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2nd Meeting of the G20 Initiative on Bioeconomy

Day 3: A Case Study Illustrating the Use of Metrics to Measure Different Dimensions of the South African Bioeconomy

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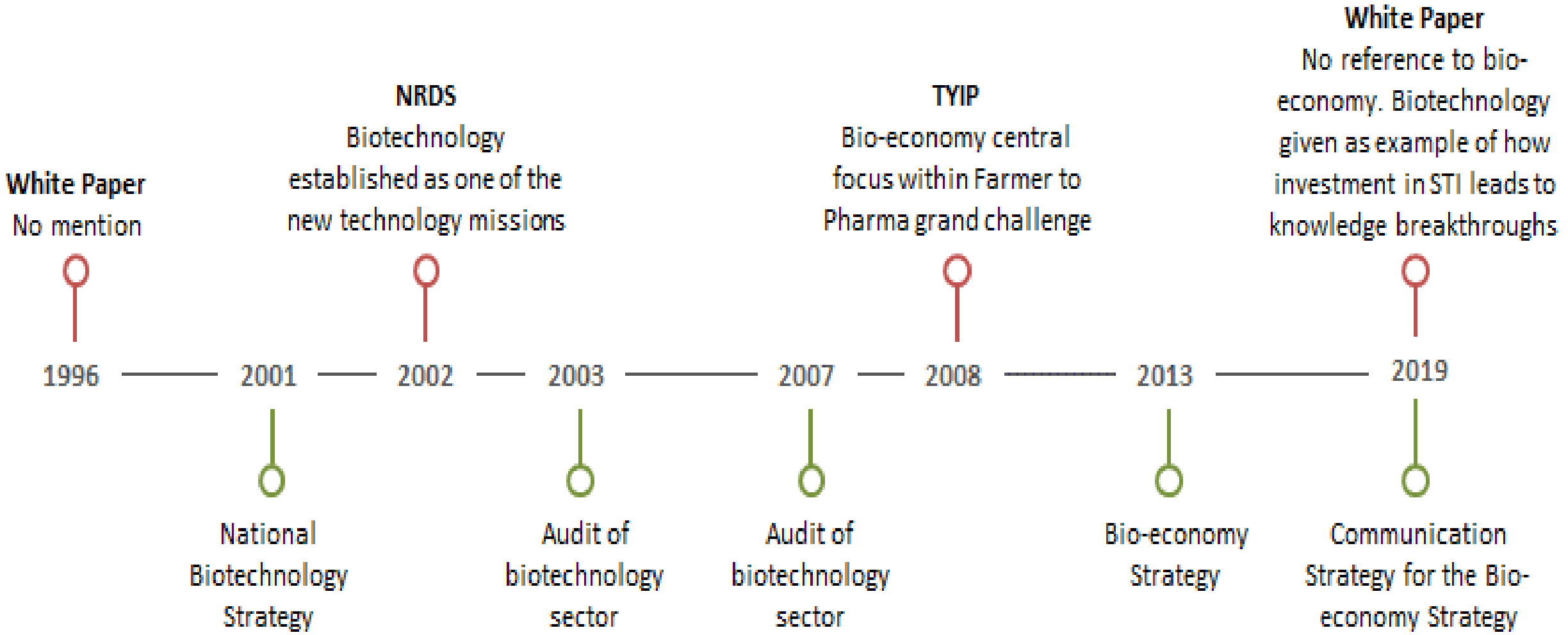
28 May 2025

Background – From Biotechnology to the Bioeconomy



The Pillars of the South African Bioeconomy

Agriculture	Health	Industry	IKS
• Crop improvement (heat-resistance and drought-tolerance) • Livestock improvement • Food quality and nutritional value • Energy crops • Bio-pesticides and bio-fertilisers	• Active pharmaceutical ingredients • Vaccines • Biopharmaceuticals • Diagnostics • Medical devices	• Bio-based chemicals • Biomaterials • Bio-energy • Water and waste (water treatment and waste recycling) • Food • Bio-plastics • Paper and pulp	• Bio-prospecting • Herbal medicine • African traditional medicine

Methodology

A group of experts in different fields (Economics, Live Sciences & Biotechnology, Monitoring, Evaluation & Learning, Statistics, etc) was assembled

The team had a difficult work of selecting indicators to measure and the track the development of the South African bioeconomy

Different stakeholders have different views on:

- ❑ the sectors
- ❑ the services
- ❑ and products that should be included within the scope of bioeconomy
- ❑ Also differ on the strategic objectives that have the greatest priority for sustainable development

