

TOWARDS A SECONDARY RESOURCES ECONOMY

South Africa's 10-Year Waste RDI Roadmap (2015-2025)



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science
& technology

Department:
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REPUBLIC OF SOUTH AFRICA

CSIR
our future through science



10-year Waste RDI Roadmap for SA

- The Department of Science and Technology (DST)
 - Published South Africa's 10-Year Waste Research Development and Innovation (RDI) Roadmap in 2014
 - Aimed at providing **strategic direction** to guide South Africa's **portfolio investment**, for the next 10 years, in **six identified clusters** of waste and secondary resources research, development and innovation activity
 - That would lead to (1) More effective **decision-making**, (2) Faster insertion of **context-appropriate Technology**, (3) **Export** of Know-How and Technology, (4) Strengthened **RDI capability** and capacity
 - And ultimately support South Africa's implementation of the National Waste Management Strategy and the waste hierarchy



The Waste RDI Roadmap

10-year Waste RDI Roadmap for SA



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www.wasteroadmap.co.za



Intent of the Waste RDI Roadmap

- Vision** *Development and deployment of performance improvements in waste management has delivered a significant contribution to the strengthening of a sustainable regional secondary resources economy in South Africa.*
- Mission** This has been achieved by means of a **National Waste RDI Programme** that supports **maximisation of diversion of waste from landfill** towards **value-adding opportunities**, including prevention of waste and the optimised extraction of value from reuse, recycling and recovery, in order to create significant economic, social and environmental benefit.

Priority RDI focus areas (clusters)



Strategic Planning

Macro-Economics

Value Chain Strategy

Policy and Legislation

Governance

Build and strengthen the basis and application of strategic analysis and advice for the purposes of evidence-based decision-making to inform strategy formulation, planning and its execution and management



Modelling and Analytics

Systems Analysis and Modelling

Business Models

Socio-Economic and Environmental Modelling

Analytics

Impact Assessment

Develop and use methods, tools, techniques, platforms, systems and frameworks for the analysis, monitoring and evaluation of technical, economic, social and environmental opportunities and impacts associated with secondary resources



Technology Solutions

Process Performance Optimisation

Technology Development

Technology Evaluation and Demonstration

Technology Localisation

Design, development, evaluation, demonstration, localisation and deployment of technologies – both local and inbound – for customer-driven performance improvement



Waste Logistics Performance

Strategic Network Design

Planning and Management Systems

Operational Logistics Processes

Optimisation of strategic, tactical and operational decision-making in respect of logistics objectives, assets and resources



Waste and Environment

Aquatic

Land

Atmosphere

Climate Change

Strengthen the ability to identify, monitor, evaluate and report on environmental impacts of waste and its management, in order to inform better targeted and more effective responses



Waste and Society

Jobs and Labour

Business Practices

Behaviour

Awareness and Communication

Human Health

Deepen understanding of waste-related opportunities and threats, to increase the success of influencing perception and practice positively

Action plans (RDI Objectives)

Set RDI Objectives

Performance improvement towards Secondary Resources



			Short Term 2015-2016	Medium Term 2017-2020	Long-Term 2021-2025
Technology Solutions	TS1	Process Performance Improvement	<ul style="list-style-type: none"> Explore ➤ Via structured dialogue with stakeholders and customers in prioritised waste streams, identify focus areas of valued needs for performance improvement ➤ Informed by techno-economic modelling (drives requirements to Modelling and Analytics services) 	TSP Established well-coordinated network of nodes of capability – driven and guided by a lead unit – supporting activity in Process Performance Improvement	<ul style="list-style-type: none"> ➤ Establish Commercialisation Vehicle
	TS2	Technology Development	<ul style="list-style-type: none"> ➤ Explore global technology landscape and identify areas of differentiated technology opportunity for South Africa ➤ Drive dialogue with key contributors, such as TIA to establish involvement and commitment ➤ Define and set up to manage a pipeline of projects along the value chain with focus on Explore and Test ➤ Build motivation, business case, model and plan for RC and CoE 	<ul style="list-style-type: none"> ➤ Establish Research Chair and Centre of Excellence with focus on technologies appropriate for developing countries – i.e. integration and performance improvement in informal sector, in urban and rural contexts ➤ Build motivation, business case, model and plan for waste-stream specific COEs 	<ul style="list-style-type: none"> ➤ Continue TS2 CoE ➤ Establish 3 further CoE with focus on particular streams <ul style="list-style-type: none"> ➤ Metals and mining ➤ Organic and biomass ➤ Polymer ➤ Tyres
	TS3	Technology Evaluation and Demonstration	<ul style="list-style-type: none"> ➤ Review global best practice in respect of evaluation and demonstration, baseline South Africa ➤ Explore identify relevant capability ➤ Define an intent and strategy for SA, build motivation, business case, model and plan for CoC (ref. Water Tech Demo Centre) ➤ Define and set up to manage a pipeline of projects along the value chain – Explore, Test, Demonstrate, Deploy – always towards Commercialisation 	<ul style="list-style-type: none"> ➤ Establish CoC – begin to move forward on the pipeline of projects ➤ Draws upon domain-specific capability from the well-coordinated network of nodes (TS1, TS2) ➤ The focus is on route to Market – practical demonstration and uptake 	<ul style="list-style-type: none"> ➤ Establish Product Development Centres – as a service node ➤ Potential for export of know-how or services, technologies
	TS4	Technology Localisation	<ul style="list-style-type: none"> ➤ Define opportunity, intent, strategy and plan (from TS2) for technology adaptation and localisation ➤ Identify capability – strength and potential (support DST Industrialisation) ➤ Establish first-line point of contact for inbound technology insertion potential 	<ul style="list-style-type: none"> ➤ Satellite node to TS2, Embedded in CoC TS3 	

