SCIENCE, TECHNOLOGY AND INNOVATION FOR A CIRCULAR ECONOMY

2020/21
ANNUAL PROGRESS REPORT

Waste Research Development and Innovation Roadmap South Africa

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR
Touching lives through innovation

SCIENCE, TECHNOLOGY AND INNOVATION FOR A CIRCULAR ECONOMY

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MESSAGE FROM THE DEPARTMENT OF SCIENCE AND INNOVATION

Dr Henry Roman

Ms Georgina Ryan

The DSI Team:

Dr Henry Roman
Director:
Environmental
Services and
Technologies

Ms Georgina Ryan
Deputy Director:
Green Economy

The implementation of the Waste Research, Development and Innovation (RDI) Roadmap has successfully completed its sixth year of implementation. The last year was a tough year globally with countries grappling with the impact of the pandemic.

It was during the initial 'lockdown' that the working conditions of waste reclaimers became national news. How would informal workers so vital to the recycling economy of our country protect themselves from the virus, while still earning an income? In 2020 the DSI in partnership with the Department of Forestry, Fisheries and Environment (DFFE) published the Waste Picker Integration Guideline for South Africa, the culmination of a 3-year research grant awarded to the University of the Witwatersrand. While a good example of evidence-based policy making in the South African waste sector, demonstrating how the NSI can contribute to the socio-economic growth of our country, this guideline provides a very real tool to improve the lives and working conditions of the informal waste sector.

Over the six years of implementation, the Roadmap has consistently maintained a strong investment focus on technology development, with the largest funding allocation (55%) directed to the Technology Solutions Cluster in 2020/21. This at a time when the DSI is considering the establishment of a Waste Technology and Innovation Centre (WTiC) in partnership with other government departments such as DFFE. This Centre is to provide guidance on the uptake of Alternative Waste Treatment Technologies to both municipalities and businesses in order to fast-track the diversion of waste from landfill.

In the past financial year, a total of 14 universities and science councils received grant funding, supporting 30 post-graduate students, resulting in 21 journal articles published, and attracting students from Asia, the Americas, Europe and Africa to pursue their studies in waste management in South Africa. This is a testament to the ground-breaking work in waste management being conducted by South African researchers.

The recently established MSc Eng in Waste and Resources Management at the University of KwaZulu-Natal had the first intake of 9 students in 2020. Courses such as these, and the dedicated M.Env. Man Waste Management at North-West University, are building the skills for South Africa to implement the Economic Reconstruction and Recovery Plan and build our country back greener.

The impact of the WRIU and the Waste RDI Roadmap was highlighted by the Minister of Forestry, Fisheries and Environment, Minister Creecy during the 2020 Plastics Colloquium where the Minister highlighted the work done on informal waste sector integration; lifecycle sustainability assessment (LCSA); bio-plastics and new end-uses for plastic studies. This is a testament to the strong partnership between the DSI and DFFE, that brings forward sector relevant research.

In order to advance the transformation agenda of government, the WRIU published its first micro-grant call, which specifically targeted historically disadvantaged institutions and universities of technology. The purpose of this grant is to further expand the national research capability in the waste sector.

It needs to be noted that the success of the Roadmap's implementation requires a core team of people who diligently drive the Roadmap agenda. This team is ably led by Prof Godfrey, a world class researcher influencing not only the local agenda but the global one. She was recently appointed to the International Solid Waste Association (ISWA) Women-of-Waste International Advisory Network, which has a focus on issues of gender and waste, and the upliftment and retention of women in the waste sector. The WRIU also provided inputs to the relevance of the G20 Action Plan and Implementation Framework on Marine Plastic Pollution for Africa. The importance of plastic in the ocean cannot be over-emphasised. The WRIU spearheaded a special edition of the South African Journal of Science, with a science review of marine plastic pollution in South Africa, which highlighted South African researchers and their contribution to knowledge in this area.

The DSI's RDI investment into the Waste Sector, through the Roadmap, accounts for around a third of the total public and private sector investment in 2020/21. For the tough economic year that has passed, to have maintained this level of investment is an indication of the importance of this sector. With increased investment through partnerships, we can set South Africa on a Circular Economy transition through Science, Technology and Innovation (STI), as envisaged in the White Paper on STI.

Imraan Patel
Deputy Director-General: Socio-Economic Partnerships

MESSAGE FROM THE WRIU MANAGER, PROF LINDA GODFREY

The year 2020 was a challenging one for the South African waste sector. Like most sectors of the South African economy, the Covid-19 pandemic had a major impact on the waste economy. Early Level 5 lockdown restrictions had a severe impact on the ability of informal waste pickers to earn a living through the collection of recyclables. This had a knock-on effect on the amount of recyclable material flowing into the local recycling economy. New protocols for safe collection and handling of municipal solid waste had to be rapidly developed and implemented to protect workers. And maintaining waste collection services in many cities and towns grappling with the impact of Covid-19 became a very real challenge for many municipalities. During the early stages of the pandemic, with many working from home, waste generation shifted from industry and commercial centres to residential areas. Combined with a reduction in recycling activities the pandemic risked overwhelming municipal waste collection and disposal systems. And with increasing infections, the volumes of health care risk waste, and hazardous waste from the pharmaceutical and medical sectors increased significantly.

The pandemic also disrupted academic institutions, with a phased return of a small number of students and staff only occurring in June 2020 under Level 3, and a maximum two-thirds return of students under Level 2 from mid-August 2020. Students prioritised for return included those in all years of study, who required laboratory and technical equipment to complete the academic year.

These disruptions had a direct bearing on the implementation of the Waste Research Development and Innovation (RDI) Roadmap in 2020/21. A number of grant projects have experienced delays due to a lack of access to laboratories; delays in the ordering of consumables and equipment; delays in processing analyses; and inability to conduct field work or engage communities, amongst others. Grant holders and students are working hard to make up these delays, where possible, but it is expected that many projects will require extensions to ensure successful delivery. This past academic year also saw the largest number of post-graduate students de-registering than any previous year.

But disruption drives innovation. The waste sector has found new ways of doing things in the face of a pandemic. Researchers and students found creative approaches to their research. Meetings, conferences and lectures moved to virtual platforms, which, granted, yielded both positive and negative benefits in terms of how we engage going forward. Insights into the various research projects supported during 2020/21 and the associated publications are captured in this report.

We also saw an outpouring of support from the public and private sectors to those negatively impacted over the past year, including relief grants, food parcels, and personal protective equipment for workers on the frontline of South Africa's waste management system.

Investing in research and the generation of evidence and knowledge often seems like a luxury in times like these. But now, more than ever, we've seen the vulnerability and weakness in existing systems, and the impacts of these systems on climate change and biodiversity loss. We understand that we must "build back better", that we must develop resilient, inclusive systems, and more sustainable development models.

In following the global trend for green and inclusive development to be the cornerstone of a post Covid-19 economic recovery, President Ramaphosa has called for a recovery that is transformative, inclusive, digital, green and sustainable. A circular economy transition is core to the South African development pathway with the President affirming that *"…we cannot afford to be out of step with international moves towards green growth and green development"*.

In light of this, and despite the setbacks of the past year, I am pleased to present here a summary of the activities of the Waste RDI Roadmap for 2020/21.

Prof Linda Godfrey

The CSIR Team:

Mr Bongani Memela
Manager: Hosted National Programmes

Prof Linda Godfrey
Manager: Waste RDI Roadmap

Ms Siphe Ngobese
Project Administrator: Waste RDI Roadmap

Mr Amit Ramsumair
Management Accountant

Ms Lulu Makapela
Contracts Manager

Mr Beeza Mtamzeli
Communications

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 AND OBJECTIVES

The Waste Research, Development and Innovation (RDI) Roadmap is an initiative of the Department of Science and Innovation (DSI) aimed at guiding South Africa's public and private sector investment in waste research, development and innovation over the period 2015-2025.

BACKGROUND

The DSI recognised the role that RDI could play in achieving the objectives of national waste policy, and in transforming the South African waste sector in a way that could provide direct environmental, social and economic benefit for the country.

In 2012, the DSI, 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 (2015-2025).

The Waste RDI Roadmap is available to review online at **www.wasteroadmap.co.za.**

OBJECTIVES

With an investment ask of approximately R3.9 billion over 10 years, the successful implementation of the Roadmap is expected to assist government and industry in significantly increasing 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 DSI, is structured around three core 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

