A 10-Year Waste Research Development and Innovation Roadmap for South Africa
2015-2025

2015/16 Annual Progress Report

REFLECTING ON THE FIRST YEAR OF IMPLEMENTATION

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

CSIR
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CONTENTS

FOREWORD BY
THE DEPARTMENT OF SCIENCE AND TECHNOLOGY

The 2015/16 financial year was a landmark year for the Waste Research, Development and Innovation (RDI) Roadmap. The Roadmap was accepted by the Department of Science and Technology (DST) and the Council for Scientific and Industrial Research (CSIR) was formally appointed to implement it.

> Waste research, development and innovation cannot, on its own, transform the waste sector. **The Roadmap** is one mechanism being implemented by government, through the Department of Science and Technology, to **move waste away from landfilling**. To ensure success, the Roadmap must be adopted as part of a suite of **public and private sector responses** aimed at addressing the **challenges** currently facing the **waste sector.**

THE ESTABLISHMENT of the Waste RDI Roadmap Implementation Unit (WRIU) at the CSIR is the culmination of three years of development and extensive stakeholder engagement. The Roadmap responds to the research, development, and innovation requirements of the Department of Environmental Affairs' National Waste Management Strategy, the overarching goal of which is the improvement in the management of waste. This includes the increased diversion of waste from landfill, taking South Africa away from a situation in which 90% of solid waste goes to landfill, to one in which waste prevention, reuse, recycling and recovery are actively pursued. To achieve this requires the innovative deployment of both technological and non-technological innovations, such as improved institutional arrangements.

Initial economic modelling indicates that diverting waste from landfill could add an additional R17 billion to South Africa's GDP. This may seem a large figure, but indications are that this is a conservative estimate. In time, with increased understanding this estimate will be improved. A specific outcome envisaged through the implementation of the Waste RDI Roadmap, is an increase in small and medium enterprises across the value chain, which should lead to job creation.

It is clear that the management of waste is an important aspect of the transition to a green economy. It has the potential to be a crucial cog in an emerging circular economy. As the Industry Waste Management Plans, required by the Department of Environmental Affairs are finalised and implemented, and the waste tyre plan matures, South Africa will be amongst leading economies that manage their waste from cradle to cradle.

To achieve this, new skills will be needed. The Waste RDI Roadmap seeks to build additional high-end postgraduate skills, leading to the improved management of waste across the public and private sectors, and the development of innovative new technologies (as well as contributing to South Africa's research outputs in the form of international peer-reviewed publications). The DST has provided seed funding for the development of the first South African degree with a specific focus on waste management, a BSc Hons in Environmental Science with specialisation in Waste Management, to be offered by North-West University.

The DST looks forward to the continued successful implementation of the Roadmap, and its contribution to a greener economy in South Africa.

Mr Imraan Patel
Deputy-Director General: Socio-economic Innovation Partnerships

MESSAGE FROM
THE WRIU MANAGER, PROF LINDA GODFREY

Research, development and innovation (RDI) in waste and secondary resources management is an emerging field in South Africa. This was evident from the capability mapping conducted by the Department of Science and Technology (DST) in 2014, and from the low level of RDI investment over the past decade.

> South Africa has been **slow to embrace** alternative waste treatment technologies, despite the significant **social, environmental** and **economic opportunities** offered by this approach. In spite of clear policy objectives to move waste up the hierarchy **away from landfilling** towards **prevention, reuse, recycling** and **recovery**, an estimated **90%** of all waste generated is still disposed of to landfill. In this lies considerable **opportunity for research, development and innovation**.

FOR THIS REASON, receiving 27 proposals in response to the Waste RDI Roadmap open grant calls, and 36 applications for the postgraduate scholarship call, in 2015 was incredibly exciting. With the limited funding available for 2015, the calls were open only to South African universities, science councils and other public research institutions. It is encouraging to see how the existing nodes of excellence at universities and science councils are using the opportunities provided by the Waste RDI Roadmap to strengthen their standing, not only in the South African research community, but also in the African and global research arenas. A goal for 2016 will be to work with the universities to prepare them to respond to future calls under the Waste RDI Roadmap.

With the R10.4m made available by the DST for the first year of implementation (2015/16), we have been able to initiate 11 strategically aligned (2-3 year) research projects, nine (9) postgraduate (masters and doctoral) scholarships, and one targeted technology mapping project for the waste electrical and electronic equipment sector in South Africa. We strongly believe that the outcomes of these projects will significantly benefit the sector, by improving the way in which waste is currently managed, and by supporting the increased diversion of waste away from landfill towards value-generating opportunities.

We are also encouraged to see how business and industry responded to the Waste RDI Roadmap in 2015/16. We wanted to bring industry and academia closer together to ensure the relevance of our research in South Africa, and so the "Industry-meets-Science" workshop series was born. While business and industry do not have a strong footprint in investing in waste and secondary resources research in South Africa, their participation in the Roadmap this past year has been meaningful and valuable to us moving forward, and we will continue to strengthen these partnerships in 2016/17.

Since partnerships are key to delivering on the vision of the Roadmap, we are committed to strengthening existing partnerships and developing new ones with government, business and academia in 2016/17. An important part of this will be unlocking opportunities for local and international collaboration and using government funding to leverage co-investment in human capital development, research and development, and innovation.

The first year of implementing the Waste RDI Roadmap has laid a solid foundation for further work, and we look forward to building on this in the new financial year.

Prof Linda Godfrey
Manager: Waste Roadmap Implementation Unit

The CSIR Team:

Mr Bongani Memela
Manager: Strategic Initiatives

Prof Linda Godfrey
Manager: Waste Roadmap Implementation Unit

Ms Estee Opperman
Financial Manager

Ms Lulu Makapela
Contract Manager

Ms Nobuhle Makoko
Procurement Officer

Ms Biffy van Rooyen
Strategic Communications

Mr Beeza Mtamzeli
Strategic Communications

Mr Steve Szewczuk
Technical consultant

BACKGROUND AND OBJECTIVES

The Waste RDI Roadmap is an initiative of the Department of Science and Technology (DST) aimed at guiding South Africa's public and private sector investment in waste research, development and innovation (RDI) over the next 10 years (2015-2025).

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.

Background

The DST recognised the role that RDI could play in achieving the objectives of the National Waste Management Strategy, in moving waste up the hierarchy away from landfilling, and in transforming the South African waste sector in a way that could provide environmental, social and economic benefit for the country.

In 2012, the DST, in partnership with the CSIR, embarked on a process to develop the Waste RDI Roadmap. This process, which was shaped by business, industry, government and academia, culminated in early 2015 with the publication of South Africa's first Waste RDI Roadmap.

Objectives

With an investment ask of approximately R3.9 billion over the next 10 years, the successful implementation of the Roadmap is expected to assist government and industry to significantly increase the diversion of waste away from landfill towards value-adding alternatives, through more effective decision-making; faster insertion of context-appropriate technology; export of know-how and technology; and strengthened RDI capability and capacity.