Anticipated benefits

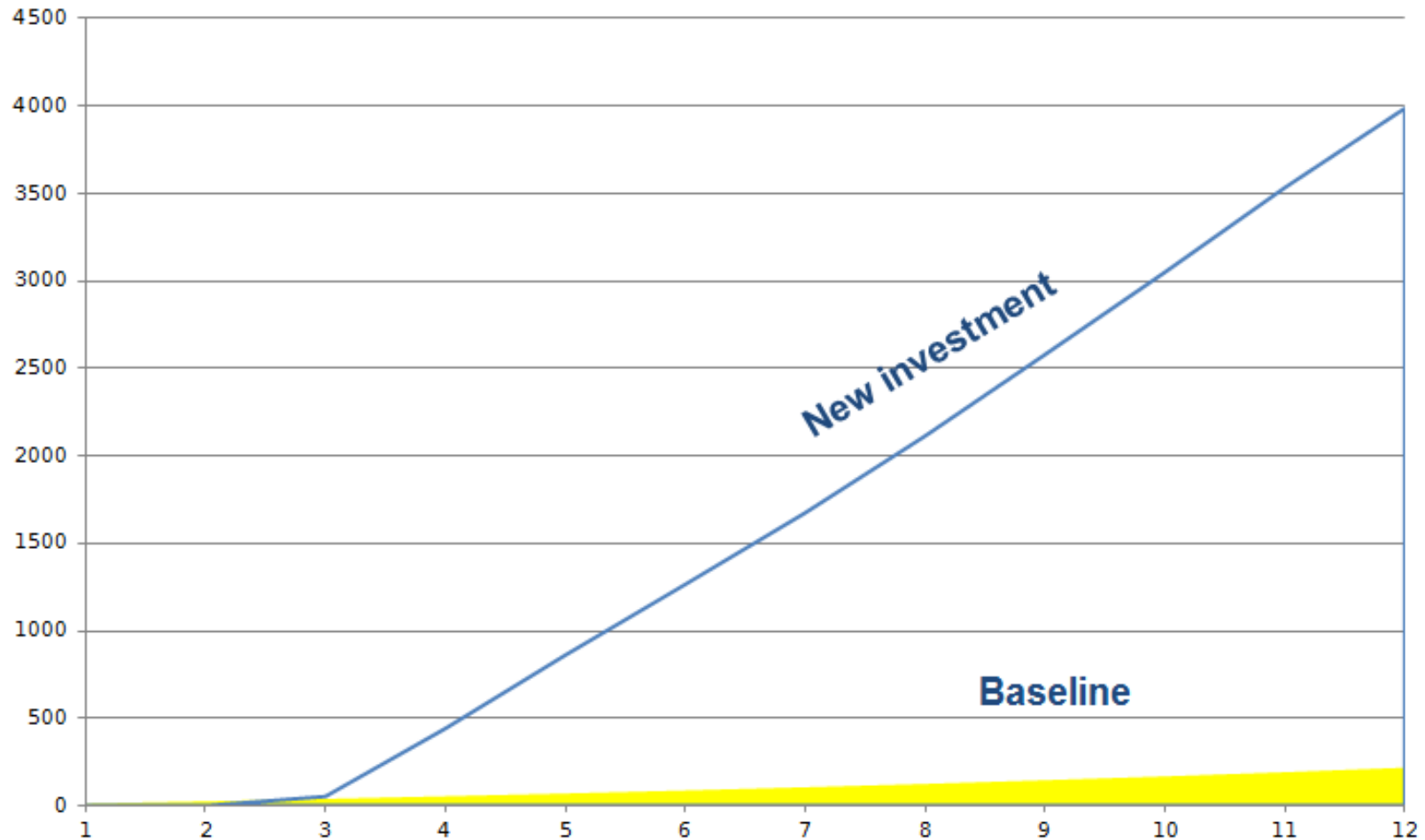
Waste Management	20% reduction (by weight) in industrial waste and a 60% reduction (by weight) in domestic waste to landfill (by 2025)*
Environmental Benefit	<ul style="list-style-type: none"> ▶ Reduced environmental impacts associated with (often poor) landfilling (including e.g. greenhouse gas emissions, leachate, litter)
Economic Value	<ul style="list-style-type: none"> ▶ Potential resource value (<i>minimum</i>):** R17.4 bn per annum (R8.2bn pa recovered) ▶ Avoided financial costs of landfilling: R4.7 bn per annum ▶ Avoided externalities of landfilling: R5.2 bn per annum ▶ Avoided financial costs and externalities associated with virgin material production (not yet quantified)
Socio-economic Benefit (not yet fully quantified)	<ul style="list-style-type: none"> ▶ Contribution of a secondary resources economy to downstream manufacturing ▶ Potential for enterprise development and creation of sustainable jobs (direct, indirect and induced) ▶ Reduced operational costs or improved competitiveness through process performance improvements ▶ 'Multiplier' (knock-on) effects on the macro-economy (<i>potentially a 1-3x multiplier</i>)

