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EXPERIENCES IN GROWING BIOECONOMIES

SHARING INFRASTRUCTURE, EXPERIENCES AND LESSONS LEARNED

G20 INITIATIVE ON THE BIOECONOMY

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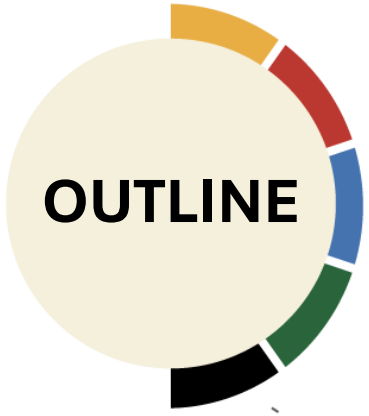
OUTLINE



- About the global bioeconomy
- South African Context
- CSIR model and insights to date
- CSIR approach to bridging the chasm
- CSIR HUB and call to action
- Knowledge Exchange hubs and call to action
- Concluding remarks

The global bioeconomy

The Opportunity

The global bioeconomy is currently valued at approximately US$4 trillion, with projections suggesting it could grow to US$30 trillion by 2050.

The hurdles

Uneven growth of he bioeconomy due to:

- A lack of translational research infrastructure;
- Scarcity of specialised skills; and
- High costs associated with scaling up technologies

The call to action

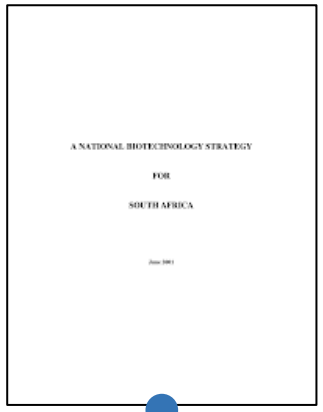
Regional and global collaboration with the G20 partners to share resources, experiences, lessons learned.

An Emerging Bioeconomy: South Africa’s Path

8.3%

Bioeconomy share of South Africa's GDP. South Africa is one of the continent’s countries with a strongly emerging, defined bioeconomy driven by deliberate policies and strategies

The White Paper on Science and Technology (1996)



The National Biotechnology Strategy (2001)

Products and services to address needs in the health, industrial and agricultural sectors of the economy.

The Ten-Year Innovation Plan (2008)

Drive a knowledge-based economy, The “Farmer to Pharma” as one of 5 Grand Challenges

This Bio-economy Strategy (2013)

Amalgamating experience, expertise and competitive advantages to create a world-class biotechnological system of innovation.

The Science, Technology and Innovation Decadal Plan (2022-2032)

Shift of focus from building the NSI, to deriving maximum impact from the NSI to help address SA's challenges

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The CSIR: Mandate

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

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

CSIR
Touching lives through innovation

The CSIR is Africa's largest multi-disciplinary research and technological organization mandated with directed research, technological innovation to drive industrial development and social impact