The Roadmap, which is anchored in the mandate of the DST, is structured around three key pillars –

- human capital development (HCD)
- research and development (R&D)
- innovation (technological and social)

The Roadmap aims to address issues relating to five priority waste streams –

- municipal solid waste
- waste electrical and electronic equipment (WEEE)
- waste plastic
- organic waste
- waste tyres

Within six broad areas, or clusters, of activity –

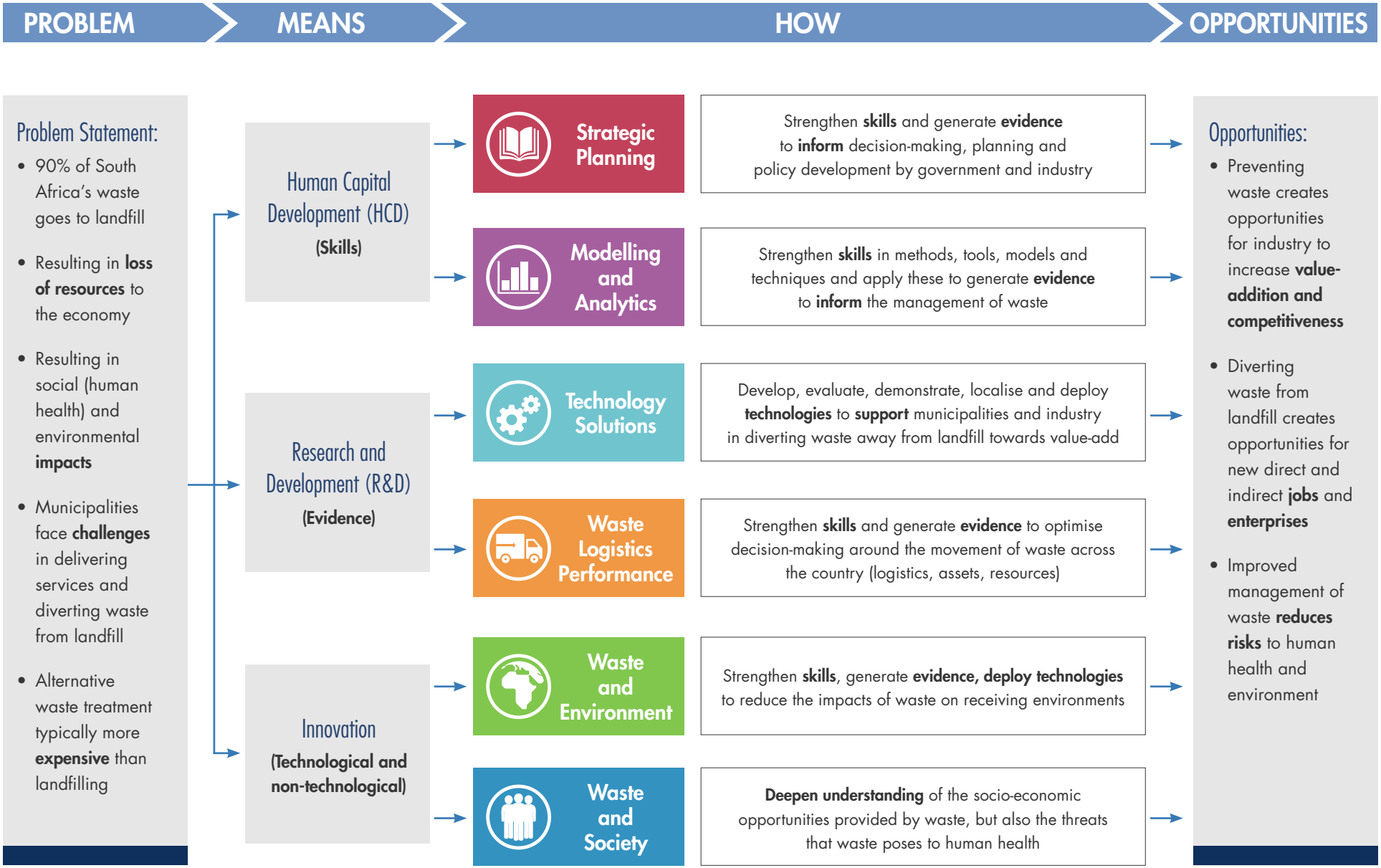
- strategic planning
- modelling and analytics
- technology solutions
- waste logistics performance
- waste and the environment
- waste and society

HUMAN CAPITAL DEVELOPMENT

RESEARCH & DEVELOPMENT

INNOVATION

PICTORIAL SUMMARY OF THE WASTE RDI ROADMAP



KEY FOCUS AREAS AND SERVICE OFFERINGS

Waste RDI Roadmap clusters and percentage of total investment per cluster expected (2015-2025)

As shown here, the bulk of the funding investment is planned for the *'Technology Solutions'* cluster, but with significant support to the other five clusters. With the funding available for the first year of implementation, the intention was to focus activities on three specific clusters, namely *"Technology solutions"*, *"Waste logistics performance"*, and *"Waste and society"*.

Waste logistics performance is an area in which South Africa has little RDI capability. No proposals were received against this cluster in 2015. Activities in waste logistics were deferred, to allow for a targeted approach to technology solutions, with a specific focus on organic waste and WEEE.

The focus of the Roadmap in 2015 has therefore been to fund activities in *"Technology Solutions"*, *"Modelling & Analytics"*, and *"Waste & Society"*. This was achieved using funding mechanisms such as non-recoverable grants, postgraduate scholarships, and targeted procurement processes. A series of calls and requests for proposals were issued by the CSIR in 2015/16 in support of the National System of Innovation (NSI).

Implementation

The CSIR was appointed by the DST to implement the Waste RDI Roadmap from 1 April 2015. The intention is for the CSIR, through the Waste RDI Roadmap Implementation Unit (WRIU), to drive human capital development (HCD), research and development (R&D) and innovation, in partnership with government, industry and academia; and to actively engage opportunities (local and international) for waste RDI collaboration and co-investment.