* DST Goal – Evaluated as Scenario 3 in the analysis of waste stream value performed as part of this project

** As at 2012 values

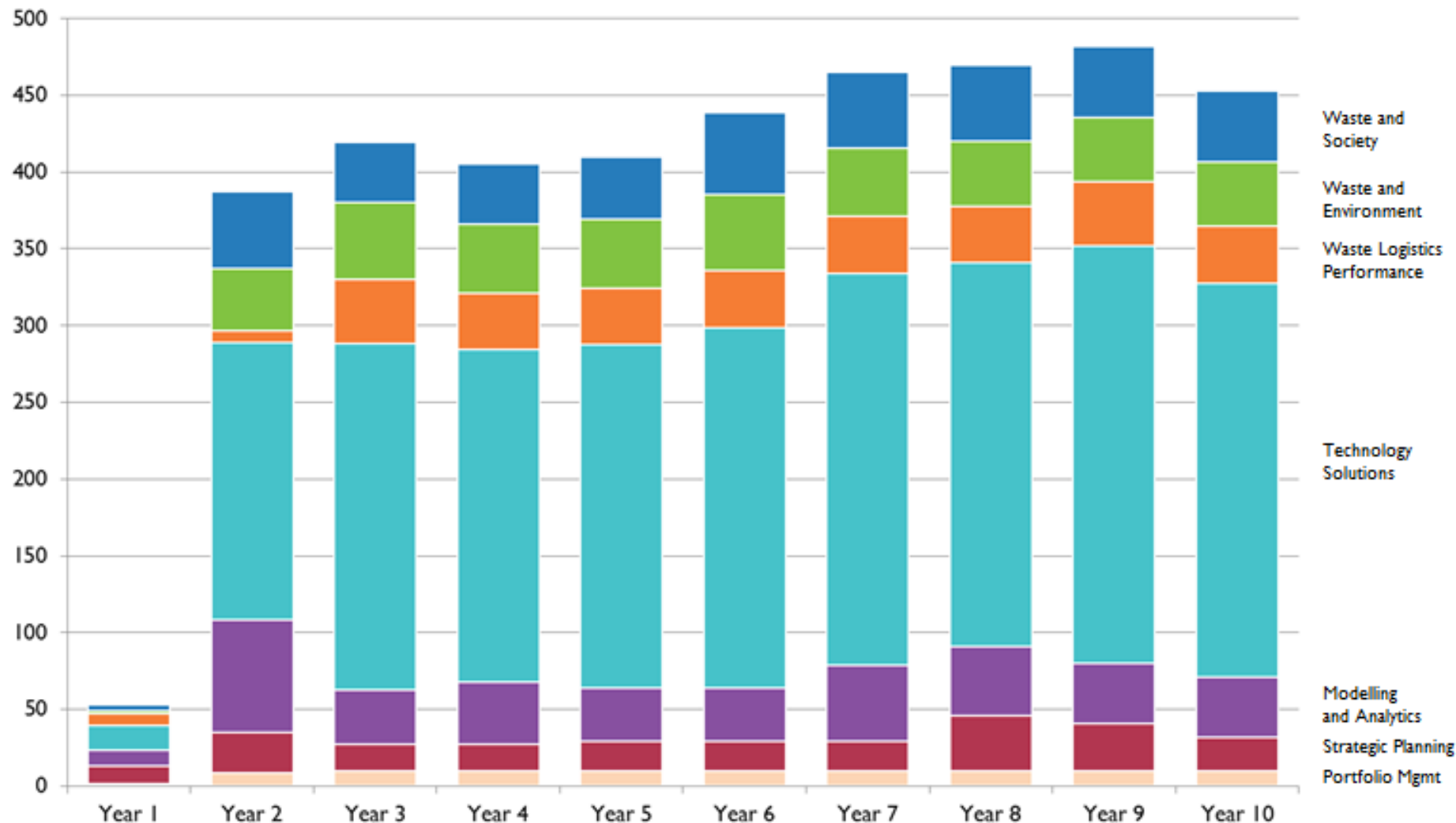
Ramping up RDI investment

10-Year Investment – Cumulative, in ZARm



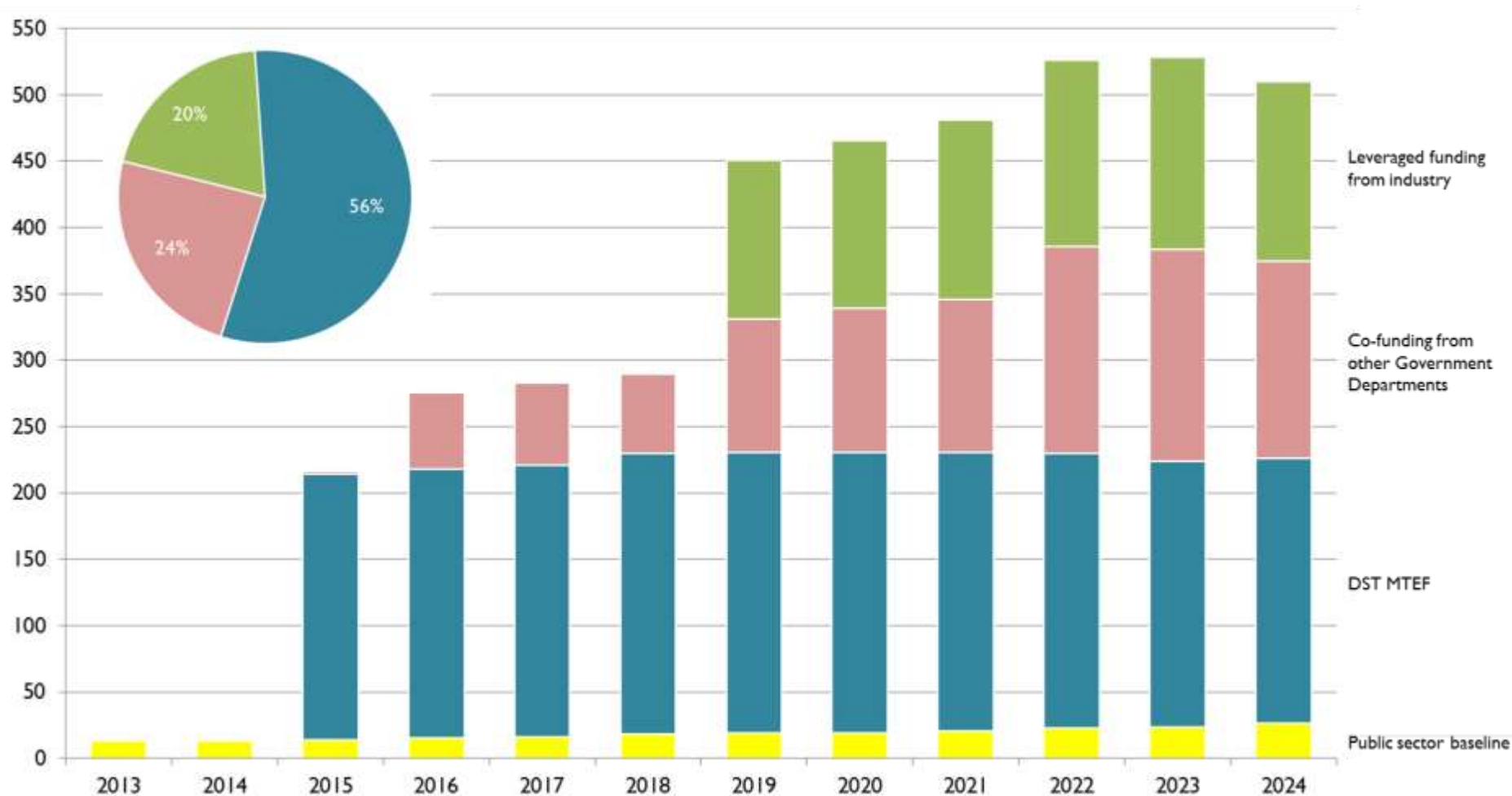
Investment in Waste RDI

Per cluster, per year, in ZARm



Investment in Waste RDI

Annual RDI Investment, by Funding Source, in ZARm



Anticipated RDI Outputs

Key Performance Indicator		Outputs Ambitious*
Technology Development	Products and services to market	4