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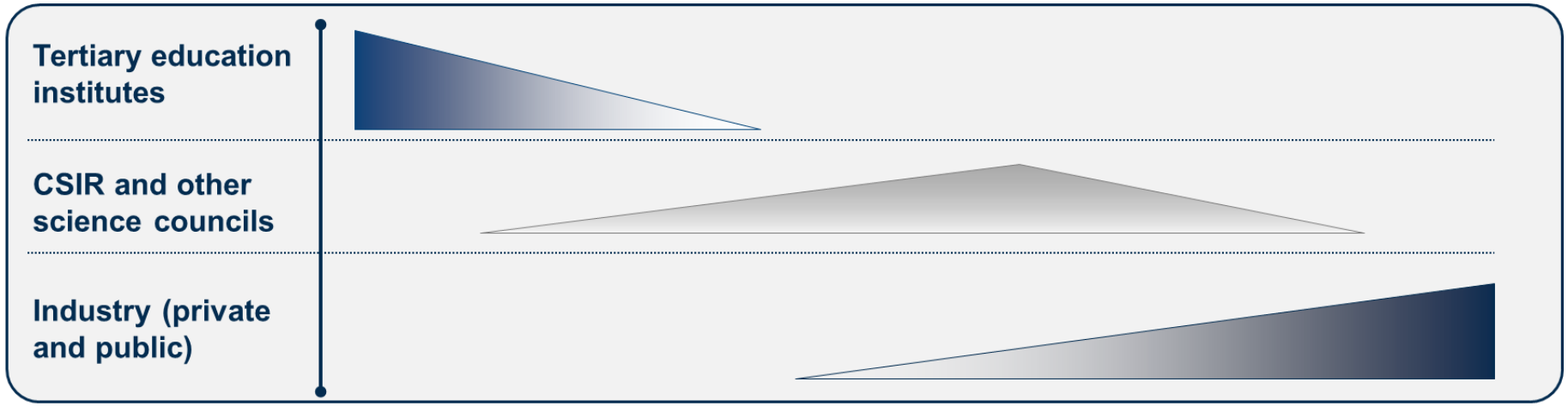
The CSIR Role in the System of Innovation



Innovation value chain

FUNDAMENTAL RESEARCH	STRATEGIC BASIC & APPLIED RESEARCH	TECHNOLOGY DEVELOPMENT	TECHNOLOGY TRANSFER & IMPLEMENTATION
understanding fundamental principles, blue sky research	generation of new knowledge and application of existing knowledge	development of technology (process, product, service)	Application of technology to impact industry, economy and society

Positioning to Support the Bioeconomy
Strategic Investment in Innovation Infrastructure

Private sector contribute equipment (OEMs) pays for utilisation, training; CSIR create new industry players on installed capabilities

Catalytic funding from philanthropic organisations and other partners

Additional investment from National Treasury on business case/strategy

Parliamentary grants to the CSIR for capability development put in Foundational capabilities

A model to repeat

CSIR NICHE:
Unique Infrastructure as a Translational Bridge

The GAP: the ability to enable scale up production to enable local development and localization

Strong infrastructure is required along the value chain, from sound research infrastructure in basic research, analytics through scaling up and production of clinical grade batches

Infrastructure
From bench to pilot scale

+

People
Skill and knowhow (more than one of each specialty)

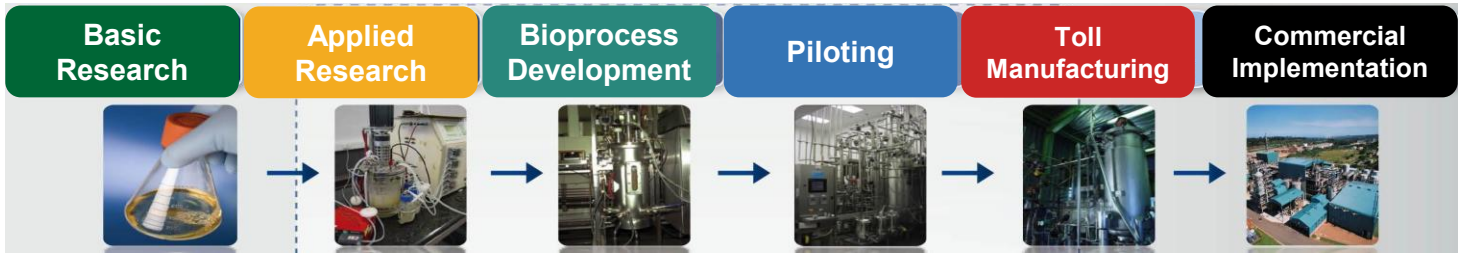
Translation requires skills beyond just the science and engineering, to include techno-economics, regulatory etc.