GOVERNANCE

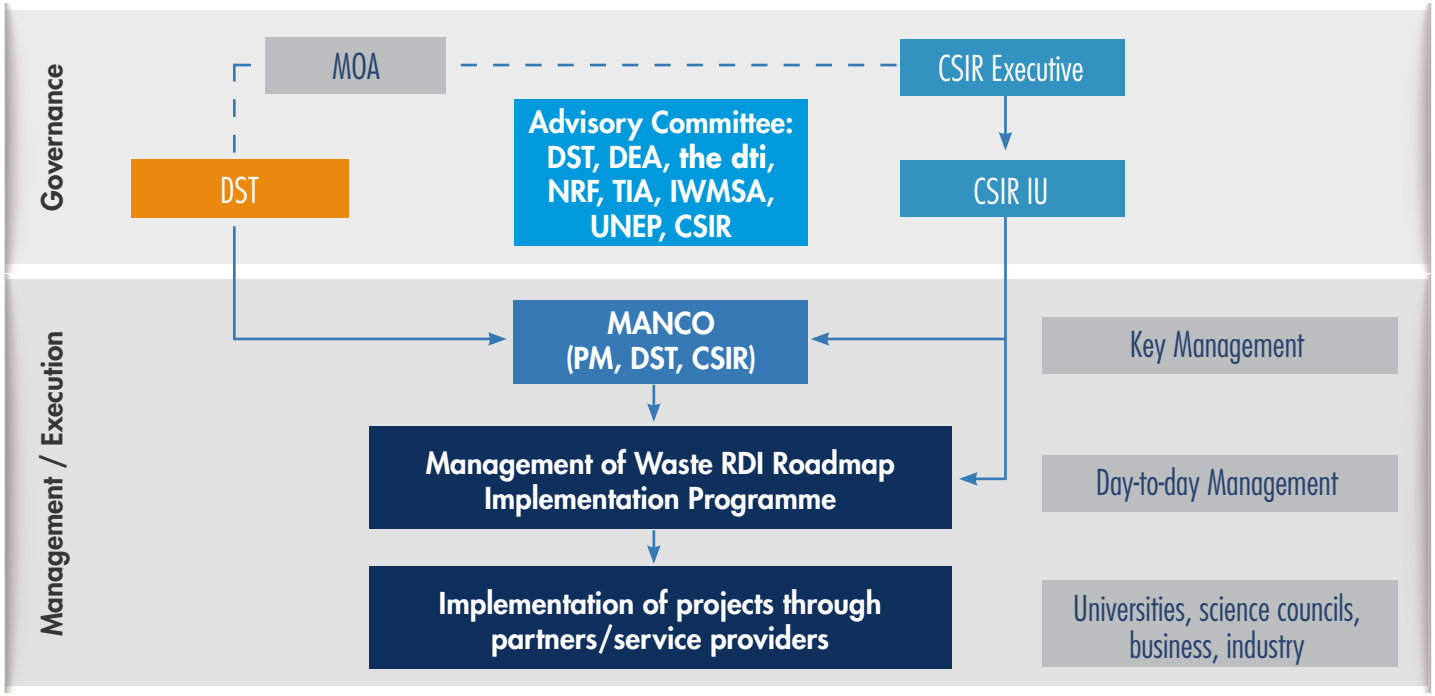
The Waste RDI Roadmap is implemented by the CSIR's Waste RDI Roadmap Implementation Unit (WRIU) in partnership with the DST, DST entities, other government departments, universities and science councils, business and industry. Effective governance and oversight of activities within the WRIU is fundamental to the Roadmap's implementation.

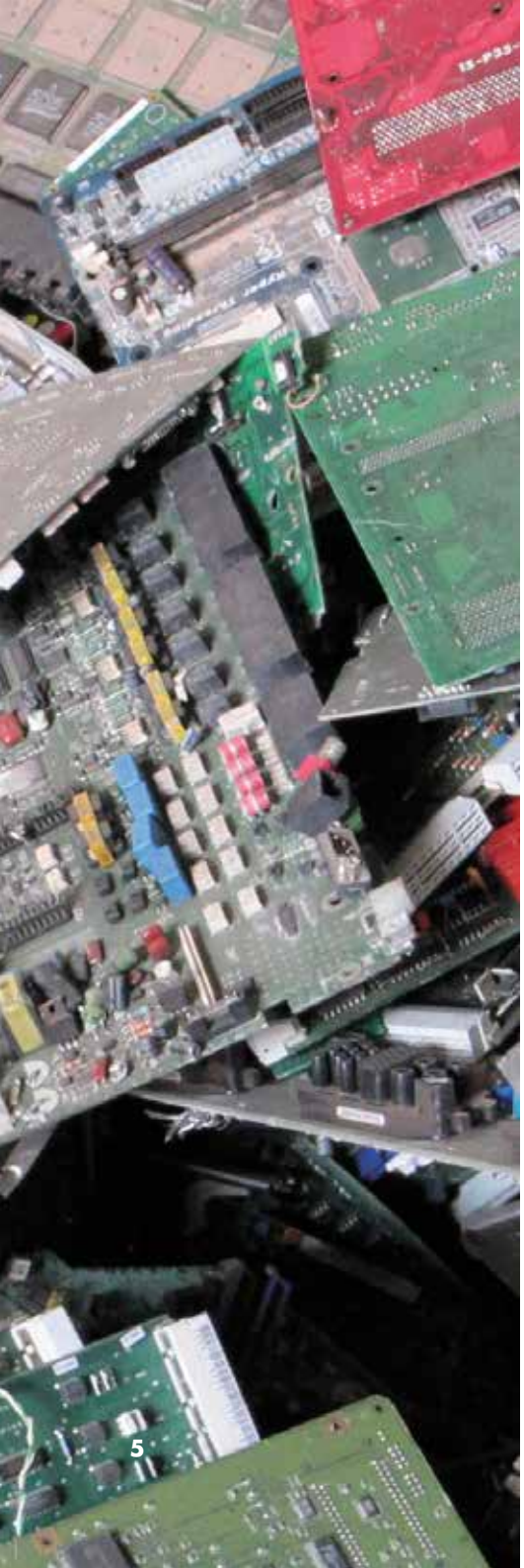
The WRIU is overseen by three governance structures –

1 an **Operations Committee**, made up of the DST Director: Environmental Services and Technologies and the WRIU Manager, who meet monthly, or more frequently if required, to discuss operational matters

2 a **Management Committee** (MANCO), made up of senior representatives of the DST and CSIR Implementation Unit, who meet annually, or more frequently if required, to discuss management and oversight issues; and

3 an advisory **Steering Committee**, made up of representatives of government, government entities and the waste sector, who are tasked with reviewing the progress of the WRIU and giving input on the planned activities for the following year.





REFLECTING ON 2015/16

RESEARCH, DEVELOPMENT AND INNOVATION

6 successful recipient research organisations

27 applications for R&D and Innovation grants

2 Industry-meets-Science workshops

8.4 MILLION RAND invested in the national system of innovation

36 MILLION RAND of R&D and innovation proposals received

11 research and innovation grants awarded

Launched: SA Bioplastics Forum

HUMAN CAPITAL DEVELOPMENT

9 postgraduate scholarships awarded

10 honours students completed their degree in waste management

36 applications for postgraduate scholarships

COMMUNICATION IMPACT

POPULAR ARTICLES

2 radio interviews

15 print articles highlighting the Waste RDI Roadmap

TOP DOWNLOADED PUBLICATIONS

2 447	Trends in waste management
1 148	South African Waste Sector Survey
1 083	The economic benefits of moving up the waste hierarchy
925	Current and required institutional mechanisms to support waste innovation
870	Waste management red meat abattoirs

WEBSITE

2 857	UNIQUE VISITORS
4 062	NUMBER OF VISITS
13 593	PAGES VISITED
17 737	DOCUMENT DOWNLOADS

TOP 5 COUNTRIES ACCESSING THE WASTE RDI ROADMAP WEBSITE

www.wasteroadmap.co.za

HUMAN CAPITAL DEVELOPMENT

Providing a pipeline of skilled postgraduates 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 postgraduate (honours, masters, doctoral) students and postdoctoral researchers

Strengthening postgraduate qualifications

In response to studies conducted by the DST in 2012 on the *"Core waste management skills and implementation modalities for an Innovative Waste Sector"*, the DST provided seed funding in 2014 and 2015 for the development of the first two postgraduate degrees in waste management – a BSc Honours (Environmental Sciences with specialisation in Waste Management), to be offered by North-West University, and a Masters (Waste and Resources Management) to be offered by the University of KwaZulu-Natal.