IMPLEMENTATION

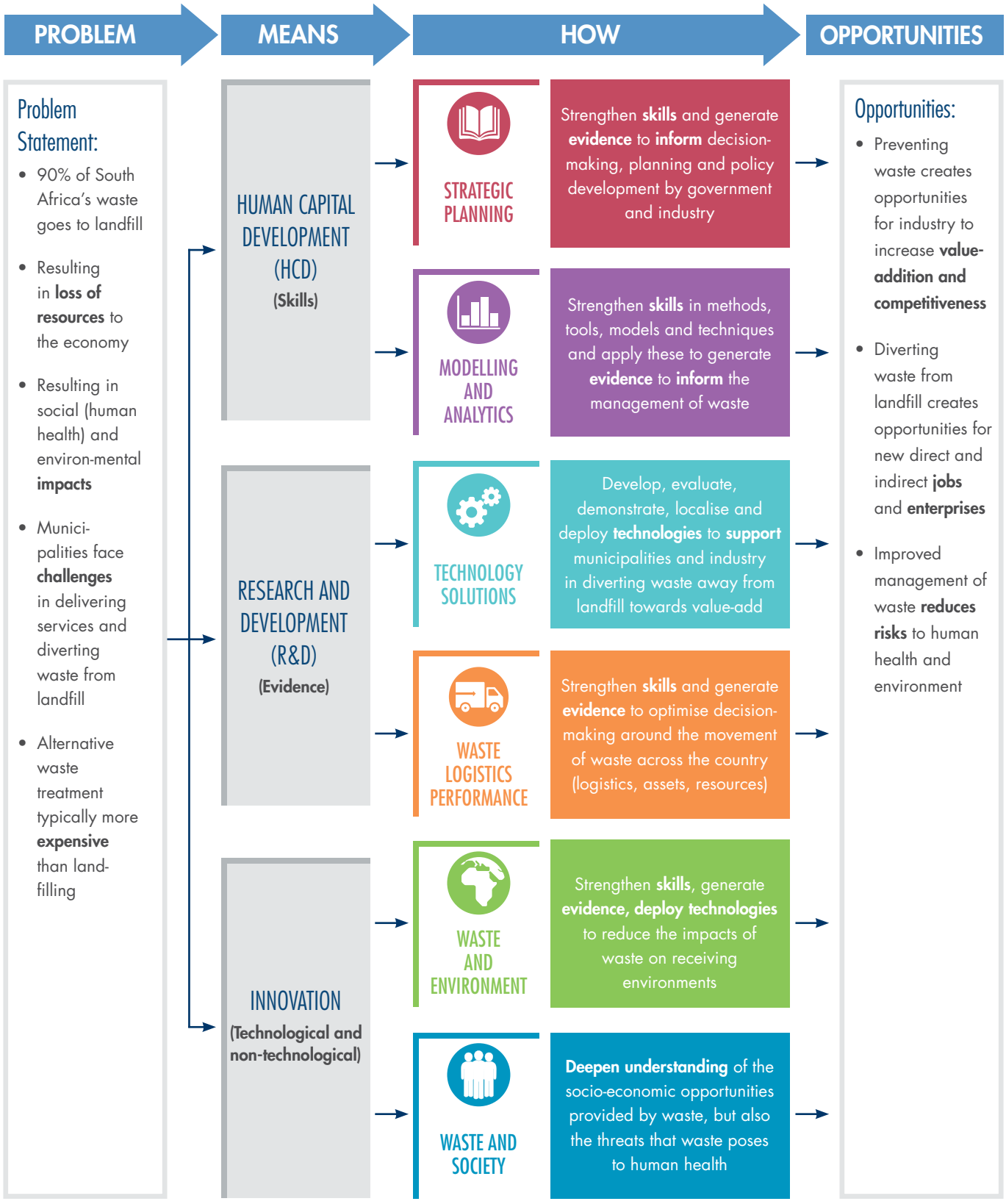
The CSIR was appointed by the DSI to implement the Waste RDI Roadmap from the 1 April 2015. The intention is for the CSIR, through the Waste RDI Roadmap Implementation Unit (WRIU), to drive human capital development (HCD), research and development (R&D) and innovation, in partnership with government,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

HUMAN CAPITAL DEVELOPMENT

RESEARCH & DEVELOPMENT

INNOVATION

PICTORIAL SUMMARY OF THE WASTE RDI ROADMAP



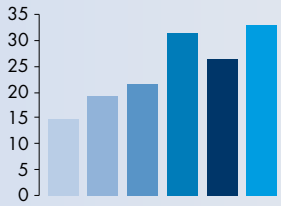
REFLECTING ON SIX YEARS OF IMPLEMENTATION (2015-2021)

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 opportunities, thereby maximising the potential environmental, social and economic benefits, while remaining true to the mandate of the DSI.

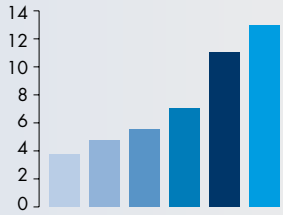
This section provides an overview of major indicator trends for each year of implementation of the Waste RDI Roadmap.

TRENDS

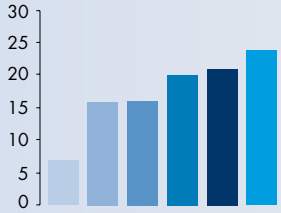
Total value of grant projects (new and ongoing RDI grants) (Rm) (2015-2021)



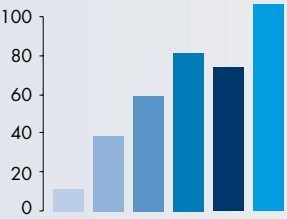
Annual transfer to RDI grants (Rm) (2015-2021)



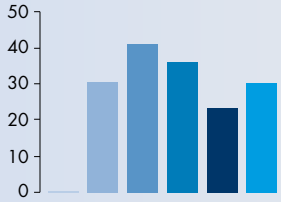
Number of RDI grants funded (2015-2021)



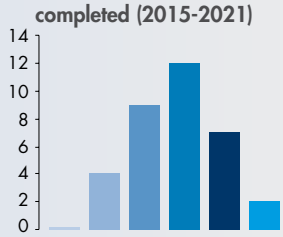
Grant-funded researchers supported (2015-2021)



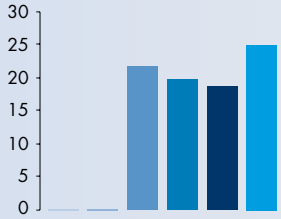
Grant-funded students supported (2015-2021)



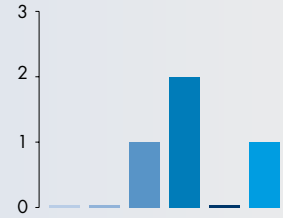
Grant-funded students completed (2015-2021)



New scientific publications (2015-2021)



New technology packages registered (2015-2021)



* *New Scientific Publications represents final dissertations, technical reports and peer reviewed journal papers*

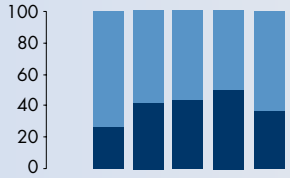
Despite a difficult economic climate, the Waste RDI Roadmap has been able to, year-on-year, grow its investment in waste research through grant projects. There has been an increase in researchers supported on grant projects and a corresponding decline in students supported on projects. Part of this is due to the nature of the projects funded, which did not support post-graduate studies. This is expected to recover in 2021/22 with the appointment of 13 new grant projects, all of which are contracted to support multiple post-graduate students. The impact of the Covid-19 pandemic is evident in the small number of students who were able to successfully complete their studies in 2020/21.

EQUITY:

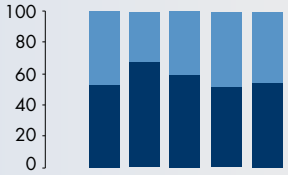
In line with national imperatives, including the White Paper on Science Technology and Innovation, which calls for a responsible research and innovation approach to support ethical science, technology and innovation, and an inclusive National System of Innovation (NSI), the Waste RDI Roadmap is committed to supporting gender and racial equity.

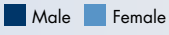
Mapping the Waste RDI Roadmap investment in post-graduate students and researchers over the past five years shows very good transformation of the sector, although noting the differences in representation between the students and the more experienced researchers.

Gender representation grant-funded students (2015-2021)

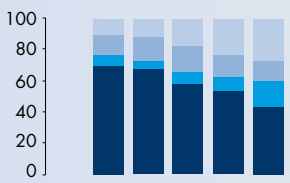


Gender representation grant-funded researchers (2015-2021)

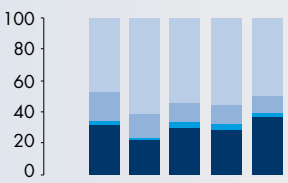


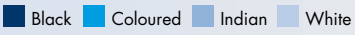


Racial representation grant-funded students (2015-2021)



Racial representation grant-funded researchers (2015-2021)





INVESTMENT:

The split in grant funding across the six clusters over the past six years, is very much in line with the original intention of the Waste RDI Roadmap. The largest share of funding (55%) was planned for investment in Technology Solutions. The actual spend to date is 61%. Waste logistics performance remains an underfunded area (5% compared to 8% ask), with the WRIU struggling to find worthwhile waste-logistics research projects to fund. While the trend is in line with the original intention of the Roadmap, the total investment amount from all partners has not been realised (see financial section).

WASTE RDI ROADMAP CLUSTERS AND PERCENTAGE OF TOTAL INVESTMENT PER CLUSTER EXPECTED (2015-2025)

		PLANNED	ACTUAL
STRATEGIC PLANNING	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	6%	9%
MODELLING AND ANALYTICS	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	10%	7%
TECHNOLOGY SOLUTIONS	Design, development, evaluation, demonstration, localisation and deployment of technologies – both local and inbound – for customer-driven performance improvement	55%	61%
WASTE LOGISTICS PERFORMANCE	Optimisation of strategic, tactical and operational decision-making in respect of logistics objectives, assets and resources	8%	5%
WASTE AND ENVIRONMENT	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	10%	7%
WASTE AND SOCIETY	Deepen understanding of waste-related opportunities and threats, to increase the success of influencing perception and practice positively	11%	11%

REFLECTING ON 2020/21

HUMAN CAPITAL DEVELOPMENT

30 post-graduate students supported through grant projects

8 post-graduate students supported through scholarships

49 post-graduate students mentored under the SARChI Chairs

16 post-graduate students mentored under the coursework master'

24 students successfully completed their degrees *(†)*

WEBSITE

341 932 pages visited

46 429 number of visits

22 247 unique visitors

3026 number of documents downloaded

Top downloaded publications

- LCSA of carrier bags in South Africa: Technical report
- LCSA of carrier bags in South Africa: Briefing Note
- Waste Picker Integration: Technical report
- Valorisation of waste chicken feathers: Dissertation
- Value recovery from solid confectionery waste: Technical report

COMMUNICATIONS IMPACT

20 print articles highlighting the Waste RDI Roadmap*

21 presentations made

9 radio interviews

1 television interview

TOP 5 COUNTRIES ACCESSING THE WASTE RDI ROADMAP WEBSITE

RESEARCH, DEVELOPMENT AND INNOVATION

31 FINAL DELIVERABLES PRODUCED

R32m committed funding for new and ongoing grant projects

R23.9m new grant proposals received

R8m allocated to new grant projects

113 researchers supported on grant projects

24 research grant projects funded (new and existing)

14 successful recipient research institutions (new and existing)

13 new grant projects awarded

† includes post-graduate students supported through grant projects, students affiliated with the two SARChI Research Chairs, students undertaking coursework master's with UKZN or NWU.