	Technology packages	20
	Prototypes	60
Knowledge Generation	Registered patents	24
	Patent applications	68
	Publications	587
Human Capital Development**	Post Docs	65
	PhDs	163
	Masters	244

* Assumes a) total investment indicated is made and b) RDI Productivity assumptions are achieved in practice

** Number of students supported over the 10 year timeframe

The development process

Approach to the Roadmap

Understanding the landscape and the reasons for SA to do something other than landfill

Understanding the needs of business / industry and the opportunities they provide for RDI

Understanding the NSI's ability to respond to these opportunities



Priority Waste Streams of Roadmap



- **Municipal Solid Waste**

e.g. paper and packaging, C&D waste, OFMSW, residual waste



- **Electronic Waste (WEEE)**

e.g. all fractions, metal, plastic, glass, etc.



- **Waste Plastic**

e.g. pre- and post-consumer plastics (all)



- **Organic Waste**

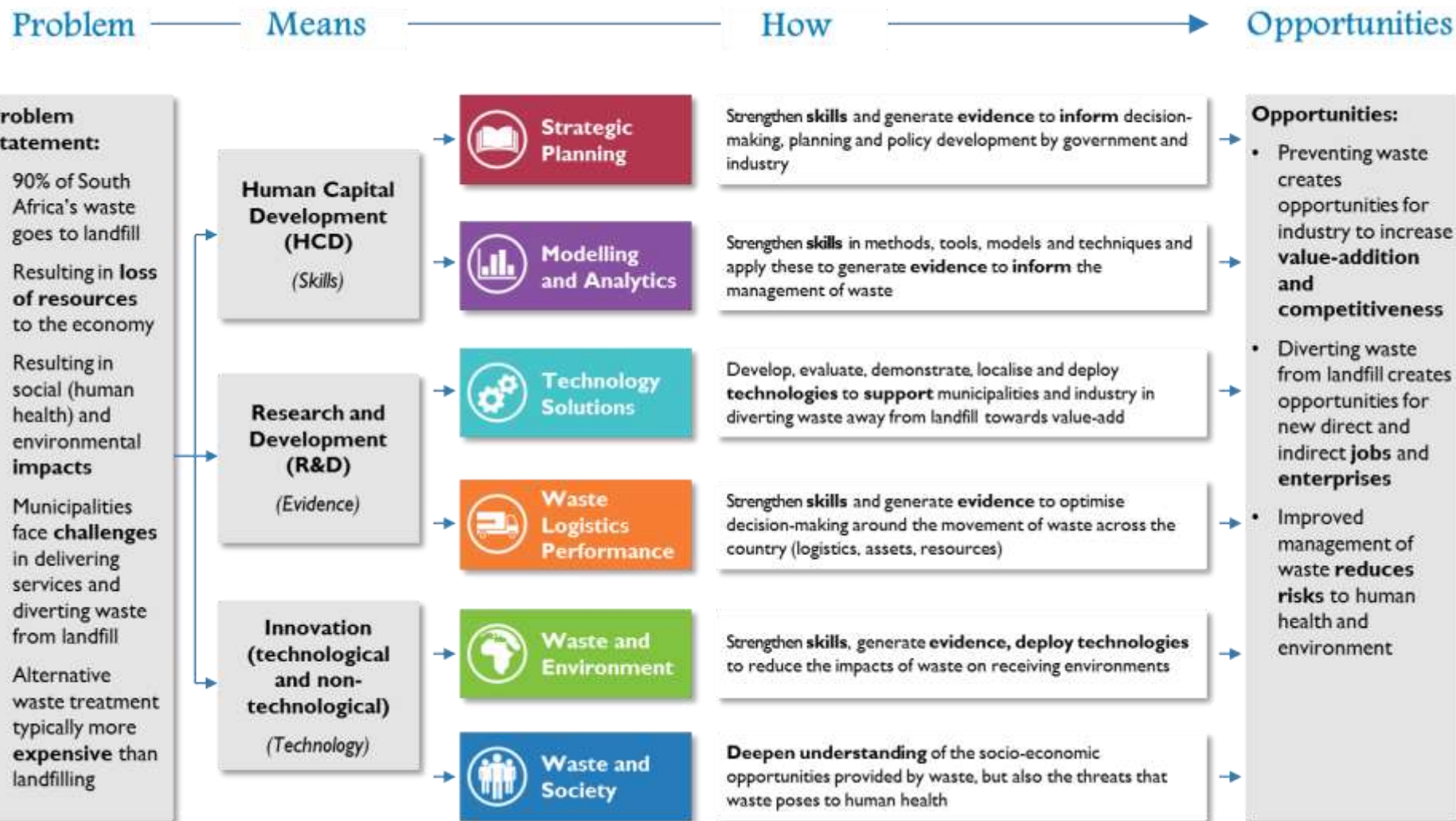
e.g. industrial biomass, OFMSW, food waste



