South Africa's Waste Research Development and Innovation (RDI) Roadmap (2015-2025)

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Outline of presentation

- Introduction
- Approach followed
  - Why the need for a Waste Research, Development and Innovation (RDI) Roadmap
- Way forward

Introduction

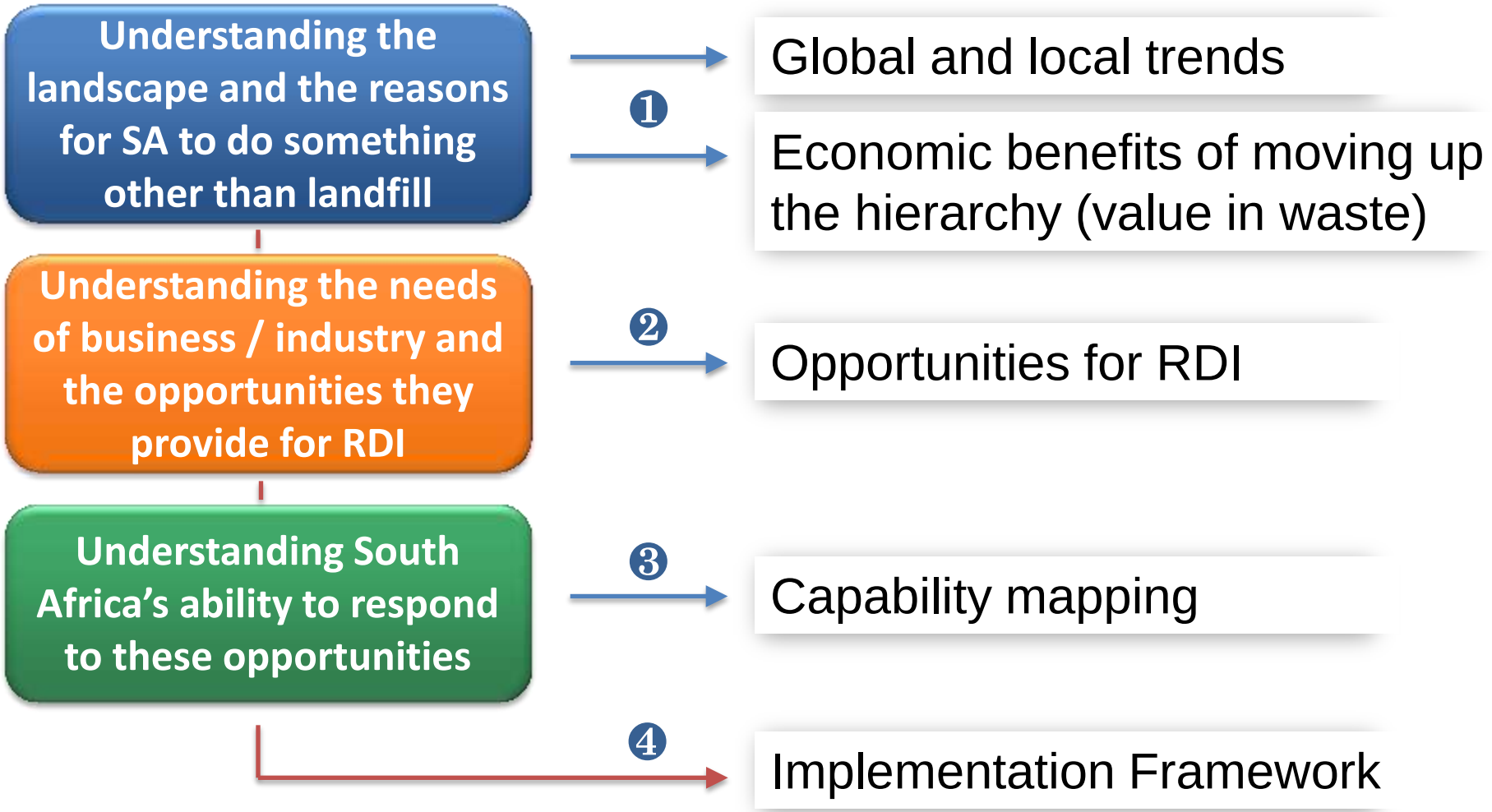
- South Africa –
  - Landfills ~90% of all waste generated and ~75% of MSW
  - Has embraced the principles of the **waste hierarchy** in legislation, to move towards prevention, reuse, recycling and recovery
- Significant **opportunity** for research and development, and innovation (RDI) to fast-track a move away from landfilling towards alternatives
- Alternatives that will **recover value** for the South African economy