The Measurement Framework

Selection of Standard Industrial Classification (SIC) codes to audit the bioeconomy - 2008/09 to 2022/23

- Fully bio-based sectors e.g. agriculture, forestry, fisheries (included)
- Partially bio-based sectors e.g. chemical (bio-chemicals), materials (bio-materials), energy (bio-ethanol, bio-diesel, etc) - estimate of the bio-share unknown (excluded)
- Non bio-based sectors e.g. bio-mining (excluded)

Indicators for South African Bioeconomy

Input Measures

- Bioeconomy gross expenditure on research and development (GERD)
- Bioeconomy business expenditure on research and development (BERD)
- Number of full time equivalent (FTE) researchers engaged in R&D and innovation

Output Measures

- Patents
- Publications

Growth Measures

- Bioeconomy share of national GDP
- Rate of growth of the bioeconomy

Employment measures

- Total employment in the bioeconomy sector
- Employment by skill level in the bioeconomy sector

Investment measures

- Gross Fixed Capital Formation (GFCF) for the bioeconomy sector
- GFCF for the bioeconomy/ turnover (sales) and/or value add of the bioeconomy

Export measures

- Bioeconomy exports
- Composition of bioeconomy exports

Major Official Data Sources

The technical team collected and analysed data from:

- **Statistics South Africa (StatsSA)**
- **The Centre for Science, Technology and Innovation Indicators (CeSTII)** a directorate of the Human Sciences Research Council (HSRC)
- **The Centre for Evaluation, Science and Technology (CREST)** interdisciplinary research centre in the Faculty of Arts and Social Sciences at Stellenbosch University
- **Quantec** a South African consultancy specialising in collecting and collating South African economic and financial data. Quantec data is primarily from Statistics South Africa (StatsSA) data

Major Official Data Sources - Deficiencies

Science-based SMMEs and employment creation are a significant outcome of the bioeconomy

- The main objective of the Bioeconomy Strategy is contribution to GDP, and globally this is achieved through the development of biotechnologies, and the creation and support of Small Micro and Medium Enterprises (SMME). **This piece of information is essential** to be covered by the SA Bioeconomy Audit

- The StatsSA/other data collectors does **not include any/many SMMEs**

- Additionally, StatsSA dataset does not provide good evidence of **DSI's support of the science-based outputs** (given that a major output of the Bioeconomy Strategy can be categorised into new technologies and the start-ups and spin-outs developed and supported)

At the centre of government policy is transformation of the South African economy in order to make it inclusive to all sectors of society

- The StatsSA and other data collectors datasets do not reflect on transformation

The Measurement Framework

Economic Activities	SIC Code	Comments
Fully Biobased (Primary Production)		**Primary sectors supported by biological components**
Agriculture, forestry, fishing	SIC 1	Primary sectors which constitute bioresources
Fully Biobased (Manufacturing)		**Manufacturing that exclusively uses biomaterial as main inputs**
Food, beverages and tobacco	SIC30	Primary inputs constitute bioresources
Wood and wood products	SIC 320 to 322	Primary inputs constitute bioresources

The Measurement Framework (Excluded for now)

Economic Activities	SIC Code	Comments
Manufacture of wood and paper products (excludes furniture)	SIC 321 to 326	Forestry as bioresource input. Including the entire sector distorts the size of bioeconomy
Manufacture of furniture	SIC 391	Forestry as bioresource input. Including the entire sector distorts the size of bioeconomy
Other manufacturing e.g. recycling	SIC 392 to 395	Production of goods/materials from waste streams
Chemistry (including bio-plastics, bioethanol Other Chemicals (includes pharmaceuticals)	SIC 331 to 335	Does not specify the bio-based share e.g. bio-ethanol. Including the entire sector distorts the size of bioeconomy. No information on bio-pharmaceuticals and APIs
Petrochemicals, coke, nuclear fuel –bioenergy	SIC 331 to 333	This includes bio-diesel, biogas & bio-electricity
Textiles	SIC 311	This sector is also partial - but the bio-share is unknown i.e. textiles that are made of bioresources e.g. wool and silk
Mining (bio-mining and bioleaching)	SIC 21 to 29	These include bio-mining activities. Including the entire sector distorts the size of bioeconomy
Medical devices, diagnostics, vaccines	SIC 374	Vaccines use bio/chemistries but including the entire sector distorts the size of bioeconomy

