society of Industrial and Applied Mathematics</p>
Ms Estee Opperman – CSIR CFO					
42	Female	White	<p>University of Pretoria BCom (Accountancy Science) Cert (Accounting Science) BCom (Hons) Accounting Sci</p> <p>Chartered Accountant: South African Institute of Chartered Accountants (SAICA)</p>	1 year 1 month	Deputy Chairperson/Trustee CSIR Pension fund



Age	Gender	Race	Qualifications	Years	Position(s) on other Boards
Dr Kaven Naidoo – Group Executive: Business Excellence and Integration					
47	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	2 years 1 month	Director The Impact Catalyst Director Students for the Exploration and Development of Space South Africa NPC; Director Enterprise K2020192513 (STEM Education)
Dr Rachel Chikwamba – Divisional Group Executive: Advanced Chemicals and Life Sciences					
56	Female	Black	University of Queensland M.Sc (Agricultural studies) Iowa State University PhD (Genetics) Gordon Institute of Business Science: Master of Business Administration	12 years 4 months	Advisory Council Member: Australian Center for International Agricultural Research (ACIAR) Non-executive Director: Wits Health Consortium (Pty) Ltd Member: Persomics AB Board Member: African Union (AU) high-level committee on Science, Technology and Innovation Strategy for Africa 2024 (STISA 2024) Director: Gauteng Provincial Government (GPG) 4th Industrial Revolution (4IR) Advisory Panel Director: Wits Health Consortium
Dr Sandile Malinga – Divisional Group Executive: Smart Society					
56	Male	Black	Rhodes University: PhD in Physics The Netherlands Business School: Master of Business Administration	1 year 6 months	Director: Innovserve Non-executive Director: South African Bureau of Standards (SABS)

D

**RISK
MANAGEMENT
PLAN**





D1

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, compliance requirements, 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.

CSIR Executive (ExCo) and the CSIR Board of Directors (BoD), acting through the Audit and Risk Committee of the Board (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 amongst employees and stakeholders about the policies and procedures that shape the CSIR's approach to risk management, CSIR has developed and implemented a risk management plan (RMP). A risk appetite and 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.1.1 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 2024/25 considers the CSIR strategic 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 ExCo, 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.1.2 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. CSIR is in the process of implementing an ERM technology platform (tool) to support the much needed automation and to complement the existing people, processes and framework.

D.1.3 SCOPE OF APPLICATION

The RMP applies to all business activities of the CSIR.

D2 COMPONENTS OF THE RMP

The CSIR manages risk through a well-defined risk-governance model, commonly referred to as 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 five lines of assurance model is outlined in Figure D.1 below.

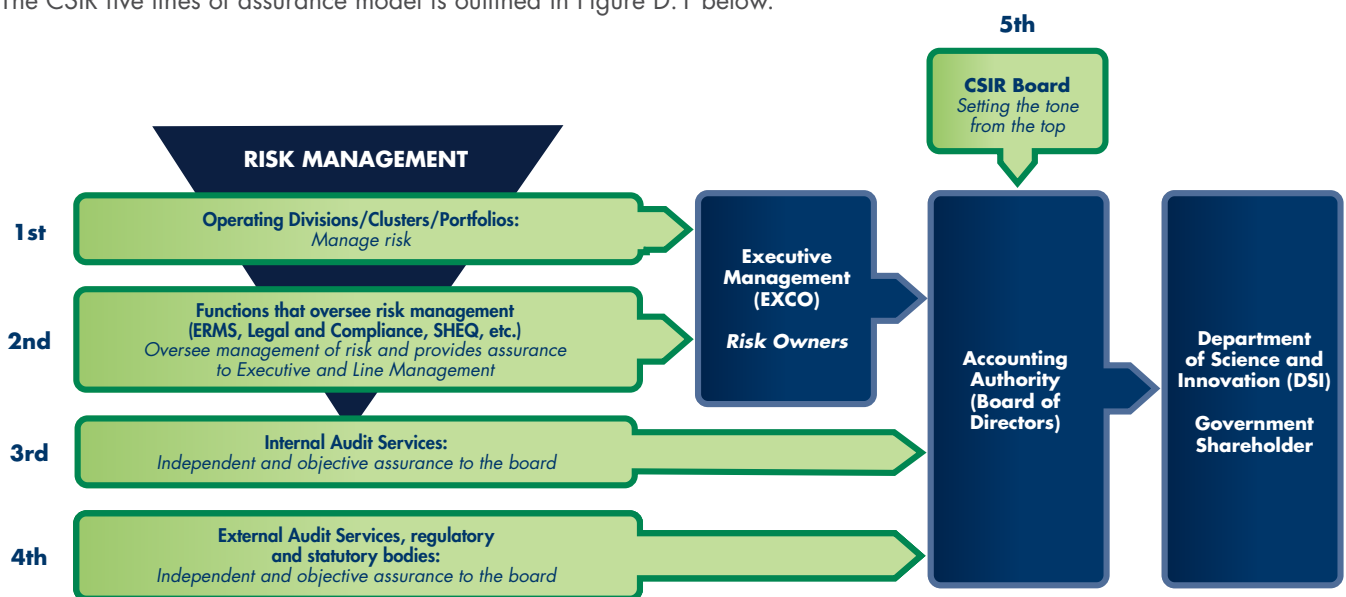


Figure D1: CSIR five lines of assurance model

Ownership and management of risk lies with those who undertake the operations within the organisation (first line assurance). Business operations are also responsible for implementing and maintaining effective internal controls, executing risk and control procedures, 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.

Functions that oversee risk management, (second line assurance) coordinate the management of risk in support of the risk owners (ExCo), who in turn report to the BoD. The latter retains ultimate accountability for risk governance. The Internal Audit function (third line assurance) provides independent assurance directly to the BoD 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 fourth (4th) line assurance providing an independent and objective assurance to the BoD and the shareholder on the CSIR financial statements (statutory audit). The Auditor General of South Africa (AGSA) is the statutory body performing this function.

Robust oversight by the BoD and Exco (fifth line assurance), establishes the cornerstone of effective risk management and set the tone from the top. To give effect to their fiduciary responsibility, the BoD is supported by the ARC. 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 risk management system i.e., policy, framework, methodology, technology system, structures, response strategies and so forth.