** while every effort is taken to identify print articles referencing the Waste RDI Roadmap, there may be articles that have not been picked up by the CSIR or DSI's media services.*

"The transition to a circular economy must be guided by evidence and science" (PACE, 2020)

Unlocking opportunities through Research, Development and Innovation

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

Supporting the development of new technology and adapting technology to South African conditions through R&D and Innovation

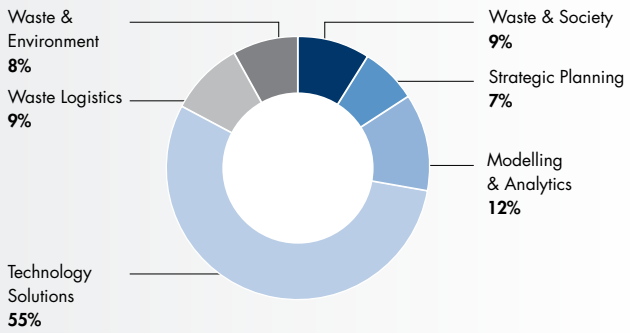
PROJECT PORTFOLIO

The Department of Science and Innovation's investment in waste research, development and innovation, together with other local and international public and private sector partners, is aimed at supporting the generation of new, relevant, scientific evidence that will inform policy, planning and decision-making; and fast-track the development and uptake of new technological and social innovations in South Africa.

CURRENT PROJECTS

The WRIU held 24 grant projects under its portfolio in 2020/21, consisting of 11 ongoing projects and 13 newly awarded projects that started in January 2021. The largest funding allocation (55%) was under the Technology Solutions Cluster, with a well distributed spread of funding across the other five clusters of the Roadmap.

ALLOCATION OF GRANT FUNDING TO THE SIX CLUSTERS FOR CURRENT GRANT PROJECTS (EXISTING AND NEW)



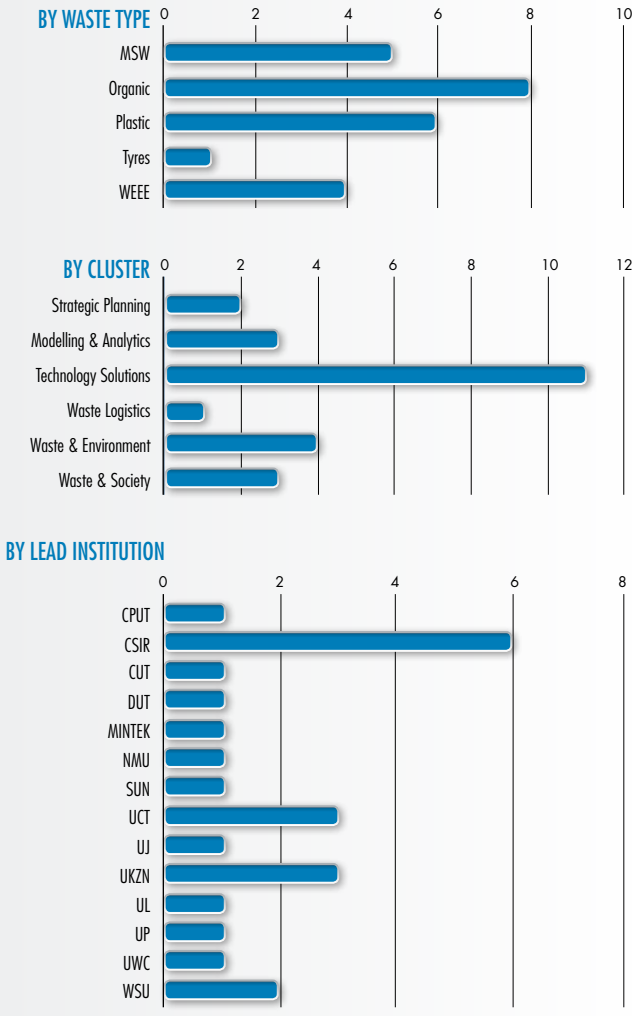
The profile of the current grant projects against the Waste RDI Roadmap clusters and priority waste streams are shown to the right.

Organic waste remains the dominant waste stream in terms of grant-funded research projects (8), followed by waste plastic, with the majority of grant projects (11) aligned with the Technology Solutions Cluster of the Roadmap.

The micro-grant call issued in 2020 for projects starting in January 2021, brought a number of new research institutions into the portfolio. Institutions that had not previously received funding under the Waste RDI Roadmap. A total of 14 universities and science councils received grant funding in 2020/21.

A brief outline of the 24 grant projects supported during 2020/21 is provided on the following pages.

THEMATIC SPREAD OF CURRENT GRANT PROJECTS (EXISTING AND NEW)



PROJECTS ENDING

Five grant projects were successfully completed in 2020/21. The final research deliverables have been made available on the Roadmap website under each of the respective project pages:

- Increasing reliable, scientific data and information on food losses and waste in South Africa
- Incentives for municipalities to divert waste from landfill in South Africa
- Informing decisions on single-use plastic carrier bags in South Africa: Evidence from a Life Cycle Sustainability Assessment
- Science review of marine plastic pollution in South Africa
- Technology landscape report and business case for the recycling of Li-ion batteries in South Africa

BIOMASS AND FOOD

Impact of food literacy on household food waste

Dr A Naicker – Durban University of Technology

Non-recoverable (micro) grant: 2020/040
Project duration: 1/2021 - 3/2023
Students supported on project: 1

Medicinal and economic potentials of citrus waste

Prof A Oyedeji – Walter Sisulu University

Non-recoverable (micro) grant: 2020/031
Project duration: 1/2021 - 3/2023
Students supported on project: 0

Waste-to-energy practices on small-scale farms

Ms C du Plessis – University of Limpopo

Non-recoverable (micro) grant: 2020/039
Project duration: 1/2021 - 3/2023
Students supported on project: 0

Curbing post-harvest losses using methane from anaerobic digestion of organic waste to drive the cold chain

Dr E van Rensburg – Stellenbosch University

Non-recoverable grant: 2019/27
Project duration: 1/2020 - 3/2023
Students supported on project: 4

Evaluation of supermarket food waste as partial replacement of commercial feed in Mozambique tilapia

Prof G Okuthe – Walter Sisulu University

Non-recoverable (micro) grant: 2020/036
Project duration: 1/2021 - 3/2023
Students supported on project: 0

Production of high-value dissolving wood pulps from sawdust waste material

Dr Jerome Andrew – CSIR

Non-recoverable grant: 2019/25
Project duration: 4/2020 - 3/2023
Students supported on project: 1

Bioplastics from local agri-industrial residues

Dr P Welz – Cape Peninsula University of Technology

Non-recoverable (micro) grant: 2020/033
Project duration: 1/2021 - 3/2023
Students supported on project: 1

Increasing reliable, scientific data and information of food losses and waste in South Africa

Dr Suzan Oelofse – CSIR

Non-recoverable grant: 2018/17
Project duration: 4/2018 - 3/2021
Students supported on project: 0

(#) postgraduate students supported on the grant project during the 2020/21 financial year.
Projects starting in January 2021 may not yet reflect verified students due to delays in the start of the academic year and registration of student

PLASTICS

Towards understanding the impacts of marine plastic debris on ecosystem services and the economy in South Africa

Dr W de Lange – CSIR

Non-recoverable grant: 2020/043
Project duration: 1/2021-3/2023
Students supported on project: 1

Valorisation of non-recyclable mixed plastic waste by low temperature pyrolysis

Dr K Moodley – University of KwaZulu-Natal

Non-recoverable (micro) grant: 2020/034
Project duration: 1/2021 - 3/2023
Students supported on project: 0

Optimisation of the Umgeni river/estuary litter-boom system for climate change resiliency and sustainability

Prof C Trois – University of KwaZulu-Natal

Non-recoverable grant: 2020/042
Project duration: 1/2021-3/2023
Students supported on project: 0

End-of-life options of biobased plastic materials and its biocomposites in landfill, compost and marine water conditions

Dr S Muniyasamy – CSIR

Non-recoverable grant: 2019/29
Project duration: 1/2020 - 3/2022
Students supported on project: 2

Booms, grids and nets: intercepting macroplastic debris in rivers

Prof P Ryan – University of Cape Town

Non-recoverable grant: 2020/041
Project duration: 1/2021-3/2023
Students supported on project: 1

The use of plastic waste in road construction in South Africa

Mr G Mturi – CSIR

Non-recoverable grant: 2018/21
Project duration: 3/2019 - 5/2020
Students supported on project: 0

Compatibilization of polyethylene – waste tyre crumb rubber blends for usable TPEs

Dr S Hlangothi – Nelson Mandela University

Non-recoverable (micro) grant: 2020/035
Project duration: 1/2021 - 3/2023
Students supported on project: 0

CIRCULAR CITIES

Assessing the impacts of burning of waste on communities in the vicinity of landfills in the Free State

Dr H Roberts – Central University of Technology

Non-recoverable (micro) grant: 2020/036
Project duration: 1/2021 - 3/2023
Students supported on project: 0

Incentives for municipalities to divert waste from landfill in South Africa

Mr A Nahman – CSIR

Non-recoverable grant: 2018/20
Project duration: 1/2019 - 3/2021
Students supported on project: 0

Municipal waste at household level: Demand estimation and service design

Prof J Joubert – University of Pretoria

Non-recoverable grant: 2019/28
Project duration: 1/2020 - 3/2022
Students supported on project: 3