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A PREVIEW INTO FINDINGS

Input Measures: R&D Expenditure for Bioeconomy

Industry	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
	R'000	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agriculture, forestry and fishing	324,894	278,037	186,237	254,828	332,614	397,138	471,347	478,856
Food, beverages and tobacco	322,618	221,703	135,331	264,358	285,133	294,463	306,211	308,029
Wood and paper products*	176,996	151,549	126,351	98,893	52,273	58,408	71,854	90,171
Total	**824,508**	**651,289**	**447,919**	**618,079**	**670,020**	**750,009**	**849,412**	**877,056**

Industry	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
	R'000	R'000	R'000	R'000	R'000	R'000	R'000
Agriculture, forestry and fishing	441,760	349,979	477,848	576,251	349,028	329,577	454,567
Food, beverages and tobacco	222,487	324,050	416,149	368,408	163,577	116,555	98,460
Wood and paper products*	77,533	76,037	60,468	58,104	56,587	64,560	10,708
Total	**741,780**	**674,029**	**954,465**	**1,002,763**	**569,192**	**510,692**	**563,735**

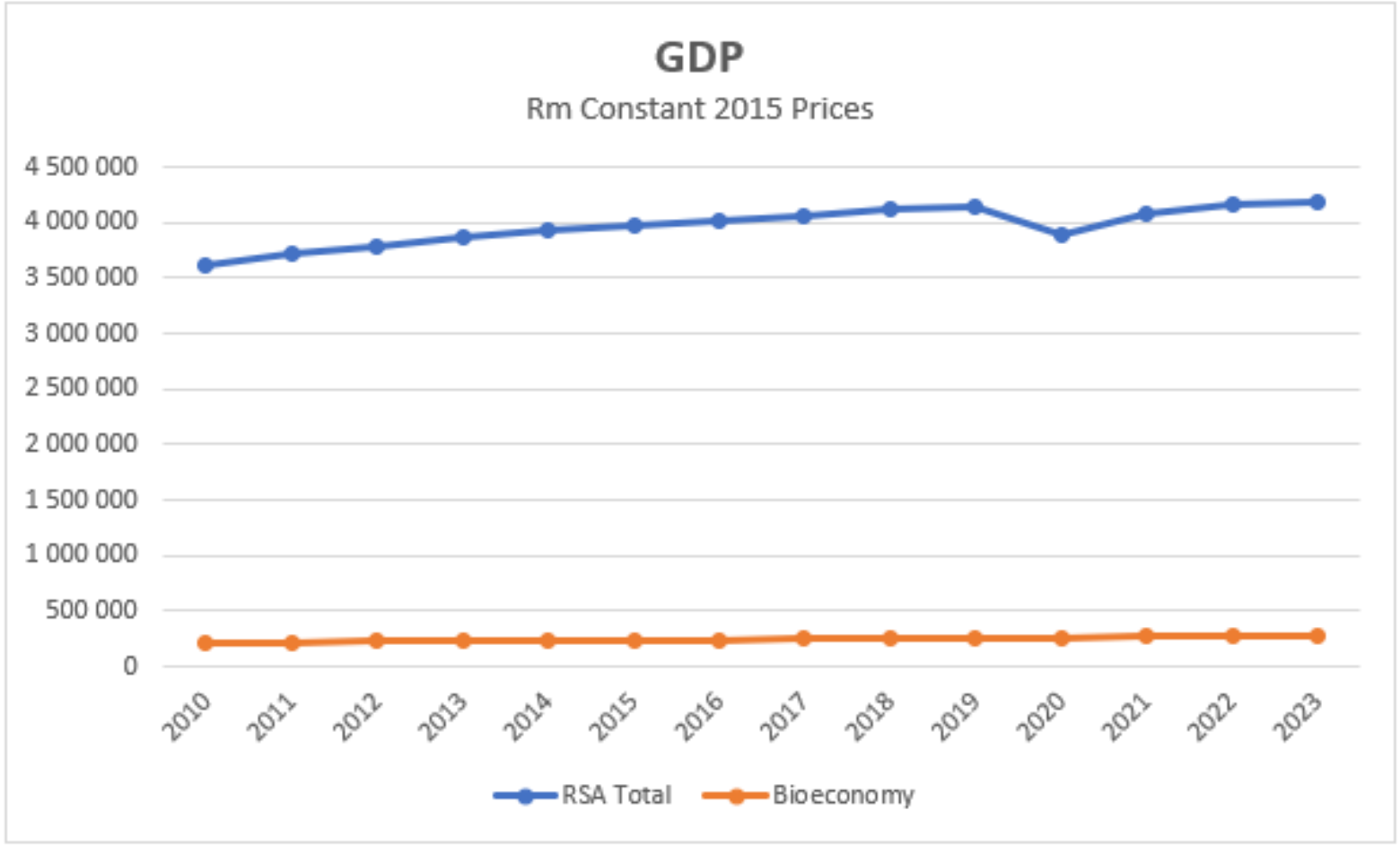
R&D expenditure (constant 2015 values) for bioeconomy from 2008/09 to 2022/23