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 D.2 below:

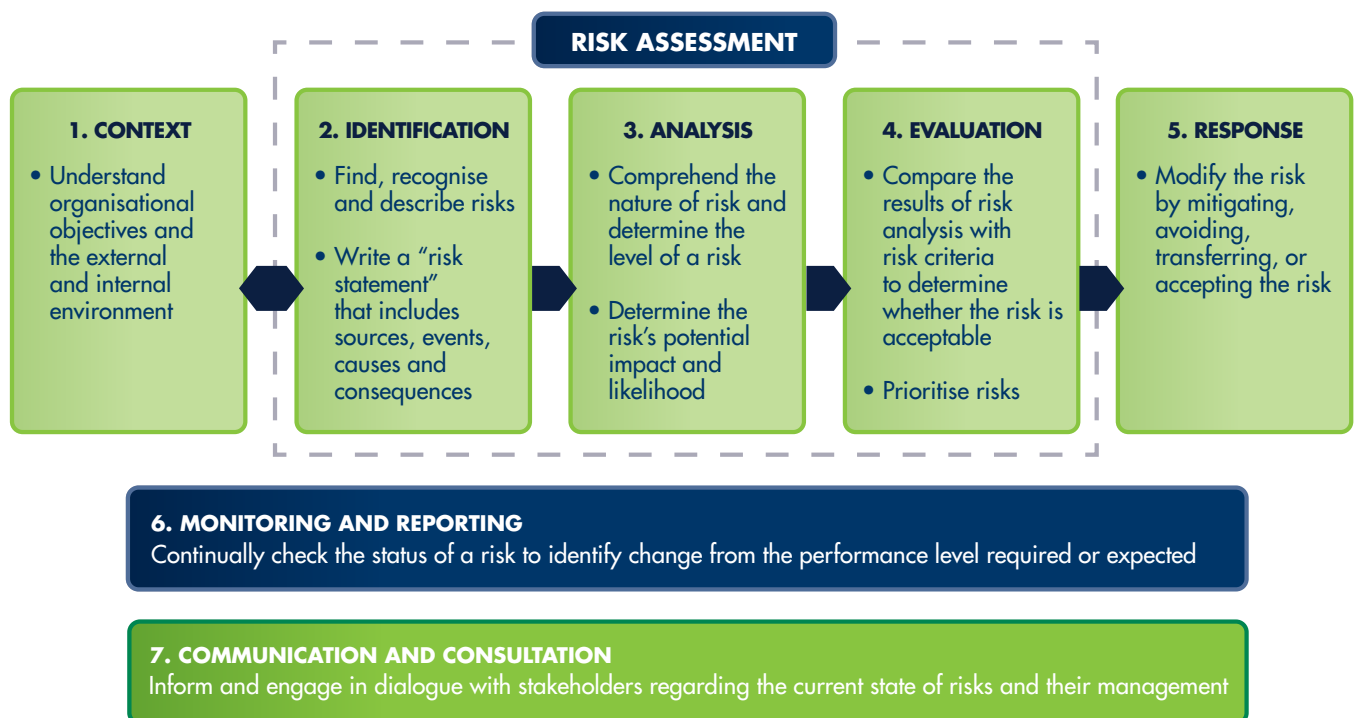


Figure D2: Risk Management Process

For clarity on the CSIR’s approach, expanded descriptions of some steps of the process are given in the following sections.

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 the diagram below:

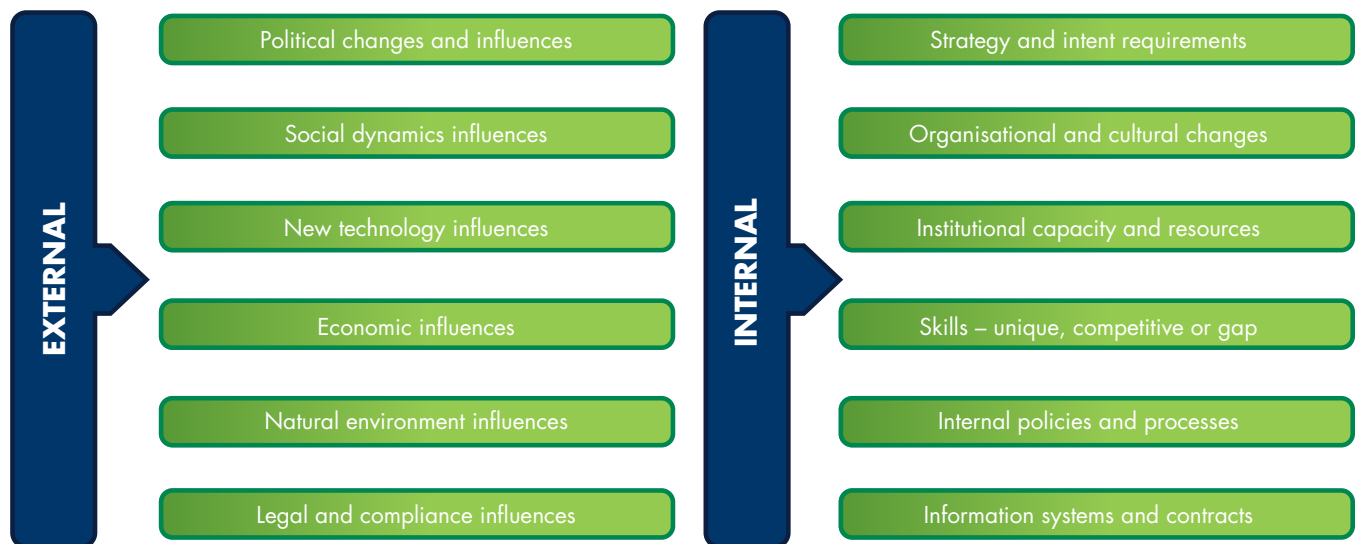


Figure D3: Risk context

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.

Risk analysis and evaluation to determine prioritisation

The outcomes of the risk identification and classification processes are compiled into multi-level and escalating risk and control/control effectiveness registers across the organisation, with major risks reported to the next level, ultimately culminating in the formulation of the CSIR’s top risks.