North-West University approved the honours degree in 2014 for inclusion in their 2015 academic programme. Ten full-time students enrolled for the degree in 2015, all of whom successfully completed the degree. The students for the 2016 academic year are all enrolled as part-time students. A part-time offering of the degree was important to the DST, to allow currently employed waste professionals to strengthen their academic qualifications.

The new master's degree was approved by the University of KwaZulu-Natal's Senate in November 2015 and submitted to the Council for Higher Education in December 2015. The degree is expected to be approved for inclusion in the university's 2017 academic programme.

Call for postgraduate scholarships

Two scholarship calls were issued by the WRIU in September 2015, for the 2016 academic year. The first was an open scholarship call aligned to the Roadmap. The second was a targeted scholarship call in partnership with Plastics|SA on specific waste plastic research questions.

Masters applications

A total of 28 masters scholarship applications were received under the open call (25) and the targeted call (3) – a total funding request of R2.24m for postgraduate studies commencing in 2016. Applications were received from nine (9) universities. The majority of the masters applications received focused on *"Technology solutions"* (61%) and *"Organic waste"* (57%). The emphasis on organic waste in the applications was not surprising, as it aligns directly with the findings of the capability mapping initiative completed by DST in 2014, which showed the highest research activity levels across South African universities and science councils to be in organic waste.

Doctoral applications

A total of eight (8) doctoral scholarship applications were received under the open call (6) and the targeted call (2) – a total funding request of R960,000 for postgraduate studies commencing in 2016. Applications were received from five (5) universities. As with the masters applications, the majority of doctoral applications focused on *"Technology solutions"* (88%). Equal interest in *"Organic waste"* (38%) and *"Waste plastic"* (38%) were received. *"Waste & Society"* was an area of interest for RDI across both the masters and doctoral applications, with the focus being predominantly on the informal waste and recycling sector.

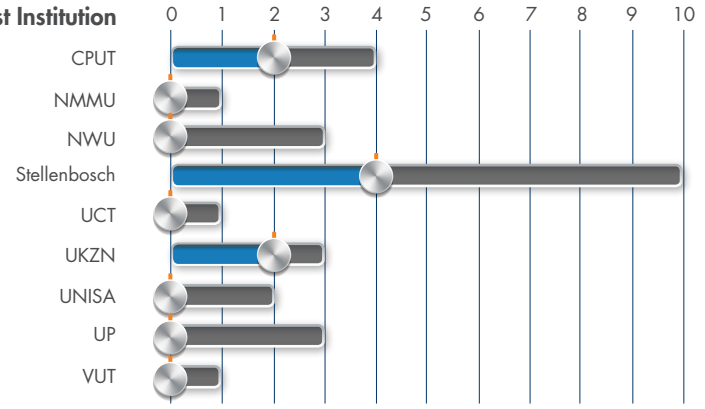
Awarded postgraduate scholarships

Of the 36 scholarship applications received, nine scholarships were awarded for 2016 (8 masters scholarships and one doctoral scholarship). The majority of the scholarships awarded (44%) are in organic waste valorisation (value recovery). In support of transformation of the waste sector, 56% of scholarships were awarded to black students, and 56% were awarded to female students.

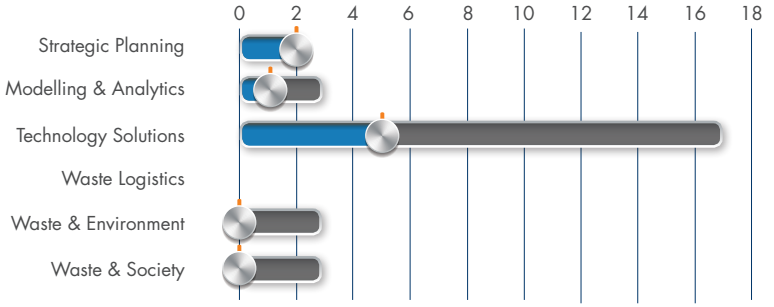
> In line with the national imperative of **equity** and **redress**, the Waste RDI Roadmap **scholarship programme** prioritised support for **appropriately qualified applicants** from designated groups viz. black and female, while ensuring that only applications that **meet the NRF merit review** and **selection criteria** are **supported**.

Thematic Spread of Master's Applications and Awards

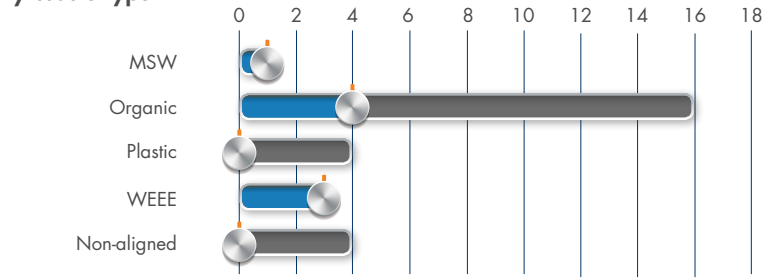
By Host Institution



By Cluster



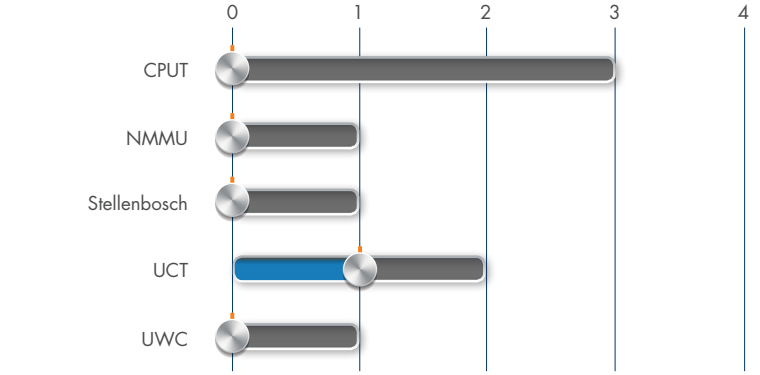
By Waste Type



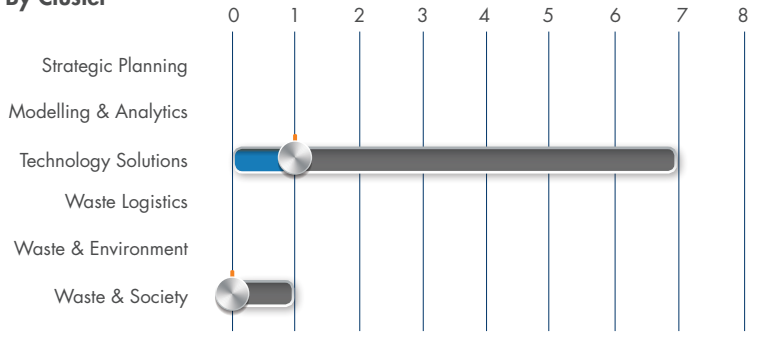
Awards Applications

Thematic Spread of Doctoral Applications and Awards

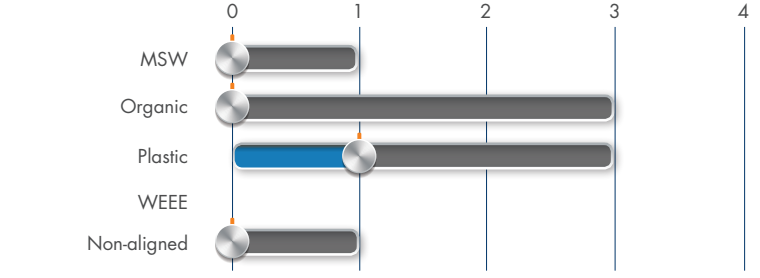
By Host Institution



By Cluster



By Waste Type



Awards Applications

RESEARCH AND DEVELOPMENT

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 African conditions through R&D

Call for open R&D grants

An open R&D call was issued by the WRIU in October 2015, for projects starting April 2016. The call was open to all public research institutions. Proposals had to be aligned with the six clusters and five priority waste streams of the Roadmap. However, since RDI in waste tyres is already being funded by REDISA, scholarships and grant applications for this waste stream were excluded from the 2015 call.