Waste RDI Roadmap: The Vision

- The **vision** of the Waste RDI Roadmap is to stimulate –

- Through the **investment in science and technology** and in so doing, support the development of South Africa's green economy

Approach to the Roadmap

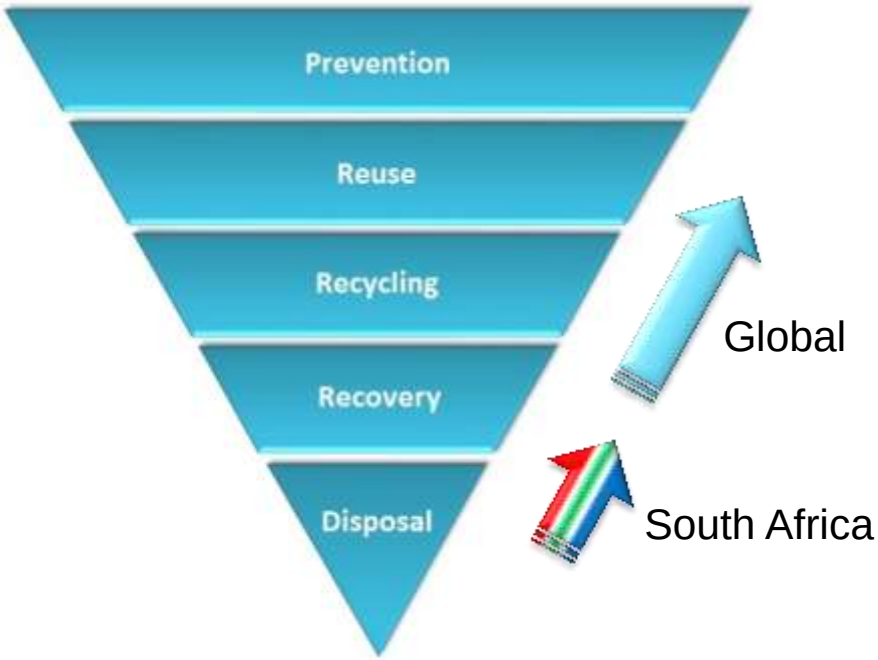


"Understanding the landscape and the reasons for SA to do something other than landfill"

- Global and local trends
- Economic benefits of moving up the hierarchy (value in waste)

1. Global and Local Trends

- Waste management is currently undergoing a major global paradigm shift



Global and local drivers:

- Population growth and urbanisation
- Increasing quantity and complexity of waste
- Climate change
- Carbon economics
- Resource scarcity
- Commodity prices
- Energy security
- Globalisation
- Job creation
- Tightening regulation

1. Global and Local Trends

- Both developed and developing countries are moving up the waste hierarchy (alternative technologies)
- Economic opportunities in waste
- Opportunity waste streams
  - Organic waste, recyclables, large industrial waste streams
- Waste is part of a global economy
- Opportunity regions – waste markets
  - Emerging economies (China, India and Latin America)
  - South Africa identified as one of five emerging markets with “exciting opportunities”
- Different paths (technology portfolios) to achieving Integrated Waste Management

1. Valuing South Africa's waste

- Understanding the **economic benefits** of moving waste up the hierarchy away from landfilling
- Calculated the value of resources lost to the economy as "waste"
- Modelled for 4 different scenarios –
  - Current – Baseline (status quo) as at 2011
  - Medium-term – IndWMP and midpoint
  - Long-term – DST Roadmap Goal
    - "20% reduction in industrial waste and a 60% reduction in domestic waste, to landfill by 2024"
  - Vision – 100% diversion from landfill towards recycling and recovery