Risk registers are reviewed and updated on a quarterly (as well as ad-hoc) basis 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 CSIR have been classified into the following three broad categories:

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



Annexure A to this document identifies the top organisational risks that have been identified through the risk evaluation processes. Risk management is in the process of being integrated into existing management processes such as planning, budgeting and performance management and evaluation;

Risk mitigation

Risk mitigation entails implementing controls to manage the risk. These control options are:

- 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 potential benefit;
- Treat/reduce – adjusting (adding or revising) relevant activities;
- Transfer – sharing the risk by involving relevant stakeholders. This works well for financial risks, risks to assets and includes securing conventional insurance or sourcing a third party to manage or undertake the risk; and
- Terminate/Avoid – avoiding or cancelling the activities that give rise to the risk after considering the cost/benefit analysis.

Monitoring and Reporting

The CSIR's top risks are considered and updated quarterly to address risk movements and emerging risks and should be considered a living document. Furthermore, Each risk is monitored by ERMS to verify 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 internal and external environment.

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

Furthermore, the CSIR will utilise the Risk, Audit and Compliance Committee (RACC) 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 ensuring 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 BoD will receive assurance regarding the effectiveness of the RMP through the following principles:

- On a quarterly basis, the RACC will provide ExCo with progress updates against the combined assurance plan and progress against the implementation of the RMP;
- On a quarterly basis, management will provide assurance to ExCo that the RMP is integrated into the daily activities of the CSIR. The CSIR CEO, as part of his quarterly report to the BoD, will provide assurance via the ARC on the effectiveness of the risk management system;



- On a quarterly basis, the Enterprise Risk Manager will provide assurance to the BoD that the planned risk management activities are being implemented according to this RMP. This assurance shall be communicated to the BoD via the ARC; and
- 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 BoD via the ARC.
- For the BoD to discharge their duty of ensuring effective and continual monitoring of risk management takes place, risk monitoring is an integral part of the CSIR RMP, to give assurance that measures remain effective.



E

**FRAUD
PREVENTION
PLAN**



E1

INTRODUCTION

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 24 hours, 7 days basis.

The Legal and Compliance portfolio, as part of their strategic business plan, working with the CSIR's Communications function, will continue providing extensive awareness and 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 whistle blower hotline. A comprehensive process of establishing a combined assurance model with other key role-players in the business to drive an adequate and effective Governance Risk Compliance ("GRC") management capability is currently underway as part of the broader CSIR review of internal governance committees. The governance review process and some newly formed and revised committees will come into full effect during the FY 2024/25 to bring about the combined assurance model of the CSIR.

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

E.1.1 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.1.2 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.1.3 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.1.4 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 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.

E2

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.

E3

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.

E.3.2 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 online soft copy 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 will 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.

The Compliance function will continue with its responsibility for reviewing and revising the relevance and implementation of the Code, its communication and supportive education. This review and revision will also consider developments in international regulatory regime, thoughts, and generally accepted principles in ethics.

E.3.3 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 FY 2023/24 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, etc;
- 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 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 devastating 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 that it engages with. 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.

E.3.4 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 HC 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 function and HR department;
- 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; and
- 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.

E.3.5 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.



E.3.6 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.3.7 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.

E.3.8 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;
- Fidelity and employee dishonesty insurance; and
- Reporting of criminal behaviour to the relevant authorities for investigation and possible prosecution.

E.3.9 WHISTLE BLOWING AND PROTECTION OF WHISTLE BLOWERS AND THE FALSELY ACCUSED

Based on the Protected Disclosures Act, the CSIR commits itself to guarantee protection to whistle blowers 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 organisation 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 legal counsel and privacy specialist within Legal and Compliance portfolio, and by virtue of their training and work appreciate legal 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 the 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.

E4

FURTHER IMPLEMENTATION AND MAINTENANCE

E.4.1 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 stance to fraud and its expectations with regard to the ethics and integrity of all stakeholders;
- Circulating appropriate sections of the Code to other stakeholders 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.

E.4.2 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 them;
- Monitoring action taken to implement recommendations relating to incidents of fraud;
- Steering and taking responsibility for the FPP;
- Reviewing and making appropriate amendments to the FPP;
- 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.

E5

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.

Independent Assurance

The internal and external auditors will provide an independent assurance on the adequacy and effectiveness of 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.

F

**MATERIALITY/
SIGNIFICANCE
FRAMEWORK**





F1

SUMMARY

In terms of Treasury Regulations for government departments, trading entities, constitutional institutions and public entities, issued in terms of the PFMA, 1999, the CSIR must have a materiality framework of acceptable levels of materiality and significance within the organisation.

The CSIR's reputation, built over more than half a century, depends on the nature of every business transaction, conducted by every employee, on a daily basis. It is built on an implicit set of values, which inspires our employees to maintain the highest ethical standards in all their dealings with our clients and stakeholders, as well as their relationships within the CSIR.

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

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

F1.1 TREASURY REGULATION 28.1.5

"For purposes of "material" [sections 50(1), 55(2) and 66(1) of the Act] and "significant" [section 54(2) of the Act], the Accounting Authority must develop and agree on a framework of acceptable levels of materiality and significance with the relevant Executive Authority in consultation with the external auditors."