Understanding societal behaviour in order to reduce and divert waste going to landfills

Prof C Schenck – University of the Western Cape

Non-recoverable grant: 2018/19
Project duration: 1/2019 - 12/2021
Students supported on project: 5

Assessing economy-wide prospects for a more sustainable circular economy in South Africa (Material Flow Analysis)

Prof H von Blottnitz – University of Cape Town

Non-recoverable grant: 2019/24
Project duration: 1/2020 - 3/2022
Students supported on project: 1

ELECTRONICS

Urban mining of Nd, Dy and Sm from rare earth magnets

Prof P Naidoo – University of KwaZulu-Natal

Non-recoverable (micro) grant: 2020/032
Project duration: 1/2021 - 3/2023
Students supported on project: 0

Technology landscape report and business case for the recycling of Li-ion batteries in South Africa

Ms. M Gericke – Mintek, South Africa

Non-recoverable grant: 2019/30
Project duration: 1/2020 - 3/2021
Students supported on project: 0

Training of the informal sector and household participation in the e-waste sector

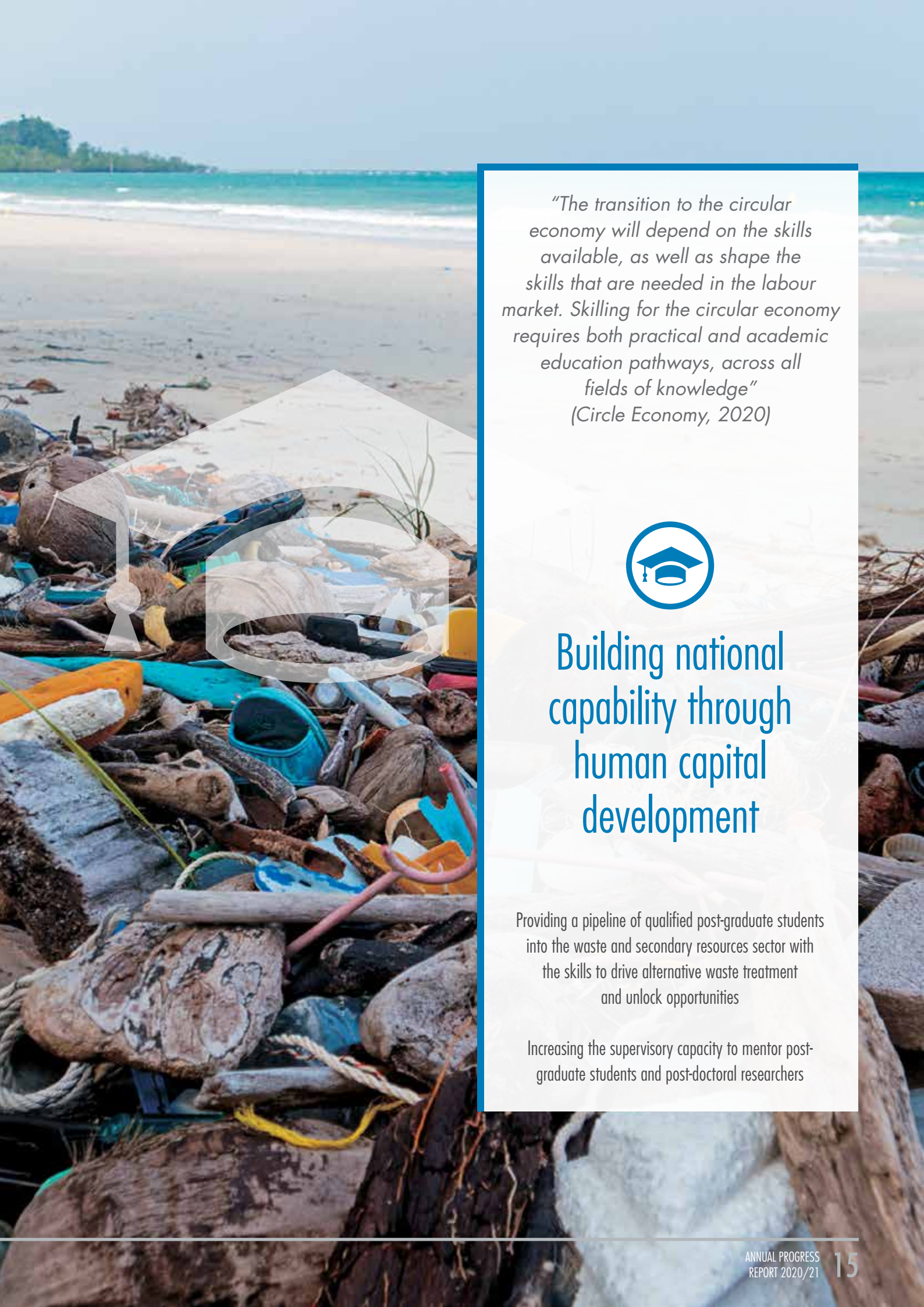
Dr T Schoeman – University of Johannesburg

Non-recoverable (micro) grant: 2020/038
Project duration: 1/2021 - 3/2023
Students supported on project: 4

Co-processing of PCB leach solutions with effluent streams from PCB manufacturing

Prof J Petersen – University of Cape Town

Non-recoverable grant: 2019/26
Project duration: 1/2020 - 3/2023
Students supported on project: 4



"The transition to the circular economy will depend on the skills available, as well as shape the skills that are needed in the labour market. Skilling for the circular economy requires both practical and academic education pathways, across all fields of knowledge"
(Circle Economy, 2020)

Building national capability through human capital development

Providing a pipeline of qualified post-graduate students into the waste and secondary resources sector with the skills to drive alternative waste treatment and unlock opportunities

Increasing the supervisory capacity to mentor post-graduate students and post-doctoral researchers

PORTFOLIO OF RESEARCHERS

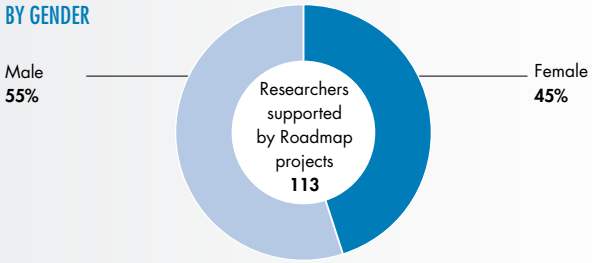
Developing, strengthening and embedding South Africa's waste research, development and innovation capability and capacity within and between research institutions, academic institutions, industry and government, will enable the sector to make more effective decisions, insert context-appropriate technologies and create opportunities for the export of know-how and technology into the African continent and beyond.

The 24 Waste RDI grant projects funded in 2020/21 provided support to 113 researchers (non-unique) at 23 research institutions. This is the highest number of researchers supported on grant projects since the start of implementation of the Waste RDI Roadmap.

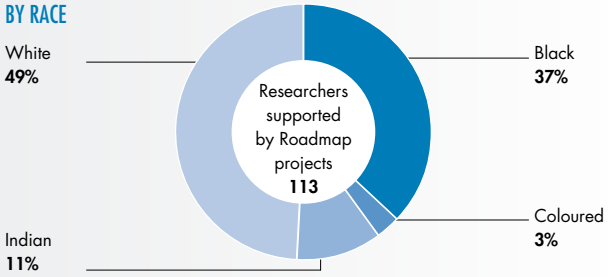
Researchers supported on grant projects stem predominantly from South Africa (80%), but also from other African countries, the Americas, Asia and Europe. This is positive for the South African waste sector, as not only is the Roadmap helping to build international capability and networks, but it is also ensuring that new ideas are introduced into the South African research community.

GRANT FUNDED RESEARCHERS

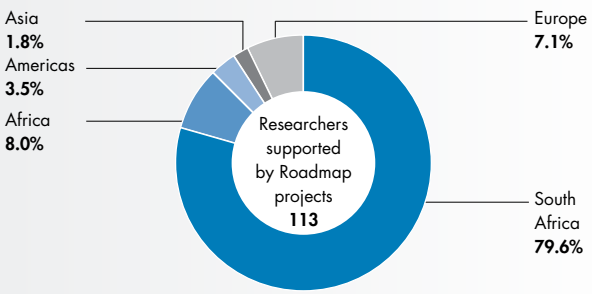
BY GENDER



BY RACE



BY NATIONALITY



PORTFOLIO OF STUDENTS

The DSI recognises the importance of investing in skills to support South Africa's transition to a more circular and sustainable economy.

A capable public and private waste sector creates a strong foundation from which to achieve the objectives of national waste policy, including the National Waste Management Strategy (NWMS), and transform the South African waste economy. Strengthening skills in waste management is, therefore, a cornerstone of the Waste RDI Roadmap.

The Roadmap has adopted the following instruments to support skills development in South Africa:

- Direct scholarships for post-graduate students
- Students supported partially or fully through Waste RDI grant projects
- Internships with organisations supported under the Waste RDI Roadmap
- SARChI Research Chairs

POST-GRADUATE DEGREE BY COURSEWORK

Students have two routes to consider when furthering their studies in the field of Waste Management in South Africa. A master's degree by coursework, or a master's or PhD by research.

Both North-West University (NWU) and the University of KwaZulu-Natal (UKZN) successfully offered their coursework master's degrees specialising in waste and resources management in 2020.

- Master's in Environmental Management, specialising in Waste Management (NWU) (M.Env.Man.)
- Master's of Science in Engineering: Waste and Resources Management (UKZN) (MSc. Eng.)