1. Valuing South Africa's waste

Stream	Value (Rand/year)			
	Scenario 1 (Baseline)	Scenario 2	Scenario 3 (DST Goal)	Scenario 4 (100%)
Municipal waste (non-recyclable portion)	0	740 547 527	1 481 095 054	2 962 190 108
Organic component of municipal waste	199 624 053	299 436 079	399 248 106	570 354 437
Biomass waste from industry	0	2 046 933 732	4 093 867 465	6 823 112 441
Construction and demolition waste	66 157 613	136 450 038	206 742 463	413 484 925
Paper	735 995 662	809 595 449	1 032 976 649	1 291 220 811
Plastic	734 824 361	1 677 846 536	2 449 411 002	4 082 351 670
Glass	150 499 090	204 584 780	282 185 904	470 309 840
Metals	5 668 103 740	6 022 360 735	6 376 617 729	7 085 130 810
Tyres	3 620 455	38 015 658	72 410 862	90 513 577
WEEE	6 884 000	19 453 250	32 022 500	64 045 000
Slag	469 959 700	587 449 625	704 939 550	939 919 400
Ash	6 867 312	14 299 656	21 732 000	108 660 000
Waste oils	146 666 667	193 333 333	240 000 000	333 333 333
Total	**8 189 202 652**	**12 790 306 399**	**17 393 249 283**	**25 234 626 353**

1. Valuing South Africa's waste

- Recycling at 10% unlocked **R8.2 billion/year** worth of resources into the SA economy (2011)
- Achieving 100% diversion from landfill (Scenario 4) would unlock –
  - In terms of **resource value - R25.2 billion/year**
  - In terms of resource value + **avoided financial and external costs – R46.5 billion/year**
- The benefits of additional recycling/recovery (above current) - **R17.0 billion/year** of resource value and **R36.0 billion/year** in resource value + avoided costs
- Have yet to calculate the additional downstream value

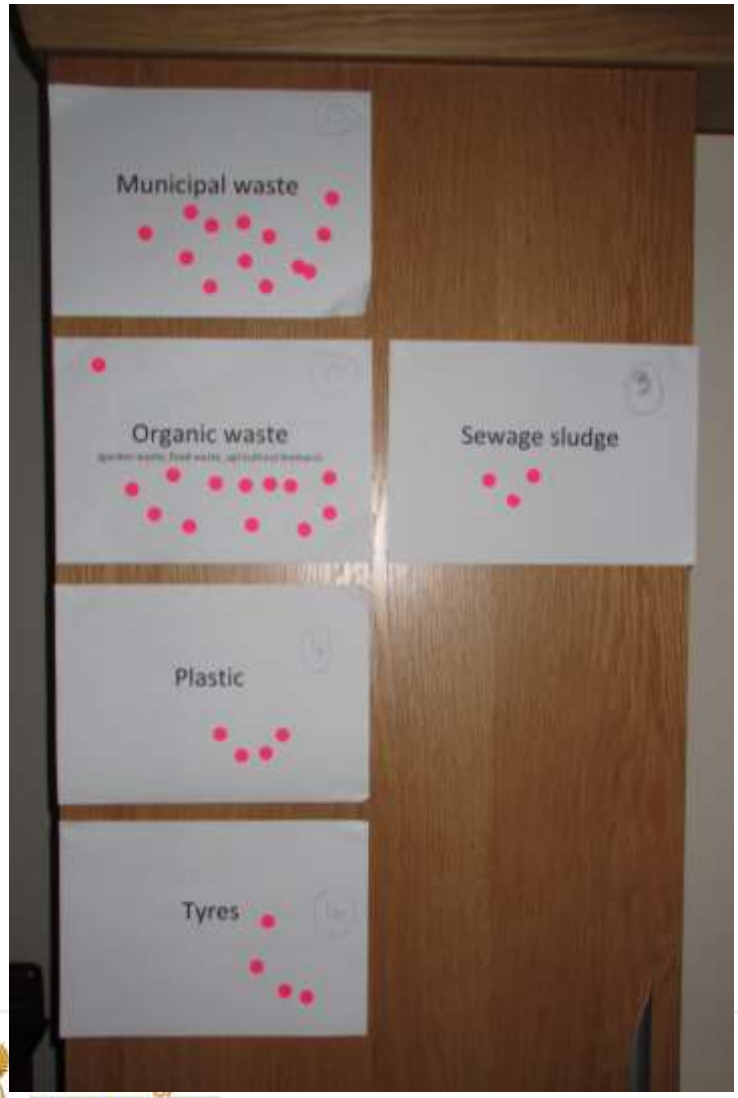
1. Valuing South Africa's waste

- So…
  - If there is 'value' (minimum **R25b**) available as secondary resources
  - If the value for most streams is greater than the cost of landfilling (R100-R200/T)
  - Why are we only recycling **~10%** of our waste?
- What are the barriers that need to be unlocked to recover "**maximum value**" from our waste?
- Can R&D and Innovation help unlock these barriers?