Applications received

A total of 22 grant applications were received under the 2015 open R&D call – a funding ask of R29.5m for R&D projects commencing in 2016. Applications were received from six (6) universities and science councils. As with the scholarship applications, the focus of R&D applications were largely on *"Technology solutions"* (59%) and *"Organic waste"* (50%).

All of the grant applications on organic waste, focussed on the opportunities of recovering valuable resources from these waste streams, and drove a strong biorefinery agenda. Support for these proposals provided an opportunity to strengthen RDI investment in the valorisation of organic waste, thereby giving effect not only to the DST's 10-year Waste RDI Roadmap, but also the Bio-Economy Strategy.

The proposals received under the R&D and the Innovation calls, identified a number of local and international research partners. Universities and science councils were the most frequently included research partners (67%). However, it was very encouraging to see the research partnerships with industry (30%), including planned industry co-investment. While the majority of the research partners were based in South Africa (82%), there were also partners from other African countries, Australia, and across the European Union.

Awarded R&D grants

Of the 22 grant applications received, 10 projects were awarded to South African public research institutions, starting in 2016. With the proposals focussing strongly on organic waste beneficiation, the DST and WRIU adopted a programmatic approach to this funding call, by awarding seven (7) projects in the area of organic waste valorisation. The remaining projects awarded under the call, focussed on municipal solid waste and WEEE.

Targeted waste RDI

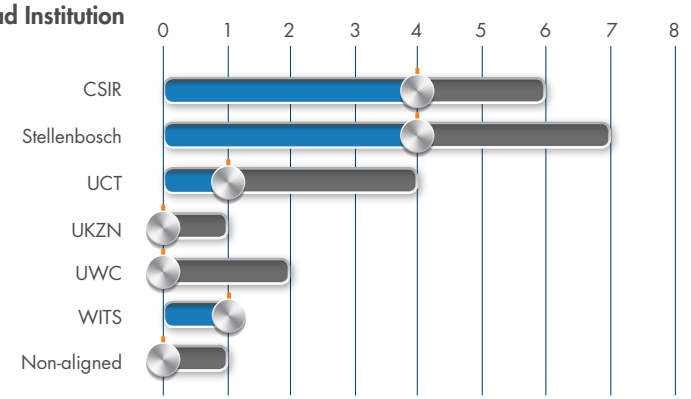
Growing interest in WEEE R&D and innovation was evident in both the 2015 scholarship and grant applications. This is very encouraging given that it was an area identified as having low research activity levels in the capability mapping initiative undertaken by the DST in 2014.

From the review of the applications received in 2015, it was evident that work needs to be done to inform future strategic investment in this cluster – in particular, to map out the future research priorities for WEEE RDI in South Africa. In response to this need, the WRIU published a request for proposals in March 2016 to map South Africa's WEEE dismantling, pre-processing and processing technology landscape. Five proposals were received and evaluated by a technical review panel. The outcomes of the research are expected to guide future investment in RDI and to inform the sector's discussion on the opportunities and challenges to investing in local WEEE technology. The results of this research are expected in the 2016/17 financial year.

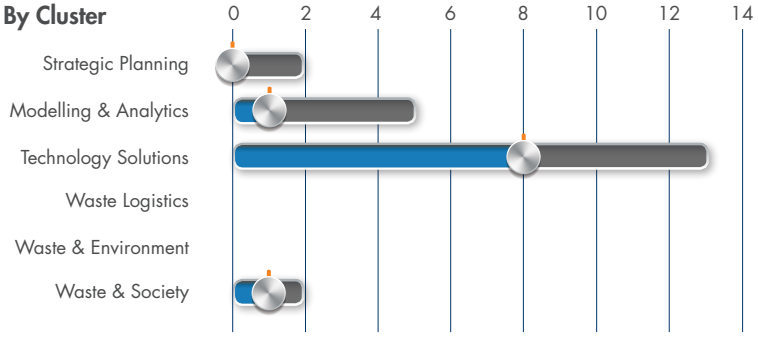
> The programmatic **investment in R&D projects** addressing organic waste valorisation, has allowed the WRIU to launch the **South African Biorefinery Research Platform**. This platform is aimed at consolidating and strengthening research on **biomass** and **organic waste** in South Africa, thereby maximising the opportunities for **value recovery** in the form of biochemicals and biopolymers **from these waste streams**.