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



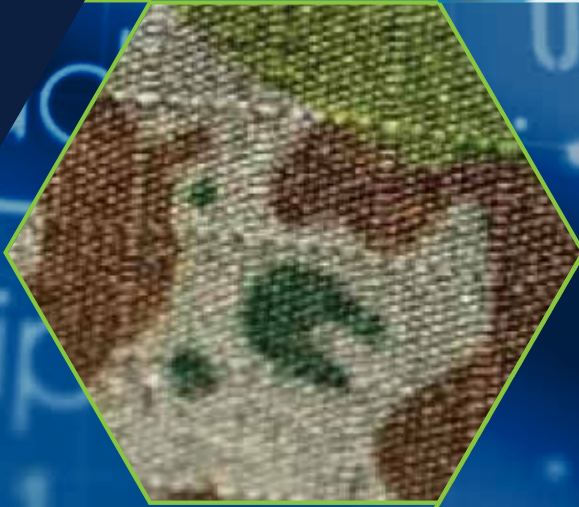
Material		
Section 50 (1)	(1) The Accounting Authority for a public entity must –	
	(a) exercise the duty of utmost care to ensure reasonable protection of the assets and records of the public entity;	Significant audit findings that could negatively impact on the CSIR’s operations and the attainment of strategic goals.
	(b) act with fidelity, honesty, integrity and in the best interest of the public entity in managing the financial affairs of the public entity;	The CSIR sets high standards on fidelity, honesty and integrity. The best interest of the public entity is always relevant in fulfilling its mandate and in the execution of the Shareholder’s Compact. Any acts of dishonesty, infidelity and others that are not in the best interests (from a research, financial and reputation perspective) of the CSIR are viewed in a serious manner.
	(c) on request, disclose to the Executive Authority responsible for that public entity or the legislature to which the public entity is accountable, all material facts, including those reasonably discoverable, which in any way influence the decision or actions of the Executive Authority or that legislature; and	The CSIR is committed to disclosing any relevant information to its stakeholders. Materiality can only be determined if the nature of the information is known.
	(d) seek within the sphere of influence of that Accounting Authority, to prevent any prejudice to the financial interests of the state.	The CSIR employs an ongoing Enterprise Risk Management System, as well as controls that are aimed at the prevention/mitigation of any prejudice to the financial interest of the entity. Lack of the required governance processes, lack of due diligence in conducting business, and fruitless and wasteful expenditure are inherently regarded as material.
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 205 255 .
	(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.



Material		
Section 55 (2)	(ii) any criminal or disciplinary steps taken as a consequence of such losses or irregular expenditure or fruitless and wasteful expenditure;	<p>R1 000 000. All cases are unique and will thus be treated as such. Issues that inform steps to be taken are:</p> <ul style="list-style-type: none"> – The level of responsibility and position of the person involved; – The affected core business/support/operational; and – The impact on other areas of operation of the CSIR. – These will be subject to internal audit reviews. – R1 000 000 (excluding losses incurred through normal operating activities) – 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 –	The CSIR complies with this requirement.
	(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).	

G

**FINANCIAL
PLAN**





G1

STATEMENTS OF COMPREHENSIVE INCOME OVER THE MTEF PERIOD

G.1.1 CSIR STATEMENTS OF COMPREHENSIVE INCOME OVER THE MTEF PERIOD

Table G1: Statement of Comprehensive Income – MTEF Period

	Forecast March 2024 R'000	Revised Budget 2024/2025 R'000	Estimate 2025/2026 R'000	Estimate 2026/2027 R'000
Statement of comprehensive income				
Total Operating Revenue	3 053 730	3 120 526	3 228 222	3 348 502
R&D Contract Income	2 338 629	2 439 268	2 524 140	2 611 306
Public – South Africa	1 619 600	1 709 552	1 750 676	1 783 926
Private – South Africa	338 675	258 229	275 843	302 214
International	269 354	357 001	381 991	404 911
Parliamentary Grant – Ringfenced	111 000	114 485	115 630	120 255
Parliamentary Grant	714 311	679 721	702 070	735 084
Royalty Income	1 684	1 916	2 012	2 112
Other Income	(894)	(379)	–	–
Total Expenditure	3 148 880	3 245 214	3 343 982	3 454 125
Employees' Remuneration	1 806 049	1 921 477	1 969 216	2 025 844
Operating Expenses	1 193 443	1 178 961	1 239 181	1 287 644
Depreciation	149 388	144 776	135 585	140 637
Profit/(Loss) before Investment Income	(95 150)	(124 688)	(115 760)	(105 623)
Net Finance Income	57 075	57 101	57 101	57 101
NET PROFIT/(LOSS)	(38 075)	(67 587)	(58 659)	(48 522)



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 2024 R'000	Revised Budget March 2025 R'000	Estimate March 2026 R'000	Estimate March 2027 R'000
ASSETS				
Non-Current assets	798 316	813 440	842 552	871 553
Property, plant, equipment and lease assets	793 666	808 790	837 902	866 903
Interest in Joint Ventures and Associates	–	–	–	–
Interest in Subsidiaries	4 650	4 650	4 650	4 650
Current Assets	1 874 674	1 790 564	1 725 903	1 668 640
Trade and other receivables	366 448	374 463	387 387	401 820
Inventory and contracts in progress	324 791	312 100	291 638	268 785
Cash and cash equivalents	1 183 435	1 104 001	1 046 879	998 035
TOTAL ASSETS	2 672 990	2 604 004	2 568 455	2 540 193
EQUITY AND LIABILITIES				
Reserves	1 240 025	1 172 438	1 113 779	1 065 257
Retained earnings	1 240 025	1 172 438	1 113 779	1 065 257
Non-current liabilities	17 246	16 852	16 511	16 217
Post retirement medical benefits and lease liabilities	17 246	16 852	16 511	16 217
Current Liabilities	1 415 719	1 414 715	1 438 164	1 458 719
Advances received	1 057 687	1 061 026	1 066 411	1 072 425
Trade and other payables	358 033	353 688	371 754	386 293
TOTAL EQUITY AND LIABILITIES	2 672 990	2 604 004	2 568 455	2 540 193

One needs to consider the budgeted current assets of R1.79 bn, cash balance of R1.10 bn in conjunction with the current liabilities of R1.41 bn. The current ratio (current assets/current liabilities) 1.27.



G.1.3 CSIR CASHFLOW STATEMENT

Table G3: CSIR Cashflow Statement

Cashflow statement	Forecast March 2024 R'000	Revised Budget March 2025 R'000	Estimate March 2026 R'000	Estimate March 2027 R'000
Cashflow from operating activities				
Cash receipts from external customers	2 294 826	2 448 821	2 539 076	2 627 852
Parliamentary Grant income	714 311	679 721	702 070	735 084
Cash paid to suppliers and employees	(3 099 767)	(3 104 783)	(3 190 331)	(3 298 949)
Cash generated from/(utilised in) operating activities	(90 631)	23 759	50 815	63 987
Net finance income	57 075	57 101	57 101	57 101
Net cash inflow/(outflow) from operating activities	(33 556)	80 860	107 916	121 088
Cashflow from investing activities				
Liquidation/(Purchase) of investments at fair value	134 487	–	–	0
Acquisition of property, plant and equipment	(148 400)	(159 900)	(164 697)	(169 638)
Net cash utilised in investing activities	(13 913)	(159 900)	(164 697)	(169 638)
Cashflow from financing activities				
Decrease in non-current liabilities	(452)	(394)	(341)	(294)
Net cash outflow from financing activities	(452)	(394)	(341)	(294)
Net increase in cash and cash equivalents	(47 921)	(79 434)	(57 123)	(48 844)
Cash and cash equivalents at beginning of the year	1 231 356	1 183 435	1 104 001	1 046 879
Cash and cash equivalents at end of the year	1 183 435	1 104 001	1 046 879	998 035