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

- Opportunities for waste RDI

2. Prioritizing waste streams



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2. Prioritizing waste streams

Stakeholder Goal Statements 10+ Years (Beyond 2024)		Likelihood of SA Realisation
1. Organic waste	Zero organic waste to landfill, with maximum value extraction (materials and energy)	Medium - High
2. Municipal waste	Maximise diversion of municipal waste to landfill (50% reduction in municipal waste to landfill), with significant increase in recycling and WtE	Medium – High
3. Tyres	100% end-of-life tyres collected and recycled, and significant decrease in backlog (stockpiles)	High
4. Plastic waste	Zero plastic waste to landfill by 2030	Pre-cons – High Post-cons – Low/Med
5. Electronic waste	50% diversion of e-waste from landfill by 2024 (12% currently)	High

2. Opportunities in waste

Attractiveness	
Customer Need	▸ Customer ▸ Outcome ▸ Outcome value ▸ Alternative Solutions
Potential	▸ Market Size ▸ Global Market Value ▸ SA Market Value ▸ Market Potential
Value and Impact	▸ Wealth ▸ Society ▸ Strategic Advantage
Fit	
Technology Know-How	
RDI Capacity and Infrastructure	
Partnerships	

Unpacked for each prioritised waste stream, by Expert Working Groups (made up of key stakeholders from business / industry)