Thematic Spread of R&D Grant Applications and Awards

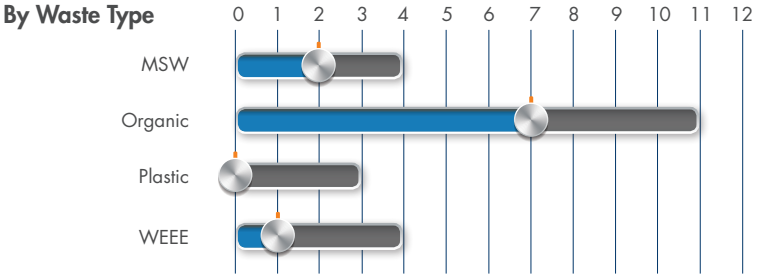
By Lead Institution



By Cluster

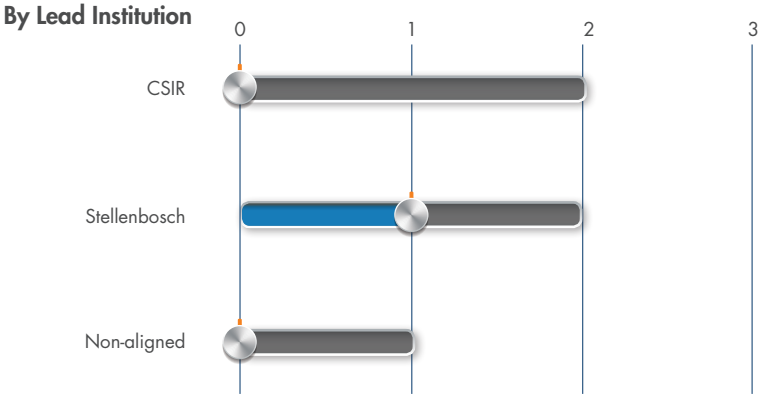


By Waste Type

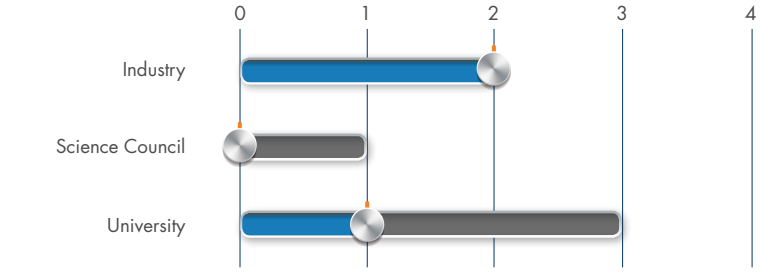


Thematic Spread of Innovation Grant Applications and Awards

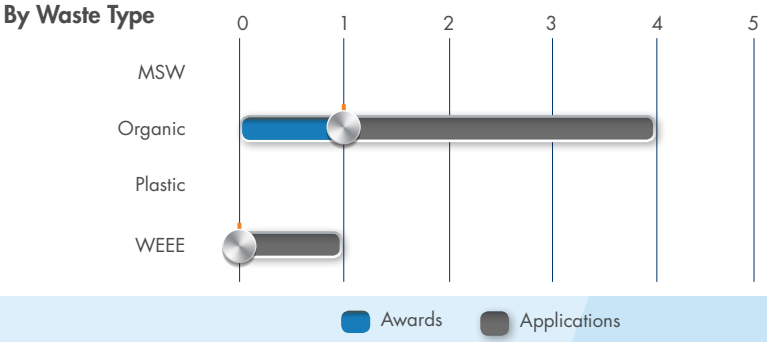
By Lead Institution



By Partner Institution



By Waste Type



INNOVATION

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

Call for open innovation grants

An open innovation call for proposals to upscale technologies from Technology Readiness Level (TRL) 3, was issued by the WRIU in October 2015, for projects starting in April 2016. The calls were open to all South African public research institutions. Proposals had to be aligned to the six clusters and five priority waste streams of the Roadmap.

Applications received

Five (5) grant applications were received under the call – a total funding ask of R6.57m for innovation projects commencing in 2016. Applications were received from one university and one science council. All of the applications received responded to the *"Technology Solutions"* cluster of the Roadmap, particularly the *"Evaluation and demonstration"* (60%) and *"Process performance optimisation"* (40%) sub-clusters. The focus of upscaling technologies was largely on opportunities to beneficiate *"Organic waste"* (80%).

Awarded innovation grants

Of the five (5) grant applications received, only one (1) project was awarded. The project is focussed on the extraction of value from solid waste by pyrolysis conversion, through pilot scale optimisation.

Industry-meets-Science workshop series

The Industry-meets-Science workshop series is an important instrument of the Waste RDI Roadmap implementation. It is aimed at strengthening research collaboration between industry and academia, by bringing experts from both sectors together to share on specific topics. Two workshops were held in 2015/16.

Bioplastics

The first workshop on *"Bioplastic opportunities for South Africa"*, was held at the CSIR in Durban on the 21 January 2016. The aim of the workshop was to explore whether South Africa can create a local bio-based plastic industry, in order to develop new market opportunities for existing resources in the sugar, forestry, and paper sectors; to drive local content in biobased products already on the market in South Africa; and to stimulate local economic development and job creation.

> The **total funding commitment** made by the Waste RDI Roadmap Implementation Unit in **2015/16**, in waste R&D and Innovation projects, was **R14.8m** over the **next three years**.

Workshop delegates actively discussed the viability of creating a local bioplastics industry; opportunity feedstocks; obstacles to a local bioplastics industry; and current gaps in knowledge.

The most immediate opportunities for bioplastics include the production of bio-based, non-degradable plastics. This is being driven largely by Coca-Cola's commitment to their PlantBottle™, which currently contains up to 30% bio-based polyethylene terephthalate (PET). Workshop delegates had the opportunity to engage via video-conference with Michael Knutzen, Global Program Director for the PlantBottle™ who is based in Atlanta in the USA. Participants discussed the opportunities for South Africa as a potential future market for the production of bMEG and bPET used in the manufacture of bioplastic PET bottles. Further engagement between the South African government and Coca-Cola is planned.

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 in Durban. The aim of this forum is to support the growth of the bioplastics economy in South Africa.

The bioplastics workshop also highlighted the need to better showcase South Africa's research in organic waste valorisation. As a result, the DST through the WRIU has initiated the development of the **South African Biorefinery Research Platform**, a web platform aimed at showcasing South Africa's research on the valorisation of biomass and organic waste generated in the country. The platform, which will be developed in the coming year, will allow users to search for waste-related biorefinery research being conducted by South Africa research organisations.

Waste electrical and electronic equipment

The second Industry-meets-Science workshop on *"Technology solutions for addressing Waste electrical and electronic equipment (WEEE)"*, held at Mintek in Johannesburg on the 8 March 2016, aimed to explore the main obstacles or challenges facing South Africa with respect to WEEE recycling; new opportunities for increasing WEEE recycling in the country; and current gaps in knowledge (to guide future targeted R&D in support of industry).

WEEE recycling in South Africa remains relatively small, despite the potential value of metals available in the products. Furthermore, a large percentage of the valuable resources recovered from WEEE are exported from South Africa for reprocessing overseas. According to the sector, the non-availability of local technology is a limitation to further WEEE recycling. Representatives of the WEEE recycling industry who were present at the workshop, noted that investment in local, appropriate WEEE recycling technology is necessary to increase local recycling rates.