Input Measures: Firms with 50% of R&D Expenditure on Bioeconomy

YEAR	Expenditure (R'000)	Number of Biotech firms	Total firms
2008/09	893,700	106	762
2009/10	711,408	63	648
2010/11	505,310	32	375
2011/12	697,081	45	380
2012/13	768,172	56	394
2013/14	851,688	56	373
2014/15	968,798	68	435
2015/16	993,004	64	403
2016/17	743,914	59	382
2017/18	757,009	53	340
2018/19	982,330	56	318
2019/20	1,009,771	62	318
2020/21	574,784	55	311
2021/22	541,736	52	313
2022/23	563,735	45	315

Expenditure and number of firms that allocate more than 50% of their total R&D expenditure (constant 2015 values) to bioeconomy activities

Growth Measures: Bioeconomy Share of GDP

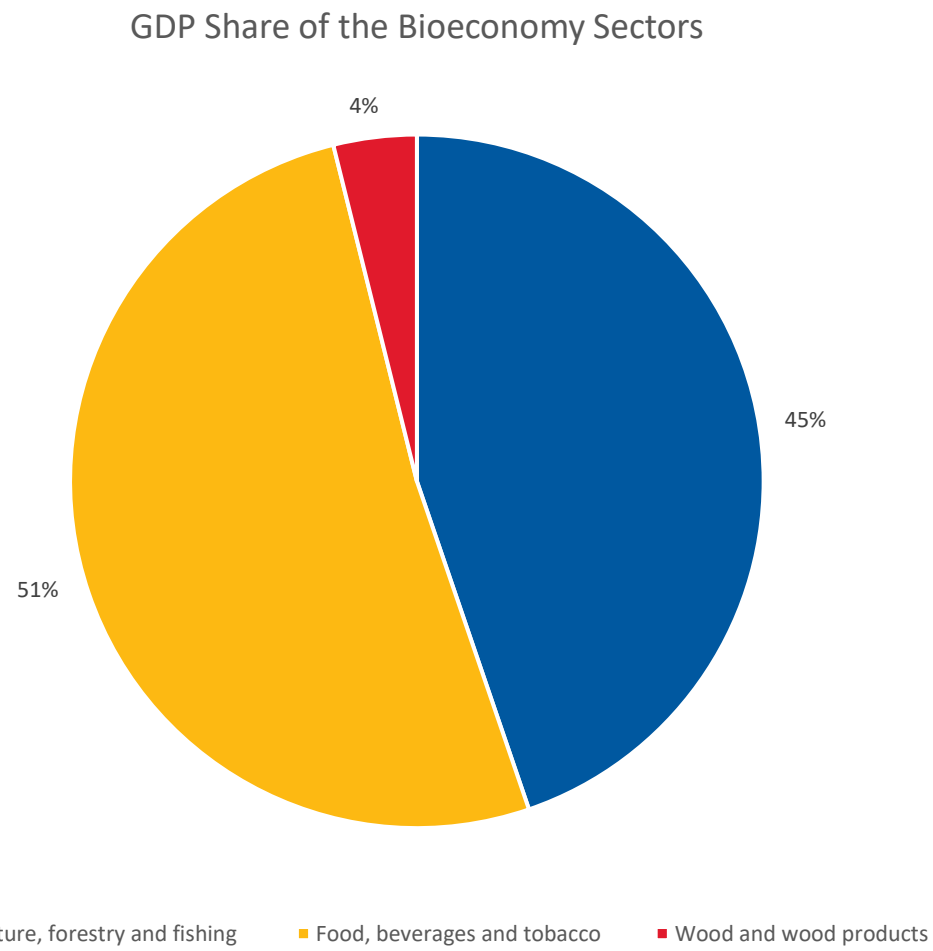


This represents between:

6.80 to 8.30 % of GDP

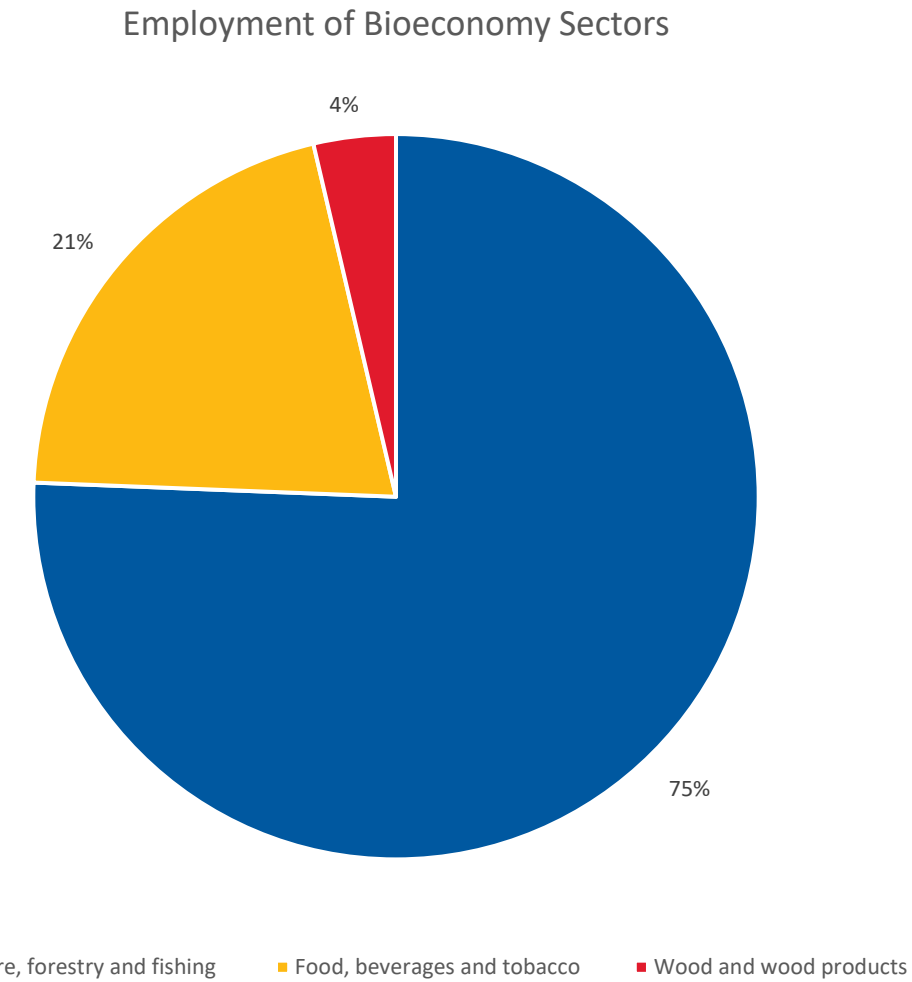
The bioeconomy share of national GDP (in R'000)