G.1.4 TWELVE MONTH CASH FLOW PROJECTION FOR PARLIAMENTARY GRANT: 2024/25 (INCLUDING VAT)

Table G4: Cash-Flow for Parliamentary Grant

R'000	Total	April	July	October	January
TOTAL 2024 MTEF ALLOCATION	1 267 606	228 974	228 974	228 974	580 686
Baseline	781 679	195 420	195 420	195 420	195 420
National Laser Centre	42 971	10 743	10 743	10 743	10 743
Laser Loan Programme	12 615	3 154	3 154	3 154	3 154
African Laser Centre	6 891	1 723	1 723	1 723	1 723
Implementation: Foundational Digital Capabilities and ICT RDI Roadmap	71 738	17 935	17 935	17 935	17 935
Infrastructure Programme	68 904				68 904
National Integrated Cyber Infrastructure System	282 808				282 808

G.1.5 PPE BUDGET SUMMARY

Table G5: PPE Budget Summary

Category	2023/24 R'000
Buildings	11 000
Equipment	103 900
ICT equipment	38 700
Furniture and fittings	4 600
Vehicles	1 700
TOTAL	159 900

The budgeted investment in property, plant and equipment for the 2024/25 financial year is R159.90 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 G6: Link between Parliamentary Grant and CSIR Strategic Objectives

PG Allocation Description	Strategic Objectives	2024/25 Indicative Allocation (excl VAT) R'000	2024/25 Indicative Allocation (incl VAT) R'000
Total Baseline Allocation		679 721	781 679
Baseline Allocation to clusters (previously Business Units)	SO1,SO2 & SO3	319 021	366 874
Portfolios and Support Functions		236 000	271 400
Leadership Team	SO5	39 700	45 655
Internal Audit	SO5	10 470	12 041
Research and Development Office	SO1,SO2 & SO3	11 390	13 099
Licensing and Ventures Office	SO1,SO2 & SO3	0	0
Planning and Reporting	SO1,SO2 & SO3	13 795	15 864
Information and Knowledge Management	SO1,SO2 & SO3	16 547	19 029
BEI Operations	SO1,SO2 & SO3	15 502	17 827
CSIR Board and sub committees	SO5	3 224	3 708
Legal Services	SO5	20 674	23 775
Compliance	SO5	5 761	6 625
Knowledge Commons	SO5	3 801	4 371
FMSS – Embedded Engineering support	SO5	3 683	4 235
Information and Communication Technology	SO5	39 824	45 798
Human Capital	SO4 & SO5	31 114	35 781
Strategic Communications and Stakeholder Relations	SO5	20 515	23 592
Capability Development Programs		104 858	120 587
Research Centres			
Research Centres	SO1,SO2 & SO3	45 000	51 750
New Capability Development Initiatives (Thematic Programme)	SO1,SO2 & SO3	23 450	26 968
RDI Infrastructure	SO1,SO2 & SO3	0	0
Human Capital Skills Development	SO4	36 408	41 869
Young Researcher Establishment Fund (YREF)	SO4	0	0
Commercialisation and Technology Transfer (Thematic)		R 50 000	R 57 500
Commercialisation Seed Fund	SO1,SO2 & SO3	0	0
Technology Demonstrator Fund	SO1,SO2 & SO3	5 000	5 750
Technology Commercialisation (APEX)	SO1,SO2 & SO3	0	0
Commercialisation Vehicle	SO1,SO2 & SO3	0	0



PG Allocation Description	Strategic Objectives	2024/25 Indicative Allocation (excl VAT) R'000	2024/25 Indicative Allocation (incl VAT) R'000
Governance Structures and CSIR Committees		3 115	3 582
CSIR Board and sub committees	SO5	2 500	2 875
Research Ethics Committee	SO5	515	592
PG Investment Committee and Industry Panel	SO5	100	115
Strategic Fund		11 727	13 486
Strategic Initiatives	SO5	11 727	13 486
Ring-Fenced Allocations		422 546	485 927
National Laser Centre	SO2 & SO3	37 366	42 971
Laser Loan Program	SO2 & SO3	10 970	12 615
African Laser Centre	SO2 & SO3	5 992	6 891
Implementation: Foundational Digital Capabilities and ICT RDI Roadmap	SO2 & SO3	62 381	71 738
National Cyber Infrastructure System (NICIS)	SO2 & SO3	245 920	282 808
Infrastructure Programme	SO2 & SO3	59 917	68 904
TOTAL		1 102 267	1 267 606



G.1.7 MEDIUM TERM EXPENDITURE FRAMEWORK ALLOCATION TO THE CSIR (EXCL VAT)

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

Category	2023/24 R'000	2024/25 R'000	2025/26 R'000	2026/27 R'000
Baseline Parliamentary Grant	821 454	781 679	807 381	845 374
Parliamentary Grant	821 454	781 679	807 381	845 374
Ring fenced allocation	444 168	485 927	519 315	553 433
Laser Loan Programme	12 073	12 615	13 180	13 784
National Laser Centre	41 124	42 971	44 896	46 953
African Laser Centre	6 595	6 891	7 200	7 530
WEF Affiliate Centre	5 956	–	–	–
Implementation: Foundational Digital Capabilities and ICT RDI Roadmap	84 232	71 738	75 960	72 971
Infrastructure Programme	–	68 904	72 966	76 309
National Integrated Cyber Infrastructure System (NICIS)	294 188	282 808	305 113	335 886
TOTAL	1 265 622	1 267 606	1 326 696	1 398 807

G2

5-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 March 2025	600
31 March 2026	700
31 March 2027	700
31 March 2028	700
31 March 2029	700

The CSIR current approval to issue guarantee instruments will expire at the end of March 2024 and the CSIR Board recently approved limits to issue guarantee instruments for the 5-year period to end March 2029. These limits are pending concurrence by the Minister of Higher Education Science and Technology and subsequent approval by the Minister of Finance.