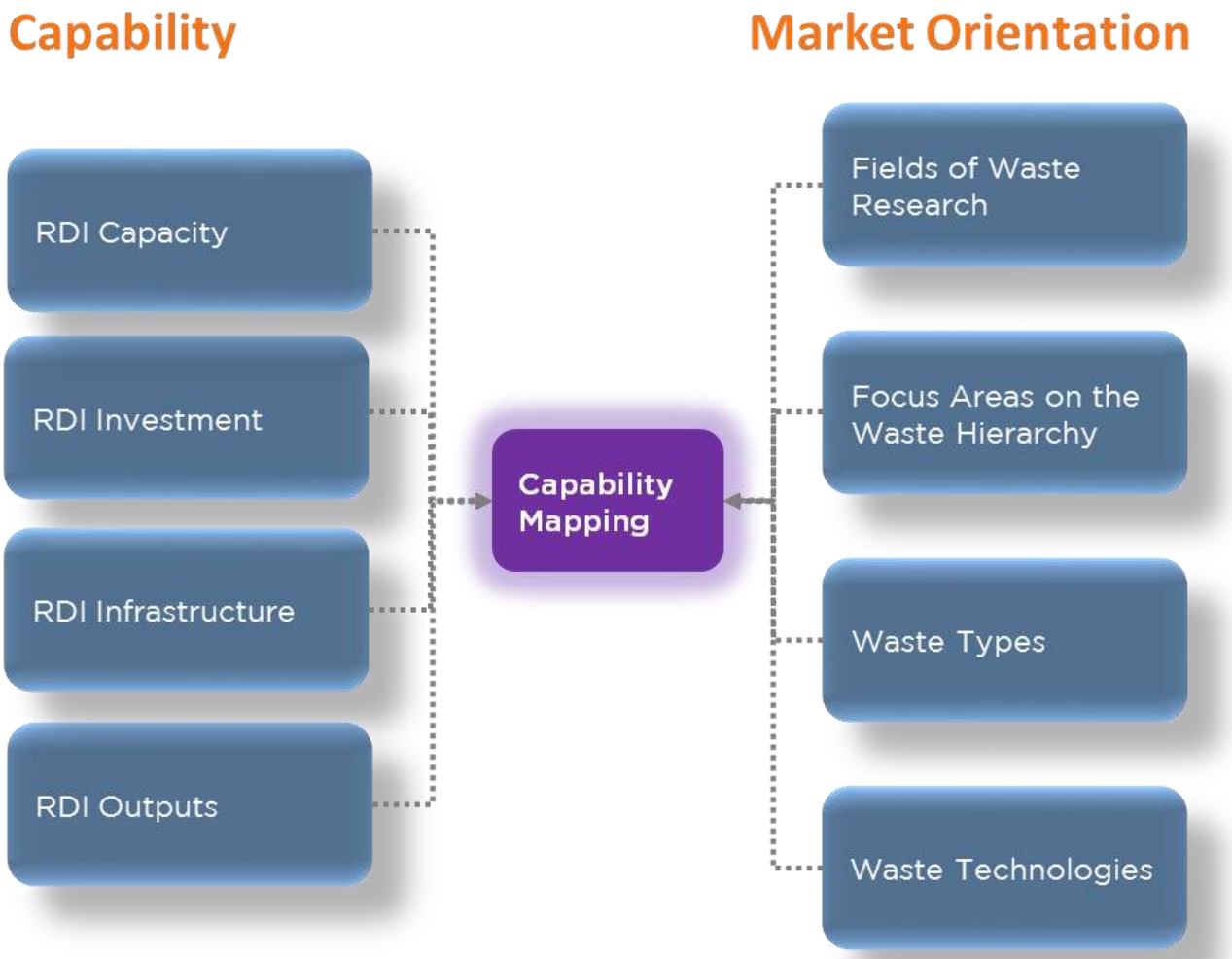
2. Opportunities in waste

Source (pre-/ post-consumption)	Collect	Process		Exploit
Generate	**Separate and Sort**	**Collect and Transport**	**Pre-Process**	**Recycle Recover**	**Manufacture**
▸ Best practice to create awareness /educate/ communicate to change behaviour ▸ Create awareness about handling of food along the value chain ▸ Create awareness of rising costs of landfill to consumer if behaviour patterns don't change ▸ Understand local recycling rates based on recoverables vs recycled in context of imports as well	▸ Best practice to create awareness /educate/ communicate to change behaviour ▸ Entrepreneurial job-creating activities to compliment/assist current collection and transport systems for more cost effective and improved services ▸ When does recycling use more resources than landfilling? (To communicate) How to lower environmental cost of recycling? ▸ How to change littering into recycling (Human behaviour); mind shift needed from job creation through littering to job creation through recycling ▸ Alternative separation at source options ▸ Rethink bin sizes and frequency of collections ▸ Best practice models for collection points	▸ Entrepreneurial job-creating activities to compliment/assist current collection and transport systems for more cost effective and improved services (without compromising reliability) ▸ Alternative energy transport ▸ Revisit rail transport feasibility ▸ Understand markets for different waste require different distances in transport	▸ Overseas trend is to go for larger and more costly capital investment in single stream MRFs – what is the best option for SA (technology vs labour- intensive approaches)? ▸ Best-case scenarios – we do have local good practice	▸ Trade-off between recycling and energy recovery (Long distances for recovery of recyclables increase cost) ▸ Understanding costs in investment vs job creation potential	▸ Need markets – green procurement policies at government and corporate levels

"Understanding South Africa's ability to respond to these opportunities"

- Capability mapping

3. Capability mapping



3. Capability mapping

Table 8. Waste Technologies

LEGEND:
- Subcritical
- Emerging
- Building
- Mature

	Waste Technologies																														
	Thermal					Biological/chemical															Mechanical/Physical						Landfill		
	Advanced Thermal Recycling	Plasma Arc Gasification	Pyrolysis	Pyrolysis/Gasification	Pyrolysis/Steam Reforming	Acid leaching	Advanced oxidation	Aerobic Digestion/Composting	Anaerobic Digestion	Arthropods	Bio-conversion to biocomposites	Biodiesel	Bioleaching/Chemical leaching	Biorefinery	Catalytic Cracking	Compressed biogenicgas	Enzymatic protein hydrolysis	Ethanol Fermentation	Syngas-to-Ethanol	Thermal Depolymerization	Alternative construction materials	Densification/pelletization	Encapsulation of nuclear waste	Recycling of nuclear fuel	Refuse -derived fuel (RDF)	Sorting/Classification	Landfill engineering	Landfill gas recovery	Landfill mining (sludge)
Cape Peninsula University of Technology				■	■							■													■				
University of Cape Town								■	■			■			■			■											
Central University of Technology								■	■												■				■		■		
Durban Institute of Technology																													
University of Fort Hare																													
University of the Free State																													
University of Johannesburg									■							■									■				
University of KwaZulu-Natal	■	■	■	■	■			■	■			■			■			■	■	■		■			■		■	■	
University of Limpopo	■	■	■	■	■			■	■			■			■			■	■	■		■			■		■	■	
Mangosuthu University of Technology																													
Nelson Mandela Metropolitan University																													
North-West University			■	■																		■	■	■					
University of Pretoria																													
Rhodes University																													
University of South Africa																													
University of Stellenbosch			■	■		■		■		■							■	■		■					■				
Tshwane University of Technology	■							■	■																		■		
Vaal University of Technology																													
University of Venda																													
Walter Sisulu University																													
University of the Western Cape							■					■			■				■										
University of the Witwatersrand																													
University of Zululand																													
CSIR	■		■	■				■	■		■	■		■							■								■
HSRC																													
Mintek	■	■	■	■									■													■			