Growth Measures: Share of Bioeconomy Sectors



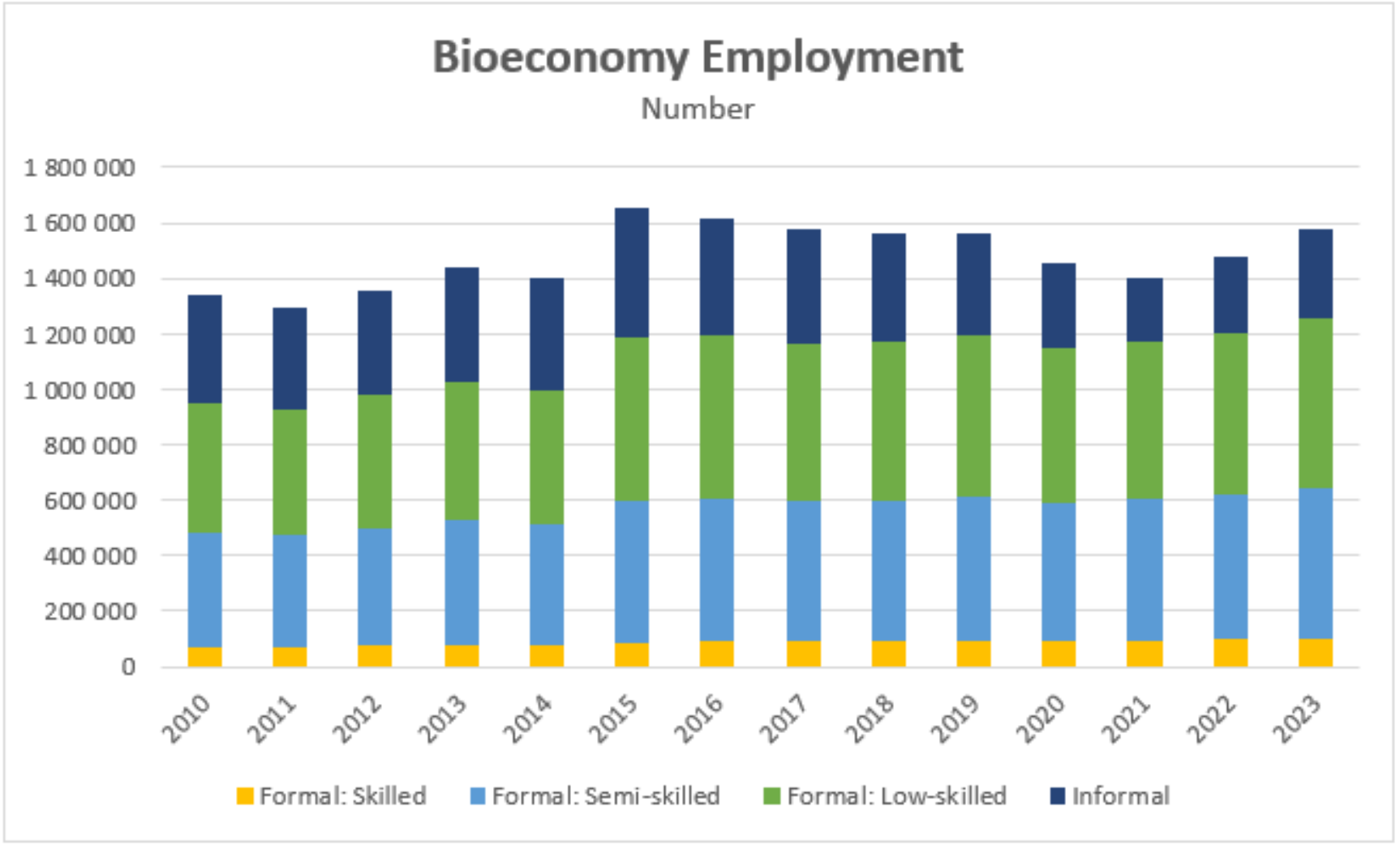
The GDP share of the different sectors that constitute the South African bioeconomy

Growth Measures: Employment Measures



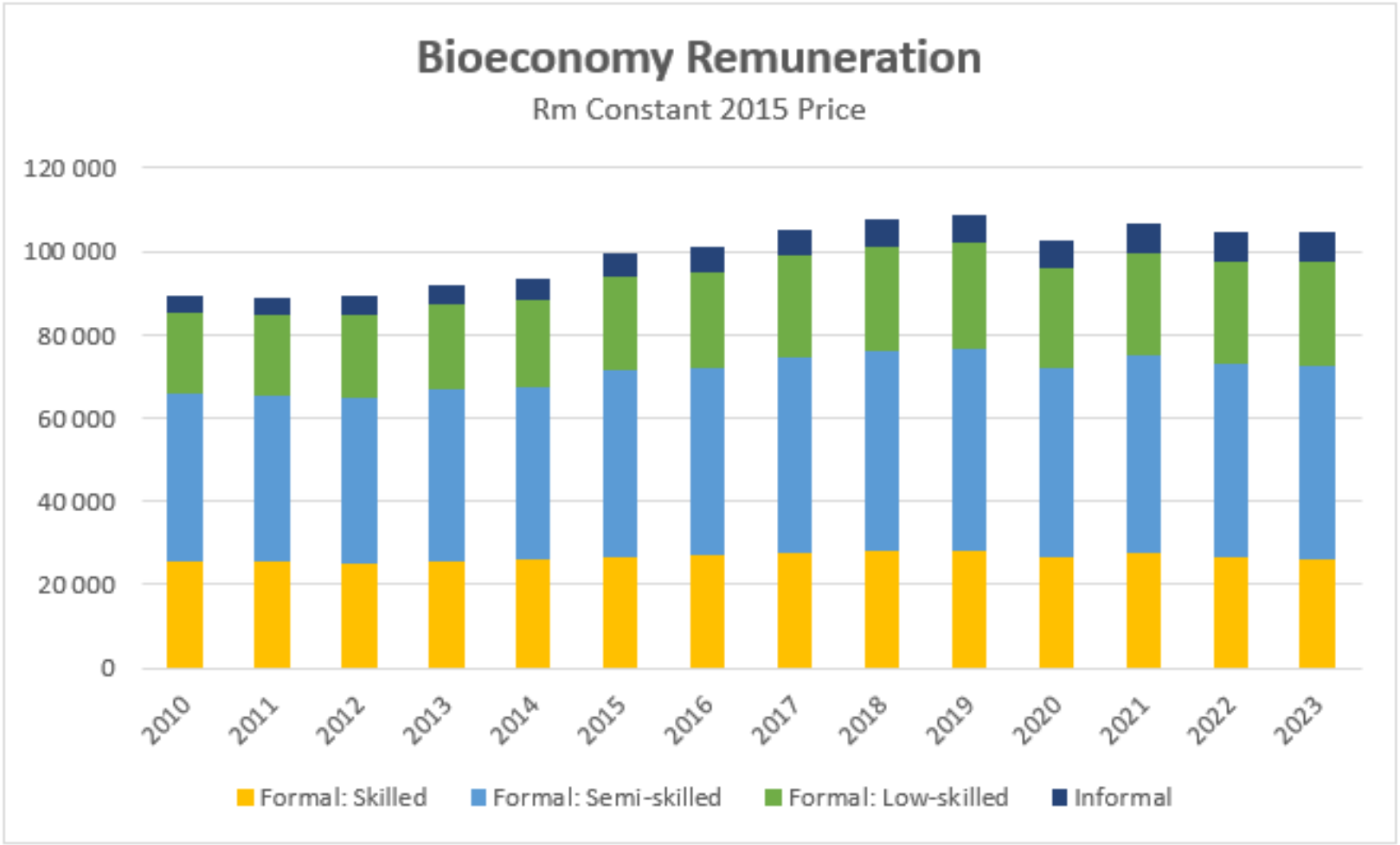
The employment share of the different sectors that constitute the South African bioeconomy