The MSc. Eng. in Waste and Resources Management (WaRM) was offered by UKZN for the first time in 2020 to a cohort of nine graduates from engineering and the natural sciences. Students are required to complete five core modules and one specialisation module (selected from three options) and a dissertation. The Covid-19 pandemic forced universities to rethink their engagement with students, with the result that from March 2020, UKZN was able to migrate all lectures and assessments online, providing an opportunity for the University to bring in international guest lecturers. In 2020, the WaRM Programme's master classes and seminars included international guest lecturers of the calibre of Prof. Maria Cristina Lavagnolo (University of Padua, Italy), Prof. Hassan El Bari (Waste Management Association of Morocco), Prof. Frederic Coulon and Team (Cranfield University, UK), and local academics Prof. Jochen Petersen and Dr Thandazile Moyo (SARChI Chair Minerals and Metals Beneficiation, UCT), Prof. Hanri Mostert and Dr Richard

Cramer (SARChI Chair Mineral Law in Africa), Prof. Anne Stark (SARChI Chair Sugarcane Biorefinery), Dr Noredine Mahdjoub, Dr Surabhi Srivastava and Dr Marc Kalina (SARChI Chair Waste and Climate Change) and Prof. Linda Godfrey (CSIR), to name a few.

Post-graduate scholarships

The Waste RDI Roadmap provides targeted scholarships to students undertaking one of the dedicated coursework master's degrees in South Africa. The Roadmap provided funding for eight (8) scholarships in the 2020 academic year. All eight students are young, black South Africans between the age of 22 and 33. It is inspiring to see the increasing number of young women entering the South African waste sector. Of the eight scholarships awarded, 50% were to young female students.

POST-GRADUATE DEGREE BY RESEARCH

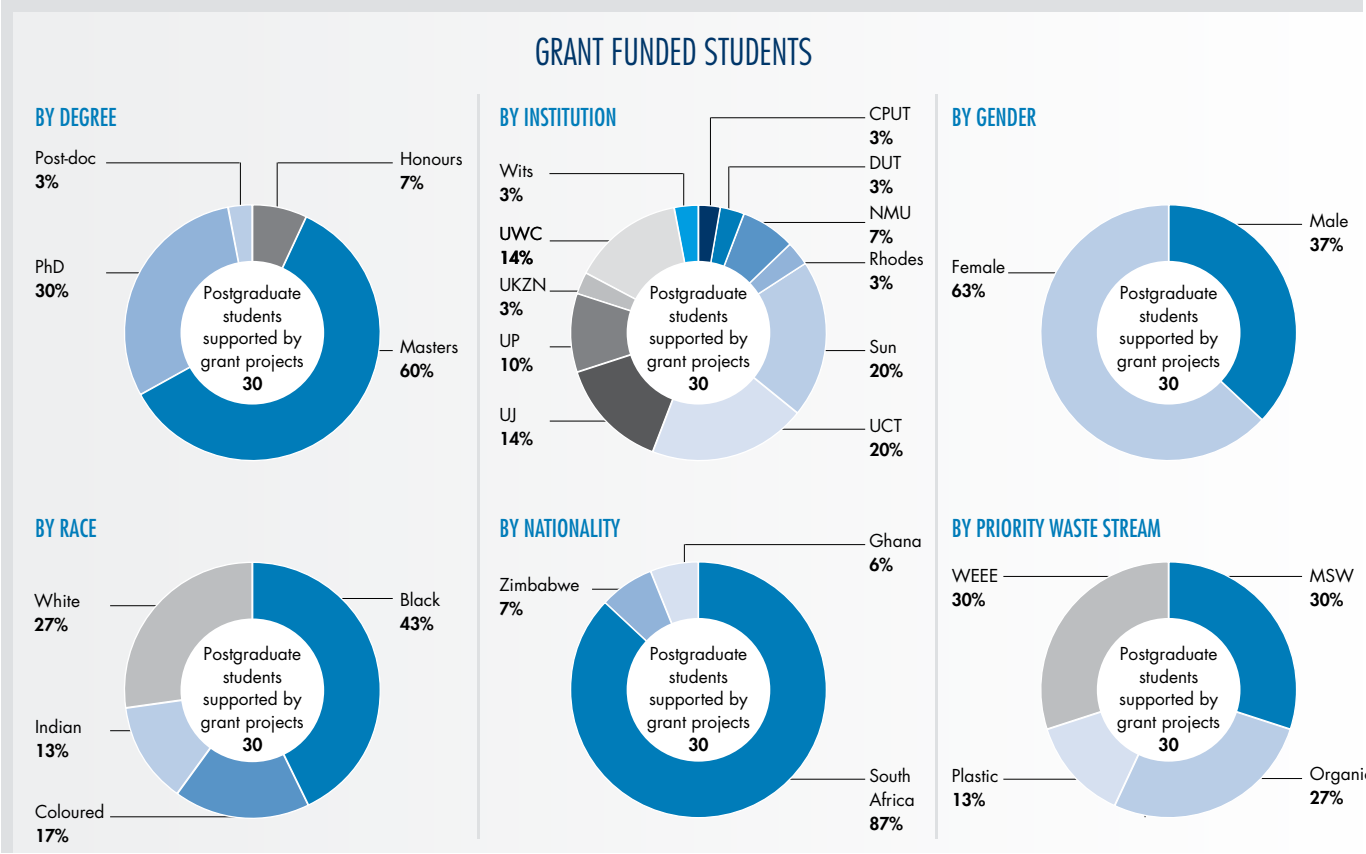
Students are able to undertake waste-related honours, master's or doctoral degrees by research, at most Universities in South Africa. Opportunities are also available for post-doctoral training.

Grant funded post-graduate students

The 24 Waste RDI grant projects funded during the 2020/21 financial year supported 30 honours, master's, PhD and Post-doc students (partially or fully). The grant projects remain an important mechanism for building capacity at the post-graduate level. While the Waste RDI Roadmap scholarship funding is only open to South African citizens and South African permanent residents, the grant projects are able to fund any student studying at an accredited, public Higher Education Institution in South Africa. In this way, the Waste RDI Roadmap is able to support the strengthening of waste skills, not only of South Africans, but of students from across Africa and beyond. In addition to the 26 South African post-graduate students (87%) supported on grant projects, an additional four (4) students from other African countries were financially supported under the Waste RDI Roadmap.

Many more research institutions hosted post-graduate students in 2020/21 as part of their grant projects. This is the direct result of the micro-grant call issued in 2020, which extended research grant opportunities to more universities. And with the cap on the micro-grant amount, the Roadmap was also able to fund more grant projects.

Previous years have seen a large percentage of post-graduate students working on organic waste related research projects. The focus started to shift in 2019/20, with the majority of grant funded students working on municipal solid waste (MSW) and waste electrical and electronic equipment (WEEE), the direct result of the targeted grant calls that were published in 2016 (on WEEE) and 2018 (on MSW). The diversity in student research projects expanded further in 2020/21, with a near equal split across MSW (30%), WEEE (30%) and organic waste (27%). This is important as the Roadmap diversifies its portfolio out to all five (5) priority waste streams and all six (6) Roadmap clusters (or focus areas).



SARChI RESEARCH CHAIRS

PROF C TROIS

Waste and Climate Change
Tier I SARChI Research Chair
University of KwaZulu-Natal

The objective of the Waste and Climate Change Research Chair is to develop and implement a research programme that delivers evidence to support the improved understanding of the –

- Climate impacts associated with the generation and disposal of waste in South Africa
- Measures (including technologies) to mitigate these impacts
- Impact of climate change on the waste sector.

Despite the disruption of the Covid-19 pandemic, the group was able to shift many of its activities to online platforms in 2020. Three papers were delivered virtually at the 5th Symposium on Urban Mining and Circular Economy (SUM 2020) and the 8th International Symposium on Energy from Biomass and Waste (Venice 2020).

In October 2020, The SARChI Chair installed and commissioned five fully operational micro-digesters (Type Agama BiogasPro) in fives crèches (ECDC) in the Ndwedwe Municipality, Ilembe District Municipality as part of the SANEDI-Lottery funded BioEnergy in Rural Areas project. Through the decentralised management of waste, the project is able to recover value from organic waste, thereby reducing impacts to land and air. The micro-digesters are operational and produce biogas for cooking from cow-dung and food waste. DEFY Appliances have also donated five 'Proudly South African' biogas stoves.

Recent publications by the Chair include:

- Bwapwa, J.K., Akash, A. and Trois, C. (2020). Jet fuel from domestic wastewater treatment using microalgae: A Review. Green Materials for Wastewater Treatment, 321-360.
- Sawyerr, N., Trois, C., Workneh, T.S., Oyebode, O., and Babatunde, O.M. (2020). Design of a household biogas digester using co-digested cassava, vegetable and fruit waste, *Energy Reports*, 6, 1476-1482.
- Ogwang, J.O., Kalina, M., Jegede, A., Mahdjoub, N., and C. Trois. (2020). The Development of an optimised small scale anaerobic digester design for rural South African areas. Presented at the 8th International Symposium on Energy from Biomass and Waste. Virtual Event. 16-19 November 2020.
- Editorial by Kalina, M. (2020). The source of waste and the end of waste: COVID-19, Climate, and the Failure of Individual Action. *Detritus*. 10. v-vii.

PROF C SCHENCK

Waste and Society
Tier II SARChI Research Chair
University of the Western Cape
http://wasteandsociety.co.za/

The objective of the Waste and Society Research Chair is to develop and implement a research programme that delivers evidence to support the improved understanding of the –

- Opportunities to create jobs and improve livelihoods through the transition away from landfilling
- Business models to support a secondary resources economy, with a focus on SMMEs
- Required behaviour change to drive the transition away from landfilling

Despite the challenges presented by the Covid-19 pandemic and subsequent lockdown and associated regulations, the group was still able to conduct fieldwork with communities. In some instances, the team managed to collect data in person under strict protocols provided by the University, but also made use of technology to facilitate engagement and data collection. The Chair continues to build out international, regional and local research partnerships. This included engagements with Texas State University (USA), University of Lapland (Finland), University of Cologne (Germany), University of Novi Sad (Serbia), colleagues from Ghana and Nigeria, and locally with the Durban University of Technology, and University of Johannesburg.