- **Waste tyres**



Framework of the Waste RDI Roadmap





Implementation



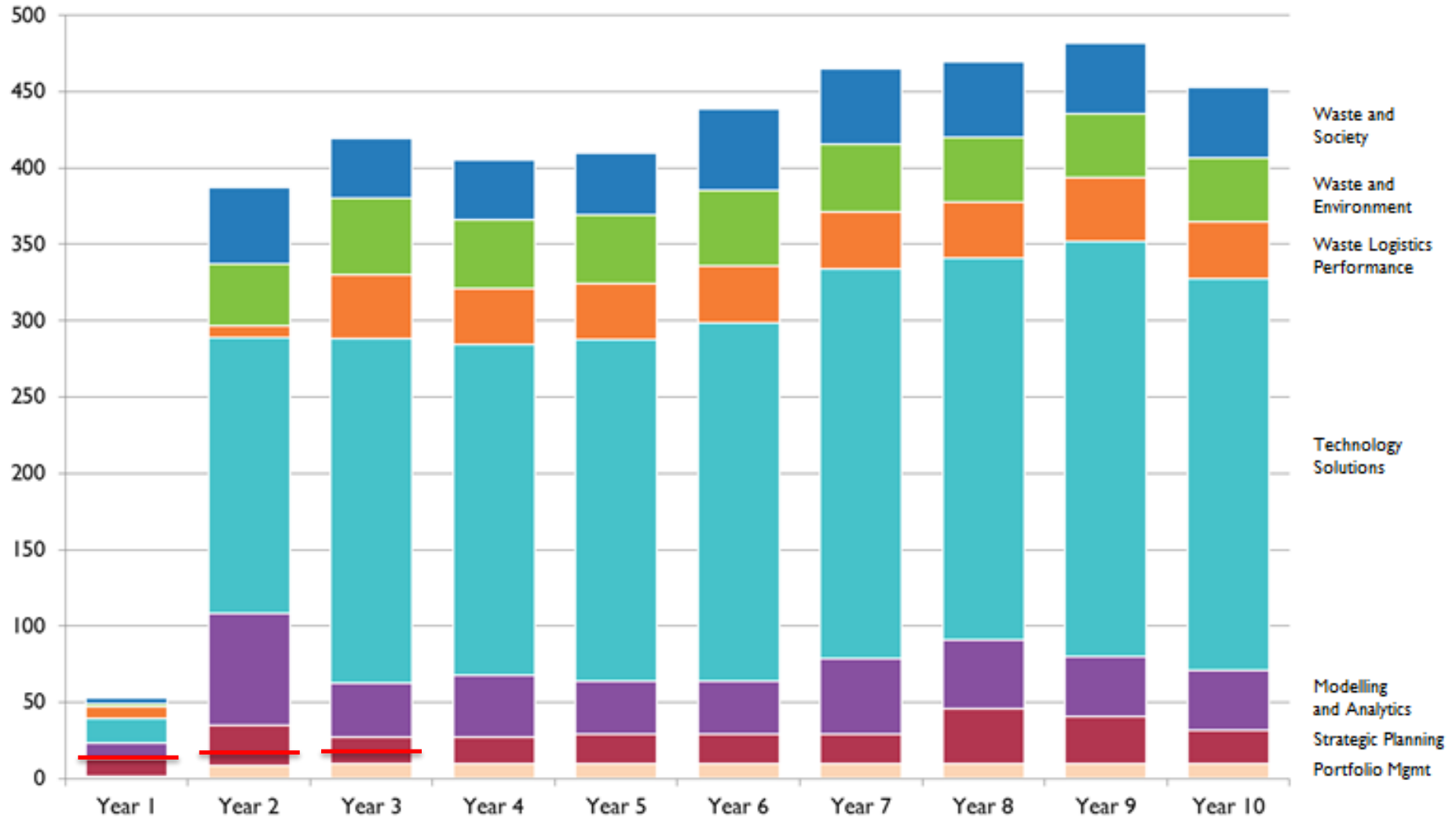
Roadmap Implementation

- The DST established a **Portfolio Management Unit** (PMU) from the 1 April 2015 to –
 - Drive the implementation of the 10-year Waste RDI Roadmap (RDI Objectives of the Roadmap)
 - In **partnership** with various DST entities (e.g. NRF, TIA) and national government departments (e.g. DEA, the dti)
 - Actively **explore opportunities** (local and international) for collaboration and co-investment
 - The PMU is currently hosted by the CSIR Implementation Unit (IU)



The constraint to implementation

Per cluster, per year, in ZARm



Diversity in “Instruments”

Post-graduate student support

Human Capital Development (HCD)

Providing a pipeline of skilled post-graduates into the waste and secondary resources sector with the **skills to drive alternative waste treatment and to unlock opportunities**

Increasing the supervisory capacity to mentor post-graduate (Honours, Masters, Doctoral and Post-Doc students)

- Post-graduate **degrees** in waste management (Honours, MSc, MEng)
- Post-graduate **scholarships**
 - 8 Masters Scholarships and 1 PhD Scholarship
 - Managed by the NRF on behalf of CSIR/DST
- **Grant funded** post-graduate student support
 - 38 students currently receiving funding support (full or partial)
 - 5 Honours, 22 Masters and 11 PhD

Grant funded R&D Projects (Open)

Waste Research & Development (R&D)

Supporting the **generation of new scientific evidence**, relevant to South Africa, that will **inform policy, planning, decision-making**

Supporting the **development of new technology** and of **adapting technology** to South Africa conditions through R&D



Project: Valorisation of **waste chicken feathers**

Grant Holder: Prof Bruce Sithole

Organisation: CSIR NRE, Durban

Period: 04/2016 – 03/2019



Project: Production of novel cellulose nanocomposites from **organic waste**

Grant Holder: Dr Annie Chimphango

Organisation: SUN, Stellenbosch

Period: 04/2016 – 03/2020



Project: Value recovery from **solid confectionary waste**

Grant Holder: Prof Sue Harrison

Organisation: UCT, Cape Town

Period: 04/2016 – 03/2019