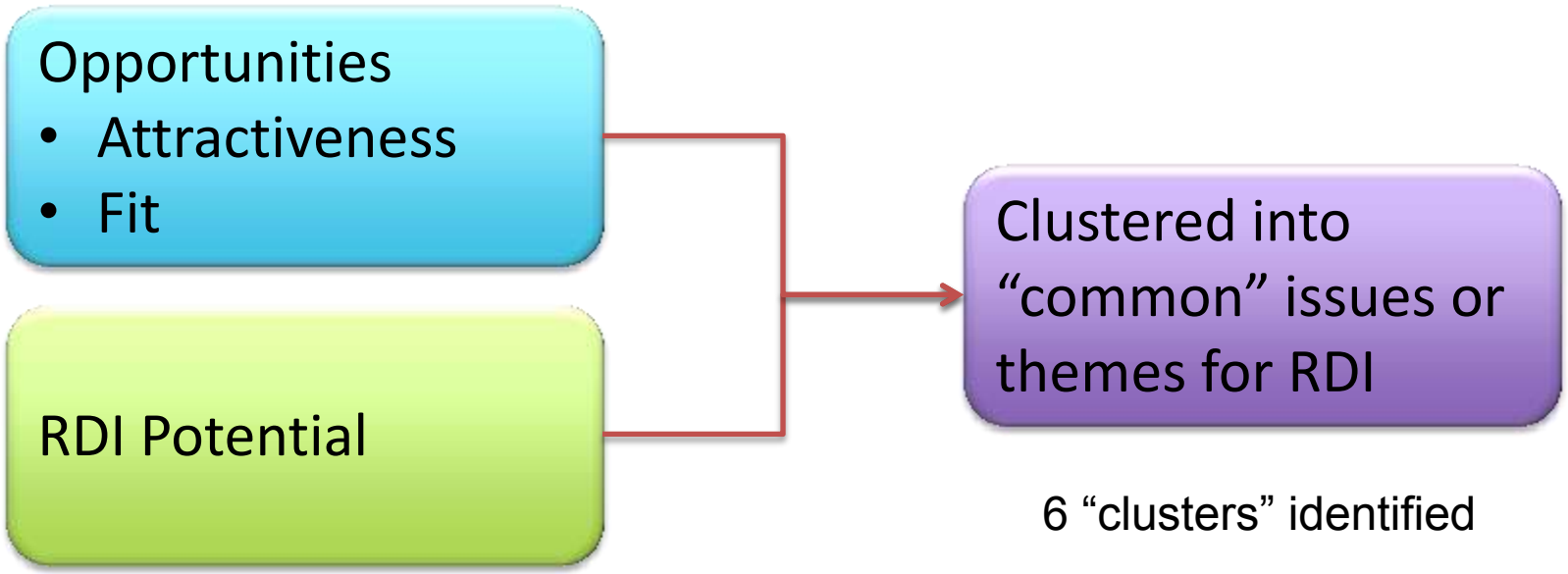
“Integrating into a Waste Research, Development and Innovation (RDI) Roadmap for South Africa”