Recent publications by the Chair include:

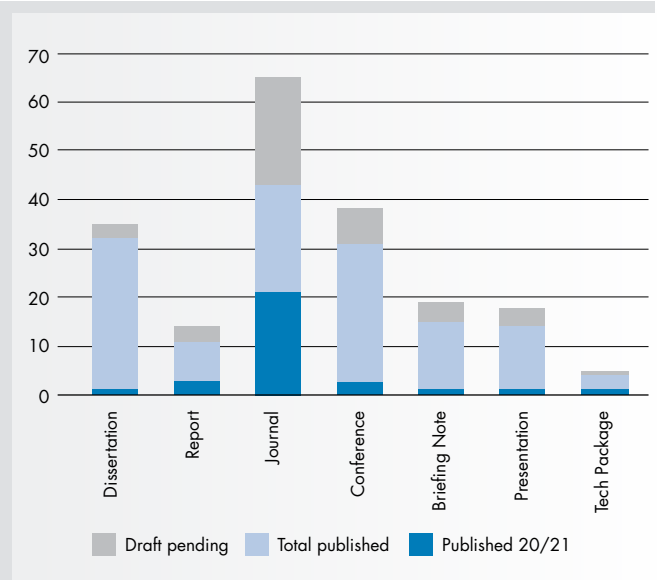
- Blaauw, PF., Pretorius, A., Viljoen, JMM. and Schenck, CJ. (2020). Adaptive expectations and subjective well-being of landfill waste pickers in South Africa's Free State Province. *Urban Forum*. 31(1):135-155.
- Yu D., Blaauw, D. and Schenck, R. (2020). Waste pickers in informal self-employment: Over-worked and on the breadline, *Development Southern Africa*.
- Niyobuhungiro, R. and Schenck, R. (2020). A Global review of drivers of indiscriminate dumping of waste: Guiding future research in South Africa. *Development Southern Africa*.
- Hoffman, M. and Schenck, R. (2020). The value chain and activities of polyethylene terephthalate plastic in the South African waste economy. *Local Economy*. 35(5):523-535.
- Barnes, K., Blaauw, D., Schenck, R. and Pretorius, A. (2021). Buy back centres in Cape Town: The key integration point in the waste economy of the Western Cape. *GeoJournal*.

RESEARCH OUTPUTS

The portfolio of grant projects produced 31 final deliverables during 2020/21. This includes post-graduate dissertations, journal papers, technical reports, conference papers and presentations, and briefing notes.

- 1 Dissertation
- 3 Technical reports
- 21 Journal papers
- 3 Conference papers and presentations
- 1 Briefing note
- 1 Summary presentation
- 1 Technology package

The current status of published RDI Roadmap project deliverables and draft deliverables is shown in the figure below.



All grant project deliverables can be accessed on the Waste RDI Roadmap website, under each of the respective grant project pages.

Select Roadmap funded deliverables published during 2020/21 include:

Attah-Kyei, D., Akdogan, G., Dorfling, C., Zietsman, J., Lindberg, D., Tesfaye, F. and Reynolds, Q. (2020). Investigation of waste PCB leach residue as a reducing agent in smelting processes, *Miner. Eng.*, 156 (linked to grant 2016/016)

Bhagwat, G., Gray, K., Wilson, S.P., Muniyasamy, S., Vincent, S., Bush, R. and Palanisami, T. (2020). Benchmarking Bioplastics: A Natural Step Towards a Sustainable Future, J *Polym Environ*, 28 (linked to grant 2019/029)

Niyobuhungiro, R.V. and Schenck, C.J. (2020). A global literature review of the drivers of indiscriminate dumping of waste: Guiding future research in South Africa, *Dev. South. Afr.* (linked to grant 2018/019)

Singh, S., Sithole, B., Lekha, P., Permaul, K. and Govinden, R. (2020). Pretreatment and enzymatic saccharification of sludge from a prehydrolysis kraft and kraft pulping mill, *J. Wood Chem. Technol.* 41(1) (linked to grant 2016/003)

Bello, F. and Chimphango, A. (2021). Optimization of lignin extraction from alkaline treated mango seed husk by high shear homogenization-assisted organosolv process using response surface methodology, Int. *J. Bio Macro*, 167 (linked to grant 2016/009)

Kakonke, G., Tesfaye, R., Sithole, B. and Ntunka, M. (2021). A novel method for rapid extraction of biofibres from waste chicken feathers. *J Solid Waste Techno. Manag*, 47(1). (linked to grant 2016/004)

Muniyasamy, S. and Dada, O.E. (2021). Recycling of plastics and composites materials and degradation technologies for bioplastics and biocomposites. In: Waste Management in the Fashion and Textile Industries, ed. Rajkishore Nayak, Asis Patnaik (linked to grant 2019/029)

Naidu, D.S. and John, M. (2021). Cellulose nanofibrils reinforced xylan-alginate composites: Mechanical, thermal and barrier properties, *Int J Biol Macro*, 179, (linked to grant 2016/005)

The fifth grant project to be successfully completed early in the 2020/21 financial year, was the publication of a series of science review papers on marine plastic pollution. Through a partnership with the Academy of Science of South Africa (ASSAf) and the South African Journal of Science (SAJS), five review papers were published on the state of knowledge on marine plastic pollution sources, transport, fate and impacts. The papers were published in a SAJS Special Edition in May 2020. The findings were further disseminated through an online webinar hosted by ASSAf on 4 June 2020, attended by more than 50 stakeholders.

Godfrey, L. (2020). Are there gaps in our understanding of marine plastic pollution? *S Afr J Sci.* 116(5/6).

Verster, C. and Bouwman, H. (2020). Land-based sources and pathways of marine plastics in a South African context, *S Afr J Sci.* 116(5/6).

Ryan, P. (2020). The transport and fate of marine plastics in South Africa and adjacent oceans, *S Afr J Sci.* 116(5/6).

Naidoo, T., Rajkaran, A., Sershen (2020). Impacts of plastic debris on biota and implications for human health: A South African perspective, *S Afr J Sci.* 116(5/6).

Aribi, S. and Nahman, A. (2020). Impacts of marine plastic on ecosystem services and economy: State of South African research, *S Afr J Sci.* 116(5/6).

Ryan, P., Pchegru, L., Perold, V. and Moloney, C.L. (2020). Monitoring marine plastics – will we know if we are making a difference? *S Afr J Sci.* 116(5/6).

PARTNERSHIPS

"I think the CSIR has done fantastic work. I want the CSIR to continue to do work for us on compostable plastics, I also want the CSIR to continue to do work for us on this issue of waste-to-energy. But there is absolutely no way that we can set up a system unless we understand the research needs that the system has and how we make sure that every decision we make is an evidence-based decision."

Minister Creecy, Plastics Colloquium, 12 November 2020"

Building local, regional and international partnerships with government, academia and business is important to achieving the long-term objectives of the Waste RDI Roadmap. The following section highlights just some of the engagements with key stakeholders during the 2020/21 financial year.

SOUTH AFRICA

Government

Collaboration with national government departments remains an important element of ensuring the Waste RDI Roadmap research outputs support decision-making, policy development and implementation. As the line department responsible for waste, the Department of Forestry, Fisheries and the Environment (DFFE) is an important partner in this regard. The WRIU has had active engagement with DFFE over the past year through various waste and circular economy-related meetings and workshops. In order to provide specific evidence to support government in the implementation of its mandate, the DSI, WRIU, and SARChI Chair in Waste and Climate Change met with the DFFE Climate Branch in December 2020 to share current research and to identify evidence needs to support future collaboration.

It was encouraging to see a number of the DSI-funded waste research projects referenced by the Minister of Forestry, Fisheries and the Environment, Ms Barbara Creecy at the 2020 Plastics Colloquium. It particular, the informal waste sector integration; LCSA carrier bag; bio-plastics; and new end-uses for plastic studies.

The WRIU was pleased to participate in the Steering Committee of the ***'Economic Empowerment of Women in Green Industries*** (EEWIGI)' project in 2020/21, a partnership between UNIDO, UN Women, the Federal Ministry of Economic Cooperation and Development of Germany, the Department of Trade, Industry and Competition (the **dtic**) and the Department of Women, Children and People with Disabilities. The purpose of this project is to advise and support policy-makers and practitioners on the establishment and implementation of a policy framework to integrate gender and green industry policies, thereby improving leadership and participation of women as entrepreneurs and industry professionals, and to advance gender equality and green industrialisation.

The DSI and WRIU also had a number of successful engagements with DFFE and the **dtic** during 2020/21 to share information on respective department work on the Circular Economy.

Academia

Universities and science councils are core to the Waste RDI Roadmap, undertaking much of the RDI necessary to evidence national decision-making and inform policy development and implementation. The response of academia to the Waste RDI Roadmap calls remains very positive. The WRIU currently has a network of over 140 researchers working in solid waste management and associated fields across South African public research institutions.

The two SARChI Chairs in Waste and Climate Change, and Waste and Society have made good progress in 2020/21. The first Research Advisory Committee (RAC) meetings were held with each Chair in September 2020, and provided an opportunity for the Chairs to present their progress for 2020 and plans for 2021. The RACs include representatives from the DSI, NRF, CSIR, SALGA, TIPS, DEFF, GreenCape, SANEDI and NMU.