Employment Measures - Employment by Skill Level in the Bioeconomy



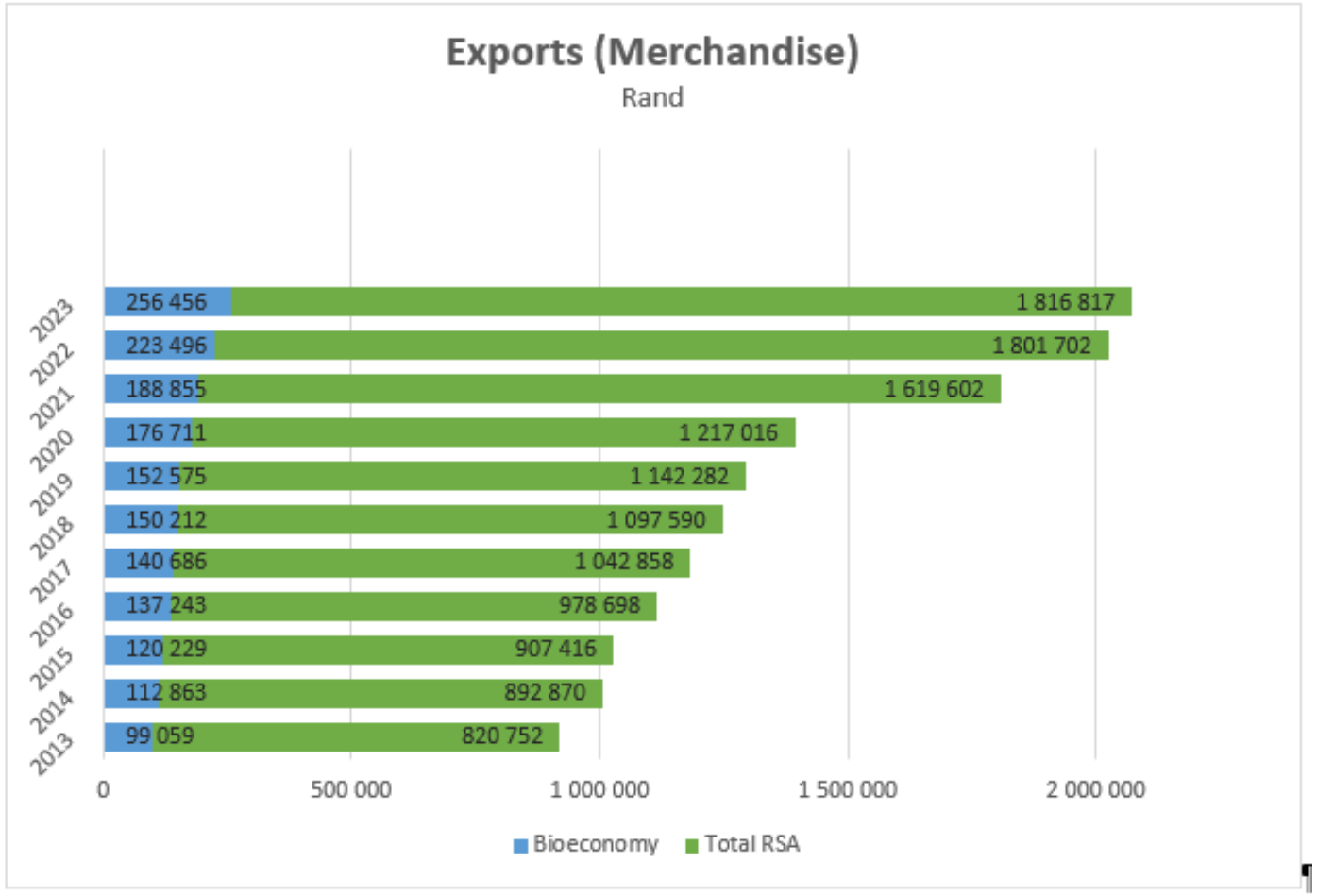
Employment numbers within the bioeconomy