- Implementation Framework

4. Implementation framework

Informed by Business / Industry Community

Unpacked by Science Community

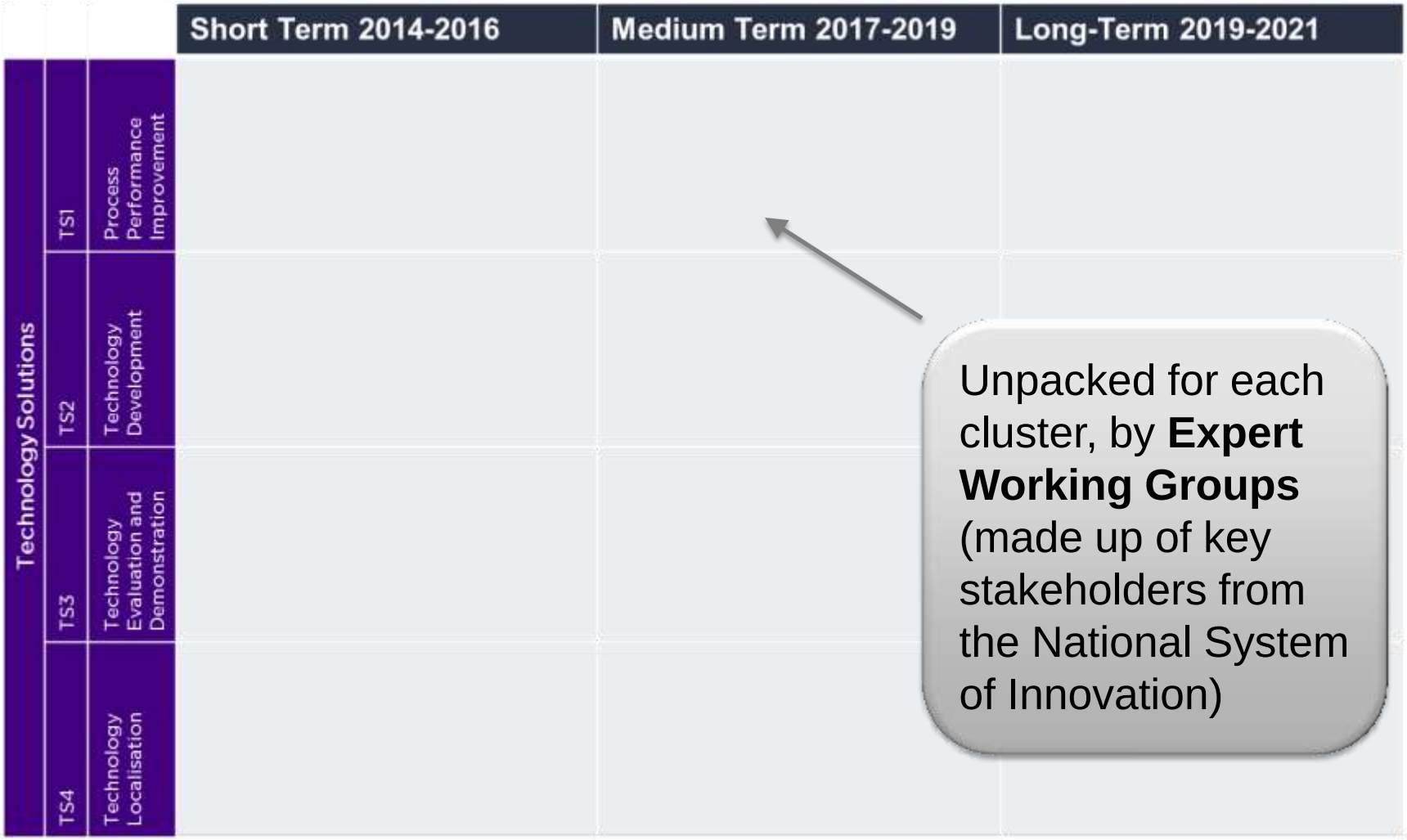


6 "clusters" identified

4. Implementation framework

Strategic Planning	Modelling and Analytics	Technology Solutions	Waste Logistics Performance	Waste and Environment	Waste and Society
Macro-Economics	Systems Analysis and Modelling	Process Performance Optimisation	Strategic Network Design	Aquatic	Jobs and Labour
Value Chain Strategy	Business Models	Technology Development	Planning and Management Systems	Land	Business Practices
Policy and Legislation	Socio-Economic and Environmental Modelling	Technology Evaluation and Demonstration	Operational Logistics Processes	Atmosphere	Behaviour
Governance	Impact Assessment	Technology Localisation		Climate Change	Awareness and Communication
	Monitoring and Evaluation				Human Health
Build and strengthen the basis and application of strategic analysis and advice for the purposes of evidence-based decision-making for the purposes of strategy formulation, planning and its execution and management	Methods, tools, techniques, platforms, systems and frameworks for the analysis, monitoring and evaluation of technical, economic and social and environmental opportunities and impacts associated with secondary resources	Design, development, evaluation, demonstration, localisation and deployment of technologies – both local and inbound – for customer-driven performance improvement	Optimisation of strategic, tactical and operational decision-making in respect of logistics objectives, assets and resources	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	Deepen understanding of waste-related opportunities and threats, to increase the success of influencing perception and practice positively

4. Implementation framework



Unpacked for each cluster, by **Expert Working Groups** (made up of key stakeholders from the National System of Innovation)