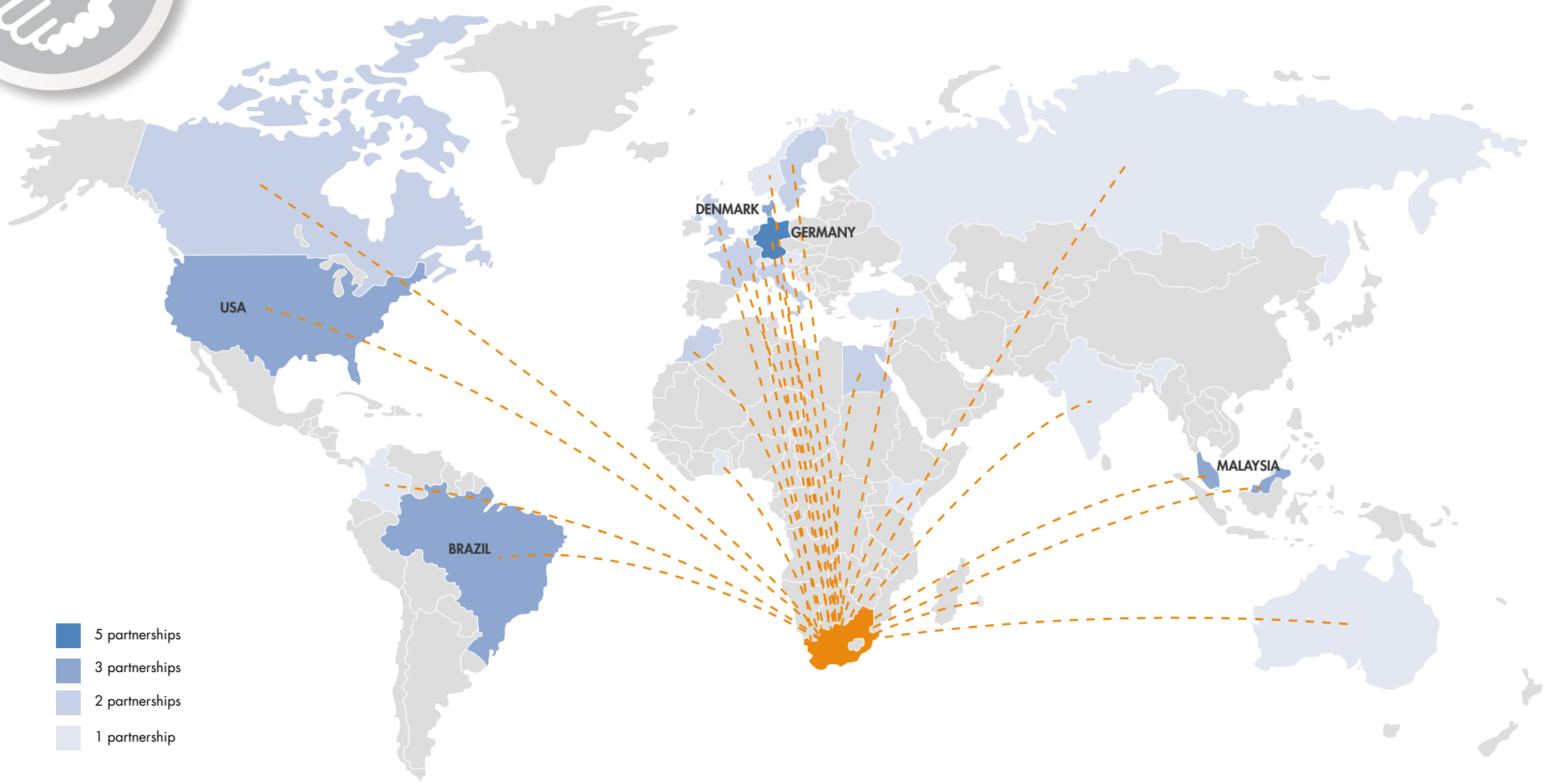
The results of the WEEE technology landscape mapping project (first referenced above) are expected to inform the sector's discussion on the opportunities and challenges of investing in local WEEE technology. Through the findings of this research, it is hoped that the sector will consider the adoption of context appropriate technological solutions to deal with the increasing quantities of WEEE being generated in South Africa, and where possible, to retain these waste streams in South Africa for beneficiation, as far as possible down the value chain.

Above: Delegates of the Bioplastics Industry-meets-Science workshop held in Durban, 21 January 2016.

All Industry-meets-Science workshop presentations and reports are available online at **www.wasteroadmap.co.za**

PARTNERSHIPS

Existing international waste RDI partnerships, reflecting all country partnerships and the top 5 partnerships by number of research projects



A **partnership** between government departments allows us to **achieve the goals set out in national policy**, while addressing issues of e**nvironmental protection, economic development, and technological and social innovation** in a more **holistic** and **integrated manner**

Government

The Waste RDI Roadmap is intended to support a number of national government departments in the implementation of their mandates, including the Departments of Environmental Affairs, Trade and Industry, and Cooperative Governance and Traditional Affairs.

Local government is an important priority of the Roadmap, with municipal solid waste being identified as one of the five priority waste streams. The intention is that the Roadmap directly benefit local government by strengthening human capital, facilitating evidence-based decision-making, and informed adoption of alternative waste treatment technologies. The WRIU is currently in discussion with one of the metropolitan municipalities to manage their Waste RDI Portfolio.

Business

Stronger partnership with the private waste and secondary resources sector is core to the Roadmap. Through partnerships with business, the Roadmap aims to drive directed RDI to addressing the key issues facing the sector. The industry associations and material organisations are particularly important partners in strengthening ties with the private sector. Plastics|SA has been a key partner in 2016/17, partnering on a targeted postgraduate scholarship call and the SA Bioplastics Forum. To further support the sector, it is recommended that 2% of the new EPR levies, proposed by DEA under the Industry Management Plans, be dedicated for R&D.

Academia

Universities and science councils are at the heart of the Waste RDI Roadmap, undertaking much of the RDI necessary to successfully redirect waste away from landfill.

International

While South Africa has a young, emerging waste and secondary resources research community, the existing local pockets of scientific excellence have already developed partnerships with international research organisations in over 25 countries. The countries with the highest number of SA research partnerships include Germany, Denmark, Brazil, USA and Malaysia (map on opposite page). The European Union member states are important partners in this field, with research organisations from at least 11 EU countries partnering with South African universities and science councils. Research collaboration with the EU has been given priority in terms of *"Building a Joint European and African Research and Innovation Agenda on Waste Management"*, agreed to by the EU and African Union in 2014. With the establishment of the **Africa Waste RDI Network** by the WRIU in 2015, Africa will be a focus for the coming year of implementation.

IMPACT

The impact that the Waste RDI Roadmap aims to achieve, is to support the improved management of waste and the increased diversion of waste away from landfill towards alternative waste treatment technologies, thereby maximising the potential environmental, social and economic benefits.

The following research, development and innovation outputs are anticipated from the Roadmap over the 10 years, when fully supported:

		Target
Human Capital Development	Post Docs	65
	PhDs	165
	Masters	245

		Target
Knowledge Generation	Registered patents	25
	Patent applications	70
	Publications	590

		Target
Technology Development	Products and services to market	4
	Technology packages	20
	Prototypes	60

Other key indicators of impact include increased investment in waste RDI, and increased waste RDI collaboration between the South African research community and the private waste and secondary resources sector.

While it is too soon to measure the impact of most Roadmap outputs after only one year of implementation, the WRIU has supported activities that will produce RDI outputs in line with these targets. Furthermore, the WRIU has driven and/or participated in activities that have directly increased RDI collaboration with the private sector; technical advisory services to government and industry; and collaboration in the international waste RDI arena.

The WRIU staff have engaged with, and provided specialist advisory support to, among others –

South Africa –

- Department of Environmental Affairs
- Department of Trade and Industry
- State owned enterprises
- Development Bank of Southern Africa (DBSA), Green Fund
- Plastics and packaging sector (including PETCO, Packaging | SA, Plastics | SA, Sustainability Council)
- Various international beverage companies (with footprints in South Africa), and their associated packers/fillers
- WEEE sector (including eWASA, HP, SAEWA)
- Various Eastern and Western Cape green economy, innovation and green skills forums

International –

- European Commission
- EU Horizon 2020 EWIT project team
- EU Horizon 2020 WASTECOSMART project team
- German Academy of Sciences Leopoldina
- Global Network of Science Academies
- Global Young Academy (GYA)
- United Nations International Labour Organization (ILO)
- United Nations Environment Programme (UNEP)

FINANCIAL STATEMENT

All financial figures are exclusive of VAT.