H

CSIR TOP RISK REGISTER



H1 CSIR TOP RISK PROFILE

H.1.1 RISK HEAT MAP

The risk heat map depicts the current top/key organisational risks recently reviewed by the executive management after considering the macro-economic, strategic, and operational context and prevailing/current risk control strategies. The update covers quarterly review conducted by ERMS and bi-annual review Executive Management.

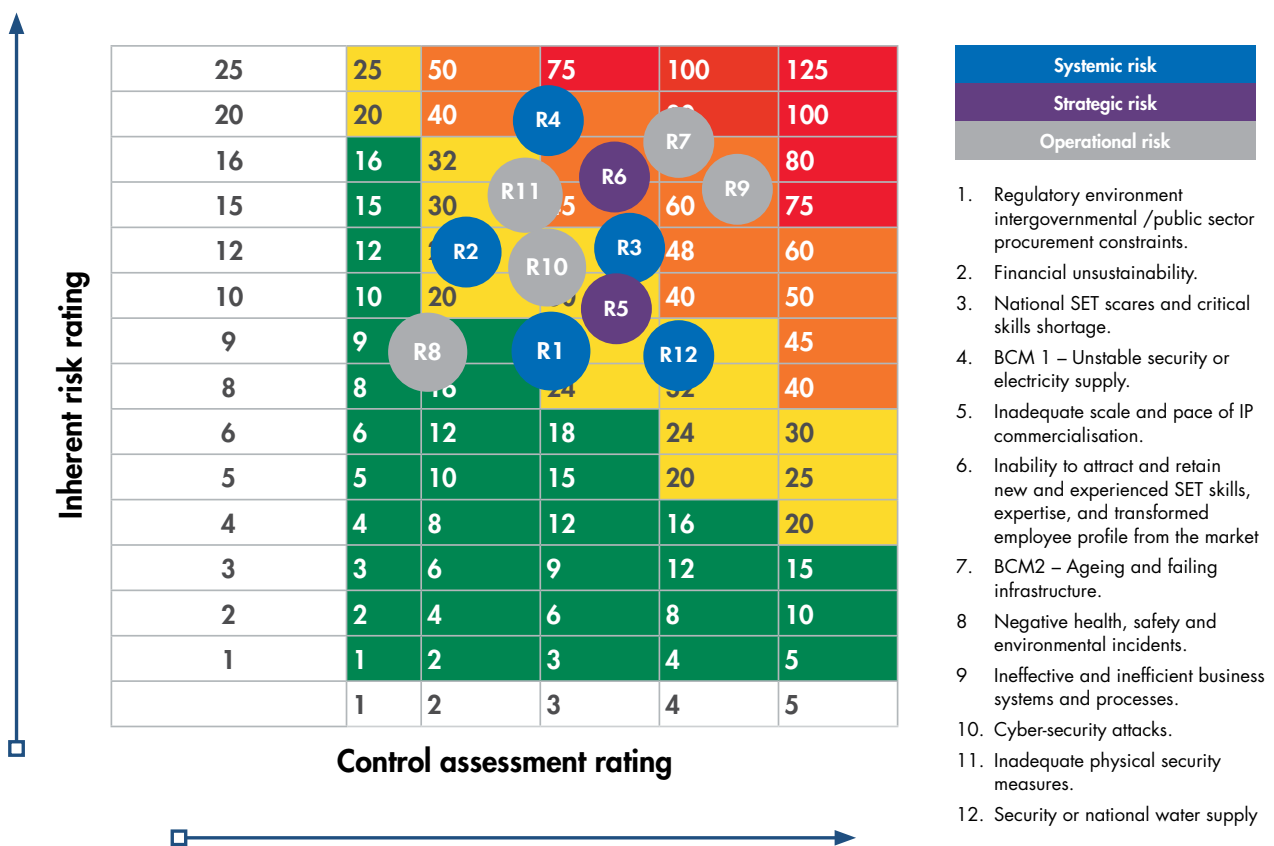


Figure H1: CSIR Risk Heat Map

The following Risk Classification Matrix informs the colour coding against the above Risk Heat Map.

Description	Rating
Low	1 to 18
Medium	20 to 36
High	40 to 64
Critical	75 to 125



Table H1: Mitigation strategies for each of the risks identified

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

Inadequate and ineffective implementation of public sector procurement requirements by Government Departments, Constitutional Institutions and Public Entities restricting the CSIRs ability to deliver on its mandate to act in the national interest.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	High	Medium

Risk rating rational:

The risk moved from high to medium due to the approval and implementation of NT note three that empowers accounting authorities and/or executives in Government, Constitutional and Public Entities to contract with other entities based on a fair and transparent sole and/or single source supplier deviation process.

CSIR engagement with DG: DSI was used to initiate the plan to engage NT on exemption request with some public sector entities.

The risk associated with the bottleneck on NT approval of deviation(s) is mitigated as entities are authorised to approve transactions/contracts.

Key mitigation initiatives:

- Continued engagement (change management) with NT and clients/partners to create awareness of the CSIRs unique value proposition and the mandated role of national R&D capabilities in enabling a capable state.
- SPU/CFO to prioritise NT note three interpretation and develop an internal framework/process at an organisational level as a guidance.
- Complete market analysis to support motivation for CSIR to be considered sole and/or single source for certain strategic contracts e.g., TSO.

Risk appetite and tolerance level:

The risk is within appetite and can be tolerated as the introduction of note three mitigated the key bottleneck of deviation approval process by NT prior to contracting.

Client change management by the CSIR is crucial to manage the risk to a low level and establish controls to ensure NT procurement compliance and manage potential audit concerns.



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.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	High	Medium

Risk rating rational:

The risk is considered medium in the context of recent financial performance but remains relevant due to market uncertainties.

CSIR achieved R23m shortfall on the annual operating revenue but achieved 91% of the KPIs.

Private and international income streams increased by 14% and 21% respectively for 2022/23 FY. Deemed significant achievement in the context of current global and local economic conditions.