Grant funded R&D Projects (Targeted)

Waste Research & Development (R&D)

Supporting the **generation of new scientific evidence**, relevant to South Africa, that will **inform policy, planning, decision-making**

Supporting the **development of new technology** and of **adapting technology** to South Africa conditions through R&D



Mapping South Africa's Waste Electrical and Electronic Equipment Technology Landscape MINTEK, SOUTH AFRICA

PROJECT INFORMATION
Waste Research Instrument: Targeted Research Call
Lead Institution: Mintek
Project Leader: Mr. M. Gerike
Research Budget: R680 398
Co-investment: R400 000
Project timeframe: May 2016-March 2017

The objective of this targeted research project was to assess the WEEE dismantling, pre-processing and processing technology landscape in the formal WEEE economy in South Africa. The outcomes of the research were expected to –

- Assist the Department of Science and Technology in assessing local technology solutions and WEEE treatment capacity, gaps in local technology solutions that could support increased local processing of WEEE, and opportunities for new areas of technological innovation
- Support future WEEE research, development and innovation in South Africa to ensure that opportunity areas, and key gaps, are addressed
- Capacitate the sector through public access to information, in order to improve the understanding of the potential business opportunities in recycling of WEEE

- Support the diversion of WEEE away from landfill towards reuse and recycling
- Support the development of a regional secondary resources economy that provides maximum local social and economic benefit

The key findings that emerged from the research, included:

- Over 100 formerly registered companies operate across the WEEE recycling value chain (from collection to processing) in South Africa.
- The WEEE recycling sector remains dominated by a few well-established 'consolidator' companies (85% of volumes handled in 2015).
- Most small- to medium-sized firms concentrate in earlier stages of the value chain (i.e. dismantling). The number of

firms offering location-specific collection, dismantling and refurbishment activities have increased over the past five years.