REVENUE	2015/16
DST seed funding	10 432 456.13
Other revenue	0.00
Total Revenue	10 432 456.13

EXPENSES	
Communications	4 095.00
Consultants	95 860.00
CSIR Project Management Unit	1 197 518.80
Non-recoverable innovation grants	1 500 000.00
Non-recoverable R&D grants	2 290 063.35
Postgraduate scholarships	905 000.00
Traveling (domestic)	46 881.50
Traveling (international)	19 589.02
Workshops and general running	13 488.46
Total Expenses	**6 072 496.13**
Income for continuing operations [1]	**4 359 960.00**
Net Income	**0**

Notes to financial statement:

(1) Income for continuing operations is funding for projects awarded in 2015/16 for which disbursements will be made early in the 2016/17 financial year. This includes funding for the first year of four grant projects (2016/17) for which funding will be transferred in April 2016, and one contract research project on WEEE which is to commence in May 2016.

THE OUTLOOK FOR 2016/17

South Africa, like most emerging economies, faces a difficult economic climate for the foreseeable future, with government and business cutting back on expenditure. This has a direct impact on South Africa's ability to invest in waste RDI, despite the social, economic and environmental benefits that can be realised when diverting waste away from landfilling towards prevention, reuse, recycling and recovery.

The focus for the coming financial year therefore remains firmly on –

- closely monitoring currently funded postgraduate studies and research projects to ensure maximum impact through this first phase of investment
- increasing national activity in waste RDI through industry and government partnerships
- ensuring that investments in waste RDI are strategic, and research outputs are relevant, thereby increasing impact and supporting uptake by local and regional partners
- increasing waste RDI collaboration between South Africa and Africa, and other key international partners
- strengthening the investment in local waste RDI through, among others, country-to-country bilateral agreements and industry partnerships
- supporting local government in the evaluation and demonstration of alternative waste treatment technologies

If the opportunity for new funding arises, the WRIU will continue to implement –

- calls for postgraduate scholarships
- calls for R&D and innovation grants
- targeted requests for proposals

Our sights remain firmly on achieving the vision and mission of the 10-year Waste RDI Roadmap and the anticipated RDI outputs.

ANNEXURES

ANNEXURE 1: **WASTE RDI ROADMAP SCHOLARSHIP PORTFOLIO**

No	Applicant	Title	Aligned with priority waste	Aligned with cluster	University	Supervisor	Funding instrument	Funding term
1	**Ms B April**	Beneficiation of wastewater sludge generated from the edible oil industry for the production of biodiesel	Organic waste	Technology solutions	Cape Peninsula University of Technology	Dr P Welz	Masters scholarship	2016 – 2017
2	**Ms S Chetty**	Can the ISO14062 standard reduce the environmental risks posed by e-waste	WEEE	Strategic planning	University of KwaZulu-Natal	Mr R Lottering	Masters scholarship	2016 – 2017
3	**Mr JP du Toit**	The conversion of recalcitrant organic wastes into hydrogen and other valuable products using Rhodopseudomonas palustris in a novel photobioreactor system	Organic waste	Technology solutions	Stellenbosch University	Dr R Pott	Masters scholarship	2016 – 2017
4	**Registration pending**	(Final title pending)	Plastic	Technology solutions	University of Cape Town	Prof S Harrison	Doctoral scholarship	2016 – 2017
5	**Mr R Nchabereng**	Recovery of precious metals from printed circuit boards (PCBs)	WEEE	Technology solutions	Cape Peninsula University of Technology	Mr M Aziz	Masters scholarship	2016 – 2017
6	**Ms M Nider-Heitmann**	Modelling processes for valuable products from sugarcane harvesting and processing waste and by-product residues	Organic waste	Modelling and analytics	Stellenbosch University	Prof J Görgens	Masters scholarship	2016 – 2017
7	**Mr G Potgieter**	Refining the recycling of printed circuit board (PCB) waste through component characterisation and classification	WEEE	Technology solutions	Stellenbosch University	Dr C Dorfling	Masters scholarship	2016 – 2017
8	**Ms J Swart**	Establishing a manufacturing process for monocalcium phosphates and gelatin from monkfish bones	Organic waste	Technology solutions	Stellenbosch University	Dr N Goosen	Masters scholarship	2016 – 2017
9	**Mr S Thakur**	Comparative study of two rural areas in respect of waste management	Municipal waste	Strategic planning	University of KwaZulu-Natal	Dr M Hansen and Dr A Nel	Masters scholarship	2016 – 2017

ANNEXURE 2: **WASTE RDI ROADMAP PROJECT PORTFOLIO**

No	Applicant	Title	Aligned with priority waste	Aligned with cluster	Principal Investigator	Funding instrument	Funding term
2016_1	**University of the Witwatersrand**	Lessons from waste picker integration initiatives – Development of evidence based guidelines to integrate waste pickers into South African Municipal Waste Management Systems	MSW	Waste & Society	Dr M Samson	Non-recoverable open R&D grant	4/2016 – 3/2019
2016_2	**CSIR (NRE)**	A Decision Support Tool for Implementing Municipal Waste Separation at Source: Incorporating Socio-economic and Environmental Impacts	MSW	Modelling & Analytics	Mr A Nahman	Non-recoverable open R&D grant	4/2016 – 3/2018
2016_3	**CSIR (NRE)**	Beneficiation of forestry biomass waste streams	Organic	Technology solutions	Dr B Sithole	Non-recoverable open R&D grant	4/2016 – 3/2019
2016_4	**CSIR (NRE)**	Valorisation of chicken feathers	Organic	Technology solutions	Dr B Sithole	Non-recoverable open R&D grant	4/2016 – 3/2019
2016_5	**CSIR (MSM)**	Sustainable utilization and conversion of post-harvest agricultural waste residues into value added materials	Organic	Technology solutions	Dr M John	Non-recoverable open R&D grant	4/2016 – 3/2019
2016_6	**University of Cape Town**	Value recovery from solid confectionary waste	Organic	Technology solutions	Prof S Harrison	Non-recoverable open R&D grant	4/2016 – 3/2019
2016_7	**Stellenbosch University**	Reactor design for industrial furfural production from sugar cane agricultural residues	Organic	Technology solutions	Prof J Görgens	Non-recoverable open R&D grant	4/2016 – 3/2018
2016_8	**Stellenbosch University**	Biogas and volatile fatty acids biorefinery by co-digestion of fruit juice industry solid and liquid wastes with lignocellulosic biomass	Organic	Technology solutions	Prof J Görgens	Non-recoverable open R&D grant	4/2016 – 3/2018
2016_9	**Stellenbosch University**	Organic waste: a bioresource for production of novel cellulose nanocomposites	Organic	Technology solutions	Dr A Chimphango	Non-recoverable open R&D grant	4/2016 – 3/2019
2016_10	**Stellenbosch University**	Amino acid leaching of metals from printed circuit board waste	WEEE	Technology solutions	Dr C Dorfling	Non-recoverable open R&D grant	4/2016 – 3/2018
2016_11	**Stellenbosch University**	Extraction of value from solid waste by pyrolysis conversion: Pilot scale optimisation	Plastics	Technology solutions	Prof J Görgens	Non-recoverable open innovation grant	4/2016 – 3/2018

June 2016

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Proofreading: DST and CSIR Communications
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Design: Creative Vision (082 338 3742)

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