CSIR maintained a level 1 BBBEE status.

Debt management plan improving and collection from clients positive.

Key mitigation initiatives:

- Cash preservation and optimised investment to increase investment returns.
- All clusters have income diversification strategies (public, private, and international income).
- Develop the capacity of the CSIR to do an analysis of public sector entity RD&I needs (BD&C function established).
- Assisting in strengthening the capability of the state to rectify the grey-listing gaps e.g., SIU MoU, working with financial institutions, assisting the national security cluster, enhancing the efficiency of the state through e-services.

Risk appetite and tolerance level:

Risk is within appetite and tolerance level and supported by the organisation’s financial performance in 2022/23 FY as well as Q1 2023/24 in the current global economic conditions.



3. SYSTEMIC RISK: National scarcity of critical SET skills and expertise.

National scarcity of critical SET skills impacting CSIR required capability. The CSIR skills and capability requirements in many instances exceeds prevailing minimum standards and impacts the business priorities and objectives.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	Medium	Medium

Risk rating rational:

The risk remains medium, and the profile is at different levels in the business areas depending on critical skills requirements e.g. process engineering, data modelling, ICT and so forth.

HC has initiated and implemented specific and targeted strategic interventions to address skills deficit, including attraction and retention.

The departments of Basic and Higher Education, Science and Innovation are implementing strategic interventions to address the shortage of STEM (Science, Technology, Engineering and Mathematics) skills and expertise at the national level.

Key mitigation initiatives:

- CSIR identified specific areas of skills needs/requirements to facilitate focused training and development.
- Perform an internal assessment to identify areas of weaknesses (skills deficiencies) to design a targeted strategy e.g., women in science.
- Contribute to the national retention drive by reducing critical skills attrition within the CSIR.

Risk appetite and tolerance level:

The risk is within appetite and tolerance level as the organisation is able to deliver on the strategic objectives and goals in the midst of the market mismatch (demand vs supply) of critical.



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

Decreasing load shedding by Eskom with some level of stability on the risk of loss of electrical supply to the CSIR and increase in diesel costs.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
Critical	Critical	High

Risk rating rational:

The risk moved from critical to high due to the decreasing load shedding levels and the threat to consistent electricity supply forecast for the winter season. However, the risk can still escalate to critical in the future.

Generators have been installed at the CSIR sites to manage business interruptions.

Ongoing consultation with clusters and portfolios to determine BCP to key business areas, systems, infrastructure, people, and processes.

Key mitigation initiatives:

- Incident Response Team (IRT) has defined a Business Continuity Plan/strategies for different risk scenarios faced by the CSIR in the short-term.
- Loadshedding BCM scenarios cover the following:
 - Current state of fluctuating loadshedding.
 - High levels of loadshedding.
 - National blackout (partial and complete).
- Current risk-response strategy is shifting focus to long-term investment strategies aligned to increased energy efficiency and associated savings (ROI) and reduction of carbon footprint.

Risk appetite and tolerance level:

Risk outside of appetite and tolerance due to daily loadshedding schedules and associated operational costs.



5. SYSTEMIC RISK: Inadequate pace and scale of CSIR IP Commercialisation.

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

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	Medium	Medium

Risk rating rational:

There is a slight risk movement to medium based on state of general robust controls to ensure IP commercialisation and the risk will move to low with the implementation of the commercialisation vehicle at strategic level.

The Commercialization Vehicle (CV) was launched by the Board and Shareholder Minister on the 25 October 2023.

The CV slogan of 'C' cube (Create, Collaborate and Commercialise) is aimed at creating industry impact through the commercialisation of CSIR IP and capabilities.

Key mitigation initiatives:

- Establishment of CSIR commercialisation vehicle.
- Development of framework/paper on BD&C terms of reference (roles and responsibilities).
- Establishment of Industry Advisory Panels to improve market alignment of R&D investments.
- Rollout of the Stage Gate Methodology will ensure consistent and effective management of investment in capabilities and technologies.
- Focus on commercialisation initiatives that fund high potential technologies seeking to enhance maturity for the market.

Risk appetite and tolerance level:

The current level of IP commercialisation is acceptable and within tolerance level, it can however be improved with planned/future mitigation strategy to improve the overall state of IP of commercialisation.



6. SYSTEMIC RISK: Inability to attract and retain new and experienced SET skills, expertise and transformed employee profile from the market.

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.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	High	High

Risk rating rationale:

2022/23 FY results indicate that the organisation has made progress and improving in achieving targets on strategic objective 4(SO4).

Important highlight is the growth on the number of chief and principal researchers, particularly the appointment of three (3) African chief researchers resulting in an improved transformation profile.

Various initiatives are ongoing to address employees’ career aspiration and provide career development opportunities (bursaries for staff, Leadership Management Development Program, Executive development programme, Mentoring and coaching programme.

Key mitigation initiatives:

- Implementation of capability development programs, which seek to address pipeline developmental gaps by assisting transition to the next level for SET employees e.g. Young Researchers Establishment Fund (YREF). Accelerated Principal and Chief Researcher Development Programme (APRDP).
- Establish succession planning (development) for high performing researchers to align investment in capability programme.
- Career ladder promotions to ensure skills retention.
- Implementation of career paths for support staff.
- Implementation of climate survey action plans.

Risk appetite and tolerance level:

Current mitigation strategies deemed unacceptable due to lack of a significant movement on the overall controls. Some areas of the business are losing highly skilled individuals and struggle to replace/recruit and therefore negatively affecting the ability to deliver on contracts.



7. SYSTEMIC RISK: Business Continuity Risk 2 – Ageing and failing infrastructure.

Ageing infrastructure prone to failures and downtime exacerbated by increased and costly maintenance.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	High	High

Risk rating rational:

The risk remains high due to insignificant movement in the implementation of key controls based on CAPEX requirements in the following areas:

- Physical accommodation infrastructure
- Utility infrastructure
- ICT infrastructure
- R&D infrastructure

Focus on the identification of different classes of infrastructure and to align to the outputs of the building condition assessment and ICT roadmap.

Key mitigation initiatives:

- Implement planned preventative maintenance and attend to unplanned breakdowns as they occur.
- Resolve findings from the building condition assessment based on the prioritisation of high-risk items.
- 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.
- Develop and implement an infrastructure investment framework and roadmap plan for all infrastructure investment requirements.