- Gauteng remains the central 'hub' for the collection, consolidation, pre-processing and processing of WEEE in South Africa (≈55% of volumes handled in 2015). The Western Cape, KZN and Eastern Cape are important provincial aggregation and sourcing nodes.
- The SADC region is emerging as an important supplementary source of WEEE inputs to the South African recycling sector and is expected to increase in importance as competition for local inputs intensifies.
- Barriers to entry are high at the pre-processing and processing stages and in specialised waste streams (e.g. lamps), but comparatively lower at the dismantling stage.

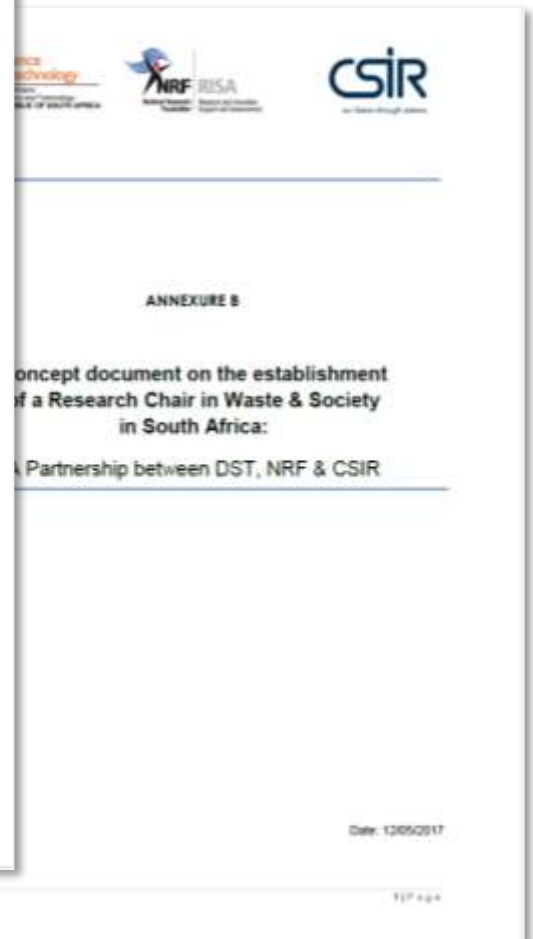
- Skills and technology are not the determining factors, rather access to WEEE volumes is.
- WEEE recycling is not profitable as a standalone business for small firms, with 58% regarding it as a secondary activity. Most small dismantlers complement WEEE recycling with refurbishment, which is regarded as being more profitable (making up to 60% of revenues).
- In 2015, approximately 17,733t of WEEE was handled by 27 firms, with the largest source of inputs being from government departments (45%). ICT & consumer electronics made up the largest contributing waste stream (79%).
- The WEEE recycling sector is currently not a significant employer, with approximately 677 people employed across 18 firms in 2015. However, at 25 jobs/1,000t handled, the sector has the potential to increase this number as more WEEE is unlocked into the value chain.

SARChI Research Chairs

Waste Research & Development (R&D)

Supporting the **generation of new scientific evidence**, relevant to South Africa, that will **inform policy, planning, decision-making**

Supporting the **development of new technology** and of **adapting technology** to South Africa conditions through R&D



Strengthening public-private RDI

Waste
Innovation
(technological
and non-technological)

Driving **technological and non-technological innovation** to improve the management of waste in South Africa and to unlock the social, environmental and economic opportunities in resource recovery

Developing technological solutions unique to South African conditions

- Industry-meets-Science



Strengthening public-private RDI

- The **South African Bioplastics Forum** was launched by Plastics|SA, in partnership with the CSIR and the DST, at the Bioplastics Industry-meets-Science workshop held in Durban in January 2016.
- The aim of this forum is to **support the growth of the bioplastics economy** in South Africa.



Conclusions

- The Roadmap (document) is just the start
- Having said that, make sure the Roadmap –
 - Is **inclusive** – walk the journey with Government, Private Sector and Academia – from the beginning
 - **Communicate** with stakeholders throughout
 - Is clear in terms of tangible, implementable **activities**
 - Allow for **diversity** in instruments to achieve objectives
 - **Partner** with organisations positioned to give effect
 - And be clear on **why** you need it (impact)

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