Translational capabilities

Products that undergo clinical development, and proceed to full scale manufacture

End-to-end Capabilities that are Used to Support SMMEs: Biomanufacturing

Biomanufacturing Industry Development Centre (BIDC)



"Fermentation Concept to Commercial Reality"

Integrate the capabilities into your overall business for long term sustainability

Private sector training and R&D

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BIDC, catalytic projects

BILL & MELINDA GATES foundation

Work Force Development Program

kfw BANKENGRUPPE

german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz

Perform CSIR R&D
De-risked R&D investment to SMMEs
Garnered international funding

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Growing the

BIOMANUFACTURING SECTOR

BIOMANUFACTURING INDUSTRY DEVELOPMENT CENTER

- Facilitates the translation of R&D to market ready products and technologies
- Makes skills and infrastructure available to industry and SMEs
- Workforce development in bioprocess and product development skills
- Partners have been the DSTI and the Jobs Fund

41
ENTERPISES CONTRACTED SINCE INCEPTION

126
PRODUCTS DEVELOPED FOR SMEs

>200
INTERNS SUPPORTED AND EQUIPPED WITH VOCATIONAL SKILLS

32
LICENCES SIGNED

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THE JOBS FUND
South Africa Siyasebenza

End-to-end Capabilities that are Used to Support SMMEs: FuturePharma Facility

End-to-end Capabilities that are Used to Support SMMEs: The Biorefinery Facility

Waste streams

Forestry waste - Hardwood and Softwood
- Sawdust
- Wood chips
- Wood shavings
- Sludge
- Alien invasive plants


Food/agricultural waste
- Farmers markets
- Hotels
- Farms
- Hemp


Other Organic waste
- Corn steep liquor
- Chicken feathers
- Molasses
- Fruit pomace


Spent Liquor
- Volatile organic compounds
- Effluent
- Sludge
- Lignin
- Hemicelluloses

Processing techniques

- RDH digestion
- Pyrolysis
- Chemical and mechanical fractionation
- Solvent extraction

- Biogas production via co-digestion
- Chemical and mechanical fractionation
- Solvent extraction

- Acid hydrolysis
- Solvent extraction
- Fermentation

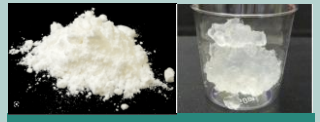
- Chemical and mechanical fractionation
- Solvent extraction
- Acid hydrolysis

Products

Composite board, Wood Plastic Composites, Engineered Transparent wood

Biochar, Activated Carbon

Bio oil, wood vinegar



Cellulose Nano Crystals, Microcrystalline Cellulose

Pellets

Biogas/ Biodigestate/Community garden

Hemp pulp

Tissue

Corrugated board

Paper

Glucose to Single cell protein (SCP) – Fish feed

Chicken feathers to keratin

Grape Pomace to biostimulants

Speciality chemicals:

Xylose to Xylitol

Lignin as Dust suppressant, Asphalt application

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Biorefinery Technologies in the Circular Economy

BIOREFINERY INDUSTRY DEVELOPMENT FACILITY

- Support SMEs/industry in the development and scale-up of biorefinery products and processes
- Bridge the gap between research and commercial implementation
- Makes skills and infrastructure available to industry and SMEs
- Advance integrated biological and chemical conversion technologies that transform waste biomass feedstocks into high-value chemicals and materials,
- Contribute to the replacement of fossil-based feedstocks and promoting a circular bioeconomy
- Partners are the DSTI and TIA

- **25 SMEs supported in technology development and technology advisory**
- **>10 Industries supported in technology advisory**
- **2 License agreements**
- **>50 interns and postgraduate students supported**

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Leveraging SA/CSIR Infrastructure and Experience to Foster Regional and G20 Collaboration

1. **The CSIR as a Practical Knowledge Transfer Hub:** The CSIR Bioprocessing, Biorefinery, Indigenous Knowledge Valorization Facilities for Advancing Bioeconomy in Africa

2. **Knowledge Exchange Dialogues:** The CSIR as an initial convener

The CSIR as a Practical Knowledge Transfer Hub (Proposal 1)