Employment Measures: Remuneration



Remuneration levels in constant 2015 Rand values within the bioeconomy sector by skill levels from 2010 to 2023

Exports



Total value of exports in current Rand values contributed by the bioeconomy sector from 2013 to 2023

South African Bioeconomy Summary

NACI's conducted a survey that found more than 124 bioeconomy SMMEs

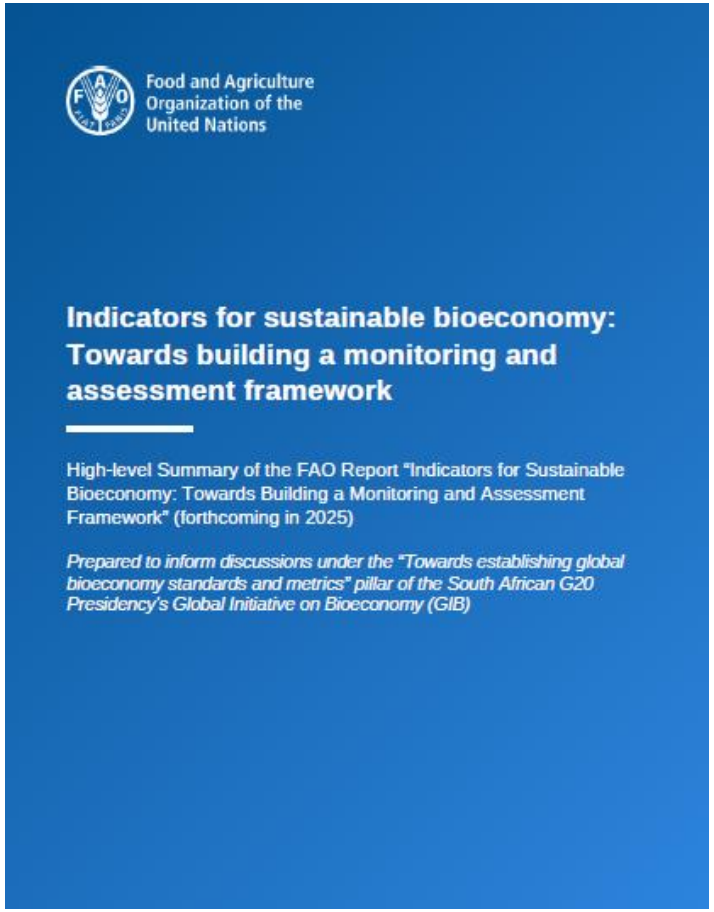
- 14% of the SMMEs have expenditure of between R50,000 and R500,000
- 26% have a total expenditure on bioeconomy-related R&D of R1 million – R5 million
- 63.5% have 1 – 5 employees
- 24.0% have 21 – 50 employees

Because many of these are pre-profit, they are non-VAT registered and invisible to official data collectors

- 106 (2008) – 45 (2023) companies
- 6.8 - 8.3% GDP
- 1.3 (2010) - 1.6M (2023) jobs

Future Work

Harmonise our indicators framework with FAO's "Indicators for sustainable bioeconomy: Towards building a monitoring and assessment framework"



Elements of the database structure for extracting the most relevant indicators

1. Levels
2. International Sustainability Frameworks
3. Strategic Objectives
4. Key Words
5. Tiers

Estimating bio-based inputs in SIC codes that have a bio-share component (Creating a Bioeconomy Satellite Account)

Dankie

Enkosi

Ha khensa

Re a leboga

Re ya leboha

Ro livhuwa

Siyabonga

Siyathokoza

Thank you