4. Implementation framework

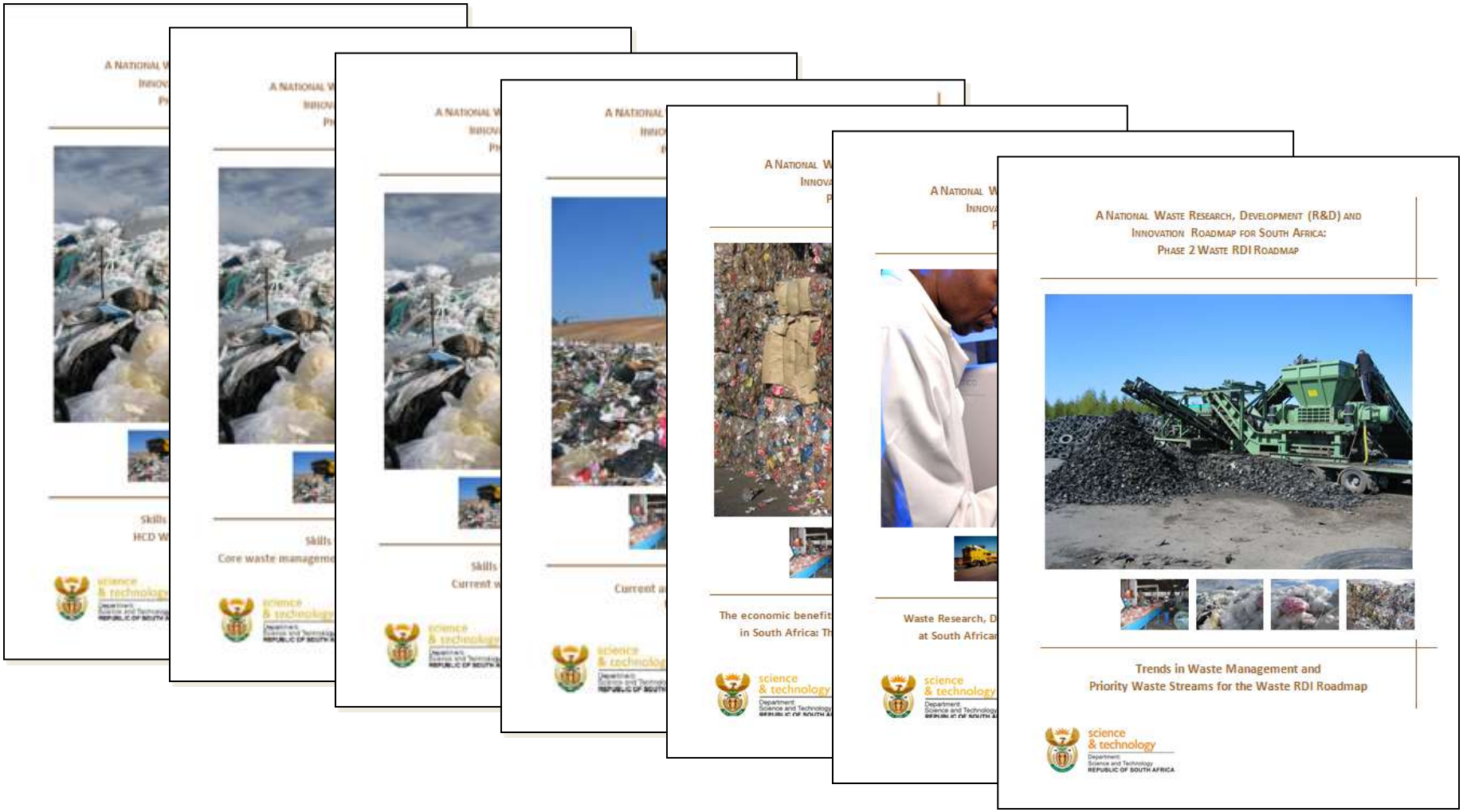
The **National Waste RDI Programme** is premised on –

- Maximising diversion of waste from landfill
- Towards value-adding opportunities
- Optimised extraction of value
- Lead to significant economic, social and environmental benefit, and a
- Sustainable regional secondary resources economy

The **contribution of R&D and Innovation** (RDI) is aimed at:

- More effective decision-making
- Faster insertion of context-appropriate Technology
- Export of Know-How and Technology
- Strengthened RDI capability and capacity

The Waste RDI Roadmap



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