CHALLENGE ADDRESSED

The bioeconomy developing unevenly due to lack of strategic capabilities

- Lack of capabilities for bioprocessing, biorefinery and valorization of indigenous knowledge locally
  - Infrastructure challenges to support scale up
  - Skills shortage: lack of product and process development skills
- Challenges in integration into local and global supply chains due to
  - including financial, technical, regulatory and operational challenges
- Low Investment into R&D
  - Single product development from R&D, scale up through commercialization can run into billions of rands

THE OPPORTUNITY

Centers of excellence in countries that are doing well can be leveraged to support regional bioeconomy development by supporting regional SMMEs

- Validating technologies at lab scale;
- Demonstrating and prototyping innovations; and
- Supporting pilot manufacturing.
- Drive valorisation Indigenous Knowledge Systems (IKS), ensuring inclusive and culturally relevant innovation.

The CSIR as a Practical Knowledge Transfer Hub

PROPOSAL

The CSIR (and Parties in South Africa's Innovation System) will avail itself **as a hub to support African small businesses** in **developing and commercialising bioinnovations** across sectors such as:

- Agroprocessing and IKS valorisation;
- Biomanufacturing and biopharmaceuticals;
- Greening industrial processes via biocatalysis;
- Biomass conversion through biorefineries; and
- Circularisation of agricultural value chains.

EXPECTED OUTCOME

18-22 African small businesses in developing competitive bio-based technologies will receive the following support

- Technology development and hands-on transfer;
- Technical support for product and process development;
- Practical biomanufacturing experience; and
- Technology packages to build investment-ready business cases;
- Business and entrepreneurial development training;
- Establishment grants for market testing and scoping manufacturing needs in their home countries.

Addressing the gaps: Open Access Approach to Support Multiple Players, Building the Regional Ecosystem

Strategic Intent

Development and scale-up of diagnostic manufacturing technologies, as well as training of relevant workforce to create a sustainable medical device industry in (South) Africa

Networking

- Connecting with service providers
- Linkage state assistance e.g. SEDA, SABS, DSDB

Access to trained staff/workforce development

- Workforce training
- Intern programme

Technical support

- Product and process development in the context of ISO13485 , packaging, scale-up/piloting, technology validation, techno economics/costing
- Licensing of technologies

Regulatory support

- Device and regulatory support/training
- Quality management systems
- Guidance for data packs/products Masterfile
- SAHPRA process guidance

Access to funding

- Pitching events
- Introductions to funders
- Raising awareness of different instruments

Access to manufacturing

- Contract manufacturing
- B2B other contract manufacturers and service providers

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The CSIR as a Practical Knowledge Transfer Hub

OUTPUTS

- Fifteen to twenty-five products and technologies developed and transferred; and
- Sixteen technology demonstrators and licenses issued to small businesses

OUTCOMES

- Eighteen to twenty-two African small businesses supported to commercialise innovations; and
- Eight to ten localised technologies adapted for regional contexts

KNOWLEDGE TRANSFER

- The initiative will foster cross-border knowledge exchange, collaboration on shared priorities, and alignment with bioeconomy standards.

CSIR as a Practical Knowledge Transfer Hub

THE ASK

€10 million to implement a three-year programme

- 18-22 African small businesses in developing competitive bio-based technologies
- ~ €5 million for training and capacity building; and
- ~ €150 000 per business for post-training

THE CALL TO ACTION

- We invite G20 members and strategic partners to support this initiative and contribute to resource mobilisation efforts.
- By investing in the CSIR's role as a regional knowledge transfer hub, stakeholders will help;
  - unlock the potential of Africa's bioeconomy,
  - foster inclusive innovation and
  - advance the G20 Bioeconomy High-Level Principles.

Knowledge Exchange Dialogues: (Proposal 2)

THE CHALLENGE

Despite its promise, the bioeconomy developing unevenly due to a knowledge gap

- **In-region disparity:** The bioeconomy has evolved unevenly within and across regions.
- **North-South differences:** Countries in the Global South continue to face barriers in harnessing their natural resource endowments, while bioeconomy sectors in the Global North flourish due to rapid technological advancement and significant financial investments.
- **Deepening Global inequality:** This disparity risks deepening global inequalities.