Risk appetite and tolerance level:

Risk is unacceptable but can be tolerance due to the general state of infrastructure and current maintenance plans are deemed effective. The organisation has not experienced material operational disruptions due to infrastructure failures.



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

Negative health, safety and environmental incidents and accidents.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	Low	Low

Risk rating rational:

Residual risk remains low due to current state of good state of SHE controls, but risk is inherently high as potential SHE incidents can change the risk profile.

CSIR has achieved its annual SHE KPI target for 2022/23 FY. The organisational culture on SHE has improved, all employees are vigilant and aware of the need for a safe and healthy working environment.

The organisation completed 2023/24 FY (365 days) with no recordable incident(s). Several programmes are being implemented by the SHEQ department to improve the culture of awareness on SHE.

Key mitigation initiatives:

- SHE training and awareness campaigns.
- Internal and external annual SHEQ audits.
- Implement elements of Behavioural Based Safety (BBS) i.e., NeuroSafety training towards fully developed BBS programme.
- Implement a SHEQ recognition and reward programme.
- Review environmental monitoring and reporting mechanisms.

Risk appetite and tolerance level:

Risk within appetite and tolerance as per the Zero-Harm strategy of the organisation and compliance to SHE regulatory and legislative requirements – based on current policy position.



9. SYSTEMIC RISK: Business processes and systems.

Inadequate enhancement of business systems and processes.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	High	High

Risk rating rational:

The risk has not moved in the current financial year and has remained consistently high.

Priority is focused on the practical implementation of priority systems, process and to eliminate current constraints.

ICT migrated from Micro-Focus suite of products to Microsoft, where a lot of information is stored on the cloud to reduce constraints on infrastructure capacity and therefore requiring less investment in infrastructure. This allows for repurposing of infrastructure to service additional organisational needs.

Key mitigation initiatives:

- OPCO focused on the review of key organisational processes to drive operational efficiency and agility. Following processes are being reviewed.
- Cross portfolio operational issues.
- Business excellence and integration (reporting).
- Finance, procurement, and ICT.
- Commercialisation policy.
- Human Capital and communications.
- Development of a structured business systems investment plan to upgrade and address priority business requirements.
- Replacement of Enterprise Server Hardware and Storage equipment.
- Implement network refresh project.

Risk appetite and tolerance level:

Risk acceptable and can be improved with the planned interventions. The organisation has not experienced significant operational interruptions due to internal process and/or system failures.



10. SYSTEMIC RISK: Cyber attacks.

Low levels of information security controls to mitigate/meet the threats that are becoming more prevalent.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	High	Medium

Risk rating rational:

The risk is inherently high due to general state of cyber-attacks/threats that can materialise at any point, but the risk is internally under control due to slight improvement in information security controls supported by recent minor cyber security incidents and improved awareness.

Information security office in collaboration with ICT management team has implemented several information security controls to mitigate different cyber threats.

An information security roadmap/strategy is defined as part of the overall ICT strategy/roadmap.

Key mitigation initiatives:

- Continuous cybersecurity awareness and training.
- Intrusion prevention and detection solutions implemented and periodically assessed.
- Regular patch management.
- Periodic penetration testing and audit of ICT infrastructure.
- Logical access control management.
- Malware protection service (Sophos) is fully functional and receives updates directly from the internet.

Risk appetite and tolerance level:

Risk outside appetite and tolerance level as the organisation has a zero-risk appetite for information security breaches and incidents with the potential for unauthorised access to sensitive and confidential data/information, including exposure of private and personal information (POPIA) – based on current policy position.



11. SYSTEMIC RISK: Inadequate security measures.

Breach in CSIR security measures resulting in loss of assets, classified information, malicious damage to physical property and endangerment to staff, tenants, contractors and visitors.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	High	High

Risk rating rational:

The risk is considered high due to internal controls failure that resulted in recent theft incidents at Scientia and Cottesloe site.

The following interventions were implemented to improve the security of CSIR crucial CSIR sites:

Deployment of patrol vehicle with armed response at Paardefontein.

Installed CCTV monitoring systems with artificial intelligence and video analytics capabilities covering the perimeter fence at Paardefontein, Rosebank and Durban.

Implemented CCTV systems with automatic number plate recognition.

Key mitigation initiatives:

- Procurement process to appoint a new service provider for guarding services.
- Upgrade of the priority security infrastructure.
- Develop a Security Capability Master Plan/strategy and road map that addresses the security threat and risks identified at all CSIR campuses.
- Strategy includes the development of security capability architecture, security operational concept, and integration of security systems into existing CSIR support systems.

Risk appetite and tolerance level:

Risk outside appetite and tolerance level as the CSIR has zero appetite to security incidents that could result if loss and/or damage to the property or injury/risk to people safety and security – based on current policy position.



12. SYSTEMIC RISK: Inadequate security of national water supply.

CSIR sites are exposed to the risk of inadequate quality water supply that has a potential to negatively impact the operations and expose staff to unhealthy facilities.

Inherent risk rating	Previous residual risk rating	Current residual risk rating
High	Medium	Medium

Risk rating rational:

Emerging risk to the CSIR due to the sporadic incidents of water shutdown and infrastructure failure in some parts of the country. Risk was identified in the previous quarter and being monitored. CSIR Pretoria has back-up capacity of 4 days average due to existing water reservoirs in use. Pretoria can withstand intermittent interruptions, but not long-term water supply interruption. High-volume requirements of medium speed wind tunnel mitigated through use of borehole water for cooling. Regional sites have no back-up capacity.

Key mitigation initiatives:

- Installation of water tanks/reservoir capacity at the CSIR regional sites.
- Upgrades to segments of the main water reticulation network.
- Maintenance and opening of the existing and new boreholes – four boreholes in Pretoria activated and operational.
- Current water use resiliency strategy and plan under development for all CSIR sites.

Risk appetite and tolerance level:

Risk is unacceptable due to escalating incidents of water shutdown and interruption. CSIR regional sites are not ready to cope with escalating water shortage trends. Pretoria site can only withstand intermittent interruptions. Water quality increasing risk impacting cost of potable water supply.

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