A Community-of-Practice (CoP), or Research Chair-led alliance, was established in 2020 with the aim of unlocking the economic, societal and environmental potential of waste as resource in South Africa. The CoP brings together the activities of a number of SARChI Chairs from different disciplines – social sciences, law, economics and engineering – ensuring that this potential is unlocked in the most equitable and appropriate way. The CoP is hosted by the University of Cape Town (UCT) and includes – Prof. Jochen Petersen (SARChI Chair: Minerals Beneficiation, UCT) (Lead); Prof. Cristina Trois (SARChI Chair: Waste and Climate Change, UKZN); Prof. Catherina Schenck (SARChI Chair: Waste and Society, UWC); Prof. Ann Starke (SARChI Chair: Sugarcane Biorefining, UKZN); Prof. Hanri Mostert (SARChI Chair: Mineral Law in Africa, UCT).

The Energy and Water Sector Education and Training Authority (EWSETA) established a Chair for Development and Research in Wastewater and Solid Waste Management in 2020. The Chair is filled by Prof. Jacques Snyman of the Tshwane University of Technology.

The WRIU is pleased to serve on the Technical Advisory Committee to the Chair to ensure alignment with the two waste SARChI Chairs funded under the Roadmap.

INTERNATIONAL

International and regional partnerships are important for ensuring that waste issues facing South Africa and Africa are appropriately represented on the international stage, and to bring international thinking and experience into the African context. In addition to direct research collaboration between South African researchers and their international counterparts, the WRIU continues to develop and strengthen international relationships in support of the Roadmap. Some of the engagements during 2020/21 include:

Royal Academy of Engineering, UK

The WRIU served on the Technical Advisory Group for the ***"Global Review on Safer End of Engineered Life"*** study in 2020. The Engineering X Safer End of Engineered Life (SEEL) programme seeks to address the safe decommissioning, dismantling and disposal of products and structures at end of their life. In response to this Global Review, the SEEL Programme expanded their portfolio of projects in 2020 to include the Open Burning of Waste, an issue highly relevant to most countries in Africa. The WRIU was able to provide input to this project through a series of meetings and workshops in 2020/21, aimed at finding solutions to this mismanagement of waste.

The PEW Charitable Trusts, USA

The WRIU has previously reported on its participation in the global ***'Breaking the Plastic Wave'*** study. The final report was published in July 2020, together with a peer-reviewed paper in ***Science*** 369, 1455-1461, Lau ***et a***l. (2020). It was important for the WRIU to participate in this global study to ensure that Africa was appropriately represented in the methodology, and that the final results be applied back to Africa. The WRIU, CSIR and South African Plastics Industry are pleased to be partnering with Pew and Oxford University to apply the Plastics-to-Ocean (P2O) data-driven coupled ordinary differential equation (ODE) model to South Africa. The intention being to provide an evidence-based strategy for addressing waste plastic in South Africa.

European Commission

Given the extensive work initiated by the WRIU on marine plastic pollution over the past two years, Prof. Godfrey of the WRIU was invited to be a panellist at the EU virtual workshop on ***"Measures to address marine plastic leakage through a circular economy approach"*** held in September 2020. Input was provided on the relevance of the G20 Action Plan and Implementation Framework on Marine Plastic Pollution for Africa. The workshop was organised by the European Commission and chaired by Ms Schomaker, Director Global Sustainable Development, Directorate-General for Environment, European Commission.

UNIDO

The WRIU participated in a number of engagements with UNIDO during 2020, as part of the Global Consultations on a Circular Economy. This engagement is important for ensuring that current global thinking with respect to the circular economy is integrated back into local activities.

UN Environment (UNEP)

Prof. Godfrey of the WRIU was invited to participate in the Action Track 2 Leadership Team ***"Shift to sustainable consumption patterns"***, Workstream 3 ***"Food waste"***, in preparation for the UN Food Systems Summit. The Action Track is led by Eat Forum, a science-based global platform for food system transformation based in Norway. The outcomes of the work will be taken forward into the UN Food Systems Summit to be held in late 2021.

Western Indian Ocean Marine Science Association (WIOMSA)

In support of the ongoing activities of the WIOMSA Group of Experts for Marine Litter and Microplastics, the WRIU provided assistance during 2020 to the ***"Review of marine plastic litter in the WIO region"***. This WIOMSA review follows on from the marine plastic pollution science review undertaken in South Africa in 2019/20.

International Solid Waste Association (ISWA)

It was announced by ISWA in August 2020, that South Africa will be the first African country to host the ISWA Annual Congress and General Assembly, since its inception. South Africa will host the 34th Conference in 2024, in Cape Town. The Conference provides exciting opportunities for the sharing of information and the development of partnerships with the international waste community. With a long history of engagement with ISWA, the WRIU looks forward to supporting the Institute of Waste Management of Southern Africa (IWMSA) as country host for the conference.

Prof. Linda Godfrey of the WRIU, was appointed in early 2021 to the ISWA Women-of-Waste International Advisory Network. The Advisory Network provides support and technical input on the Task Forces' activities, which focuses on issues of gender and waste, and on the upliftment and retention of women in the waste sector.

The WRIU would also like to acknowledge the many local, regional and international organisations with whom it's had the privilege of engaging this past year, and who are not mentioned here by name. These engagements have been invaluable in strengthening our shared understanding of the waste sector.

FUNDING INSTRUMENTS

RDI GRANTS

Over the past six financial years, the WRIU has issued two open grant calls (2015 and 2019) and two targeted grant calls on WEEE (2016) and MSW (2018). No grant call was issued in 2017 due to a lack of funding.

The WRIU also published a smaller, targeted grant call for academics to undertake a science review of marine plastic pollution in South Africa in 2019. The intention of this targeted grant call was to consolidate and evaluate existing South African research and identify current gaps in knowledge. The outcomes of the science review were used to drive a targeted research call on land-based sources and pathways of marine plastic debris; and ecosystem service and economic impacts of marine plastic litter, which was issued in 2020.

The WRIU published an open micro-grant call in 2020, targeting historically disadvantaged institutions, universities of technology, and universities that had not previously been awarded grant projects under the Waste RDI Roadmap in previous years. The intention being to expand national research capability in the waste sector.

GRANT APPLICATIONS RECEIVED

A total of 39 proposals were received under the 2020 open micro-grant call and the targeted marine plastic pollution call, a funding ask of R23.9 million for projects commencing in 2021. Applications were received from 14 universities and science councils. It is particularly encouraging to see the increase in proposals from emerging universities and universities of technology. This can be attributed, to some extent, to the roadshow undertaken in 2018 and early 2019, aimed at raising awareness regarding the Roadmap and the associated funding opportunities.

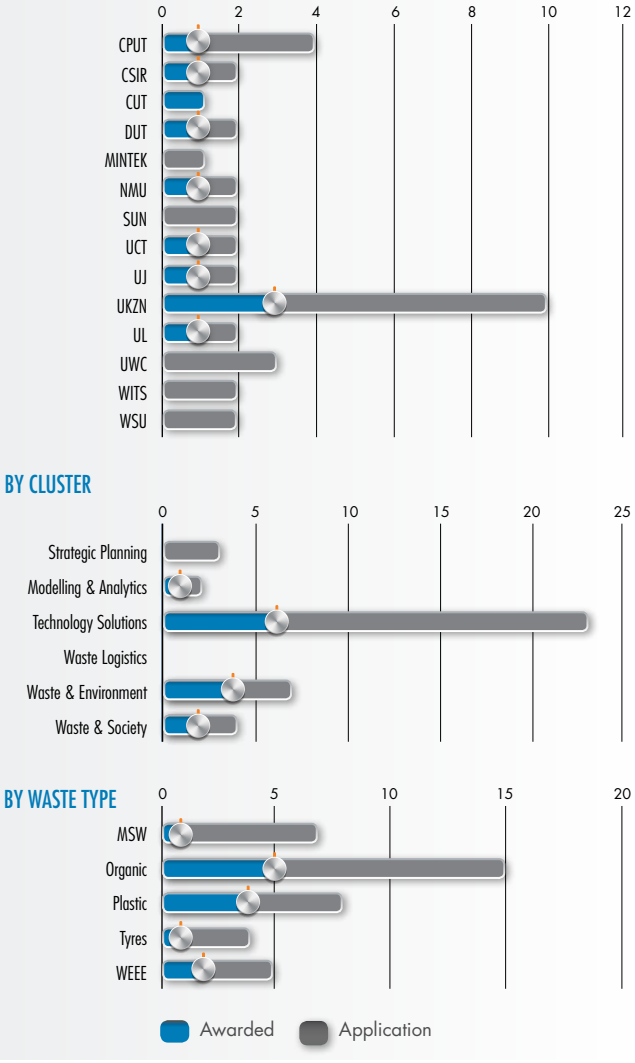
The grant proposals included a large number of academic, business and government partners. In addition to the 14 applying institutions, another 51 research partners were included in the proposals – 36 from academia, 11 from business or non-governmental organisations (NGO) and four (4) from local government. This is very encouraging as it creates opportunities for impact through research collaboration with potential implementation partners.

The proposals were evaluated by an independent panel of experts from government, business and academia.

AWARDED GRANTS

Of the 39 proposals received under the two grant calls, 13 projects were awarded to South African public research institutions – 10 micro-grant projects and three (3) targeted marine plastic pollution projects. The number of grants awarded was limited by the available funding, and not by the quality of proposals received. The overall success rate of eligible proposals received under the calls was 33%, significantly up from the 11% of 2019.

THEMATIC SPREAD OF GRANT PROPOSALS AND AWARDS UNDER THE 2020 GRANT CALL



WASTE RDI ROADMAP FINANCIAL STATEMENT

The 2020/21 financial investment in the Waste RDI Roadmap was down from the 2019/20 financial year. However, the WRIU was able to increase the investment in grant projects as a result of ring-fencing of funding for continuing operations. This allowed the WRIU to issue a new micro-grant call and a targeted marine plastic pollution call in 2020. The funding still remains significantly below that outlined in the Waste RDI Roadmap. This has a direct bearing on the extent and magnitude of the activities of the Roadmap.

All financial figures are exclusive of VAT.