THE OPPORTUNITY

The G20 Platform provides an opportunity for robust knowledge exchange and cooperation

- Share technologies already deployed in the Global North could offer valuable lessons and solutions for the Global South.
- G20 bioeconomy counterparts to exchange knowledge, share implementation experiences

Knowledge Exchange Dialogues

- That each G20 presidency, through its Bioeconomy workstream, identifies a technology application relevant to bioeconomy development and convene a scientific and technical dialogue to explore its deployment.
- A suitable institution/research and technology organisation in the host country would lead the convening.
- That South Africa's Council for Scientific and Industrial Research (CSIR) as the initial convener.

Knowledge Exchange Dialogues

POSSIBLE DIALOGUE TOPICS

Topics for discussion at each annual meeting should be selected by the convening institution and must be relevant to the G20 partnership and could focus on;

- Thematic technology areas that could grow the bioeconomy, e.g. agroprocessing, biomanufacturing and Indigenous Knowledge Systems valorisation.
- Technologies that are relevant to sustainable use of biodiversity, or reducing impacts to biodiversity
- Enabling and converging technologies that could prime the bioeconomy,
- Developing ecosystems that support a thriving bioeconomy, e.g. strategy development, regulatory agility, blended finance models, bio-entrepreneurship, incubation and acceleration, business plan writing, network development, etc.

CSIR PROPOSED TOPIC

The CSIR would like to convene a discussion on advanced manufacturing, including biocatalysis and biomanufacturing, including

- Models we have used to fund infrastructure development,
- The model of access by SMMEs and Entrepreneurs
- Work we have done to support start-ups and SMMEs,
- Efforts in workforce development, as well as what is required to support a biomanufacturing industry.

Knowledge Exchange Dialogues

FORMAT OF CONVENINGS

Convenings may adopt a hybrid format, allowing both in-person and virtual participation.

- In-person attendees will have the opportunity to:
- Tour CSIR facilities;
- Engage directly with scientists and SMMEs; and
- Experience practical demonstrations of technologies.

The CSIR will host and provide venue, facilities and meals. Travel and accommodation costs will be borne by participants.

THE EXPECTED OUTCOMES

Convenings should aim to:

- Facilitate experience exchange and peer learning;
- Share successful models and lessons learned;
- Produce actionable outputs, including:
  - **Policy briefs** with problem framing, technology insights, application and scaling in the private sector, and recommendations;
  - **Communities of practice** for ongoing collaboration; and
  - **Joint programs** to support bioeconomy growth in lagging regions.

Knowledge Exchange Dialogues

CALL TO ACTION

We invite G20 countries to:

- Provide feedback and endorse the principle behind the proposal
- Nominate relevant technical bodies to refine and participate in the dialogue
- Suggest priority topics for future convenings
- Recommend mechanisms to include or strengthen capacity in developing countries

THE LONGER TERM VISION

Subject to support, we develop a complementary track (not yet developed) for non-technological bioeconomy models, e.g.

- biodiversity-based economies,
- ecotourism and
- sustainable wildlife trade.

Concluding Remarks

UPHOLDING G20 HIGH LEVEL PRINCIPLES

These proposals directly support several key principles, including:

- **Principle 5**: Promoting sustainable and circular use of biological resources
- **Principle 6**: Ensuring responsible use of science, technology and traditional knowledge
- **Principle 8**: Applying transparent, inclusive and science-based sustainability metrics
- **Principle 9**: Advancing international cooperation, innovation and capacity building

BUILDING MOMENTUM FOR THE GLOBAL INTITIATIVE ON THE BIOECONOMY

These convenings would bring together G20 bioeconomy counterparts to;

- Exchange knowledge,
- Share implementation experiences
- Build momentum for the Global Initiative on Bioeconomy.

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Thank you