REVENUE	2020/21	2019/20
DST seed funding	13 691 573.91	21 289 086.96
Other revenue	6 417 413.09	225 000.00
Total Revenue	**20 108 987.00**	**21 514 086.96**
EXPENSES		
Communications	42 620.00	69 298.75
CSIR Project Management Unit	2 670 290.65	2 073 778.55
Non-recoverable innovation grants	0.00	0.00
Non-recoverable R&D grants	12 988 363.37	11 086 609.57
Targeted RDI projects	206 640.00	1 195 509.57
Post-graduate scholarships	310 000.00	0.00
SARChI Research Chairs	1 705 200.00	1 705 200.00
Travelling	1 055.37	124 623.52
Workshops and general running	0.00	0.00
Total Expenses	**17 924 169.39**	**16 255 019.96**
Income for continuing operations [1]	**2 184 817.61**	**5 259 067.00**
Net Income	**0.00**	**0.00**

Notes to financial statement:

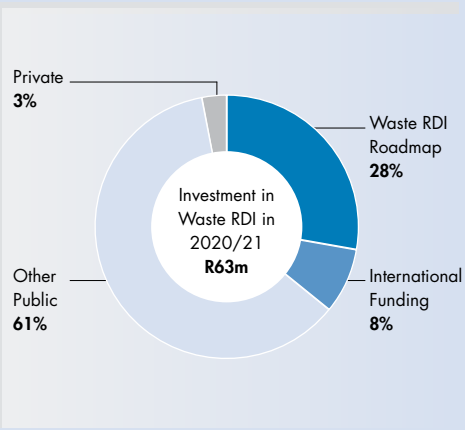
1 Income for continuing operations is committed funding for grant projects awarded in 2018-2020, for which disbursements will be made in the 2021/22 financial year. This includes CSIR co-investment into the Waste RDI Roadmap.

SECTOR INVESTMENT IN WASTE RDI

As reported in previous years, there remains no single mechanism (information system) to extract data on the investment being made in waste RDI in the South African NSI. As such, the following information on broader sector-level investment in waste R&D in 2020/21 was collected by means of a questionnaire sent to the Roadmap network of researchers. Therefore, the data reported here is susceptible to weaknesses in reporting by researchers. The financial figures presented here should be seen as a minimum spend, with a high degree of uncertainty.

It is estimated that at least R63 million was invested in Waste RDI in South Africa in 2020/21. Other public sector funding remains the major source of waste RDI funding at 61%, followed by investment made directly through the Waste RDI Roadmap, which for 2020/21, is recorded at 28%. International funding and particularly local private R&D sector funding remain disappointingly low. The proportion of investment by the different sectors remains very much aligned with previous years.

A number of academics noted that, while they did not receive any research funding in 2020/21, they did utilise their author funding to support further research, including post-graduate students. This additional funding is not captured in the graph shown here on co-funding.



SCIENCE COMMUNICATION

PLATFORMS FOR LEARNING AND KNOWLEDGE EXCHANGE

South Africa has developed considerable expertise in waste and resources management in the context of a developing country, and in the context of a circular economy, which is of growing interest to the local, regional and international waste community. Science communication by the WRIU and its partners provides an opportunity to:

- Showcase South Africa's waste R&D and Innovation locally and internationally
- Build local and international capacity based on South African learning
- Strengthen local and international partnerships

Creating and participating in platforms for knowledge exchange and learning are important to achieving the objectives of the Roadmap, in particular, strengthening human capital.

WRIU ENGAGEMENTS

The WRIU had the opportunity to share the South African perspective on waste management at a number of events in 2020/21. Some of the highlights include:

- *"Minerals to Metals: Circular Economy and the way towards sustainable metals"*. UCT Panel Sustainable metals and how do we get there?, 13 May 2020
- *"Overview of the e-Waste Landscape in SA"*, Action Dialogue, e-Waste Strategy and Policy for the Gauteng Province, 25 Sep 2020
- *"Meeting the challenges of addressing plastic leakage to the ocean – Relevance of the G20 Framework for countries in Africa"*, EU Workshop on Measures to address marine plastic leakage through a circular economy approach, 8 Sep 2020
- *"Opportunities in transitioning Africa to a circular economy"*, IFAT Africa Webinar, 4 Sep 2020
- *"Breaking the plastic wave"*, SA Plastics Pact Conference, 8 Oct 2020
- *"Developing and achieving a Circular Economy in South Africa – A Strategic Overview"*, WRC Circular Economy Dialogue, 22 Oct 2020
- *"Circular economy macro reflections – South Africa and Africa"*, DEFF Training, 17 Nov 2020
- *"Potential for job creation in waste recovery, reuse and recycling"*, WasteAid and Huhtamaki Circular Economy Network Launch, 3 Dec 2020
- *"Opportunities in waste and circular economy"* Presidential Employment Stimulus, Panel discussion, Science Forum South Africa, 10 Dec 2020
- *"The value of waste: Insights from Africa"*, South Africa – Norway Sustainability Webinar, 3 Feb 2021
- *"Placing South Africa's research within the context of key issues facing the waste sector"*, Waste & Society Webinar, 11 Feb 2021
- *"The role of municipalities in EPR"*, SALGA – Industry EPR Workshop, 12 Feb 2021
- *"The challenge of plastic waste management in Africa"*, Abidjan Convention Webinar, 4 Mar 2021
- *"Transitioning towards a circular economy for plastics"*, Safripol Conference, 17 March 2021

The WRIU also continues to play a mentorship role to local and international post-graduate students in shaping their research projects. This includes identifying potential research topics of local, regional or international importance, to ensure impact through research.

MEDIA ENGAGEMENT

A summary of the media engagement over the past year is provided in the section "Reflecting on 2020/21'. Engagement with the media is an important element of supporting knowledge transfer to key stakeholders, including the general public.

WEBINARS

The Waste and Society SARChI Chair plays an important role in facilitating the dissemination of research findings, through a series of webinars started in June 2020. The aim of the webinars is to create a platform where students, national and international researchers, policy-makers and industry can present their research, and creates a platform for networking.

MONITORING AND EVALUATION

STRUCTURES

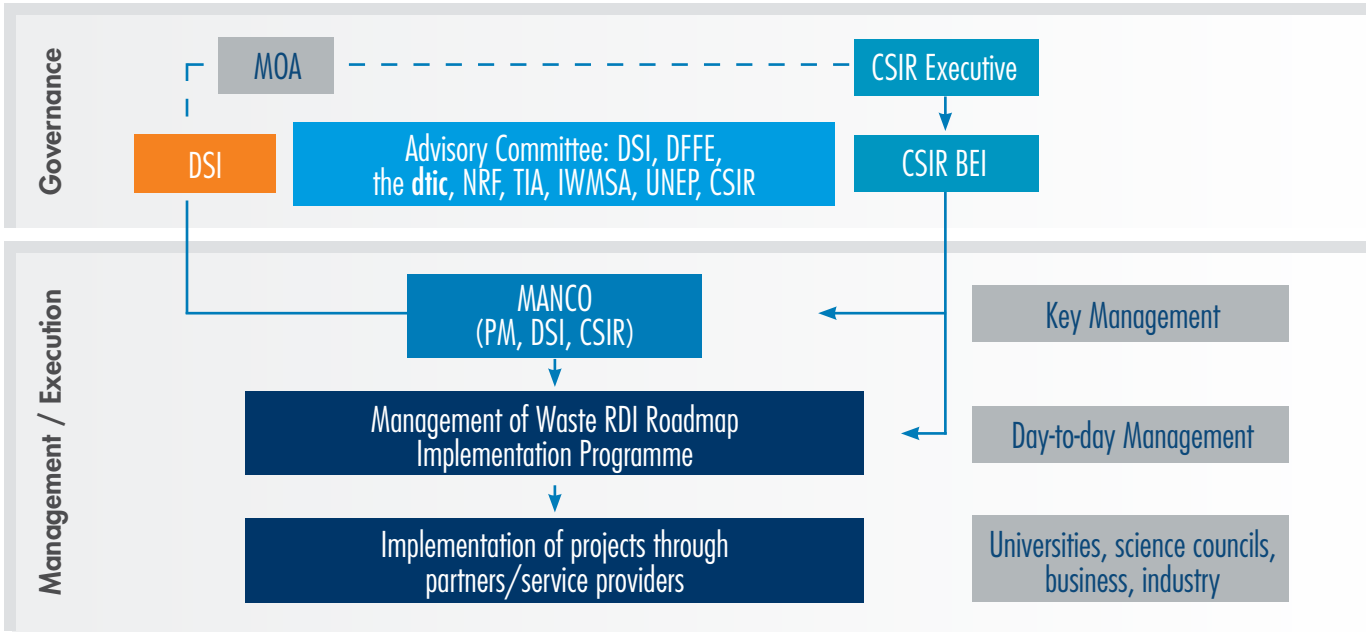
The Waste RDI Roadmap is implemented by the CSIR's WRIU in partnership with the DSI, DSI entities, other government departments, universities and science councils, business and industry. Effective governance and oversight of activities within the WRIU is important to the Roadmap's successful implementation. The Waste RDI Roadmap governance structure is as follows:

- an **Operations Committee**, made up of the DSI Director: Environmental Services and Technologies and the WRIU Manager
- a **Management Committee**, made up of senior representatives of the DSI and CSIR Hosted National Programmes
- an advisory **Steering Committee**, made up of representatives of government, government entities and the waste sector

REPORTING

The Waste RDI Roadmap portfolio of funding is monitored through regular reporting. All grant holders are contractually required to submit quarterly progress reports to the WRIU. These reports cover technical, operational and financial progress for the quarter. Twice a year, grant holders are required to submit proof of registration for all post-graduate students supported on grant projects. All information is consolidated by the WRIU and reported quarterly to the DSI on the overall implementation of the Waste RDI Roadmap.

The Waste RDI Roadmap governance structure is as follows:



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