Changing the face of waste management in South Africa through research, development and innovation

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ABSTRACT
The 10-year Waste Research, Development and Innovation (RDI) Roadmap for South Africa aims to develop and deploy performance improvements in waste management in order to maximise the diversion of waste away from landfill towards value-adding opportunities, thereby creating social, economic and environmental benefit for the country. This paper outlines the progress made during the first year of implementation of the Roadmap. With the seed funding provided by the Department of Science and Technology, the Waste RDI Roadmap Implementation Unit has already awarded 9 post-graduate scholarships and 11 research grants to South African Universities and Science Councils in support of human capital development and strategic waste RDI. The Roadmap has also successfully held three Industry-meets-Science workshops, with the aim of increasing RDI engagement between industry and academia. Leveraging local and international investment, the Roadmap has the potential to contribute significantly to waste management in South Africa, through improved human capital development, R&D and technological and social innovation.

1. INTRODUCTION

1.1 Background

The Department of Science and Technology (DST) initiated the development of a national Waste Research, Development and Innovation (RDI) Roadmap for South Africa, in 2012. The aim of the Roadmap being to stimulate human capital development (HCD), research & development (R&D), and innovation (technological and non-technological), in the South African waste sector, through the strategic investment in science and technology.

The DST approved the 10-year Waste RDI Roadmap for South Africa in early 2015. The Roadmap presents a structured national approach to waste RDI over the next 10 years, as a means of "*supporting the implementation of national policy, strategy and planning on waste and secondary resources management in South Africa*". Through directed RDI, the Roadmap aims to develop and deploy performance improvements in waste management that are able to maximise the diversion of waste away 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 social, economic, and environmental benefit for South Africa.

From the 1 April 2015, the CSIR has been contracted by the DST to implement the Waste RDI Roadmap. This paper outlines the progress made to date in achieving the short-term RDI objectives of the Roadmap.

1.2 Development of the Roadmap

During the period 2012-2015, a team of experts from the DST, CSIR, Mutualfruit and Icando, worked with representatives of government and industry, to craft a Waste RDI Roadmap that would directly support the needs of the country. The following documents were produced during this period, which helped to shape and define a 10-year Waste RDI Roadmap for South Africa:

- Current and required institutional mechanisms to support waste innovation (DST, 2012)
- South African Waste Sector (2012). An analysis of the formal private and public waste sector in South Africa (DST, 2013)
- The economic benefits of moving up the waste management hierarchy in South Africa (DST, 2014a)
- Capabilities at South African Universities and Science Councils (2014) (DST, 2014b)
- Trends in waste management and priority waste streams for the Waste RDI Roadmap (DST, 2014c)
- Opportunities for priority waste streams (DST, 2014d)
- A Waste Research, Development and Innovation Roadmap for South Africa (2015-2025) (DST, 2014e)

1.3 Focus of the Roadmap

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)

Through a process of regional stakeholder consultation, the following five priority waste streams were selected for inclusion in the Roadmap (for Phase 1) –

- Municipal solid waste
- Waste plastic
- Organic waste
- Waste electrical and electronic equipment (WEEE)
- Waste tyres

Finally, by working together with Expert Working Groups from each of the five priority waste stream sectors, cross-cutting issues and challenges facing the sectors were identified and grouped together to define six broad areas, or clusters of activity –

- Strategic planning
- Modelling and analytics
- Technology solutions
- Waste logistics performance
- Waste and the environment
- Waste and society

Short-, medium- and long-term RDI Objectives were defined by specialists active within the National System of Innovation, in each of these six clusters, thereby mapping out an implementation plan for achieving the objectives of a 10-year Waste RDI Roadmap for South Africa.

2. IMPLEMENTATION OF THE ROADMAP

The Council for Scientific and Industrial Research (CSIR) was appointed by the DST in early 2015, to implement the Waste RDI Roadmap on their behalf. The Waste RDI Roadmap Implementation Unit (WRIU), hosted by the CSIR was established in April 2015. The following sections summarise the progress made to date in implementing the Roadmap.

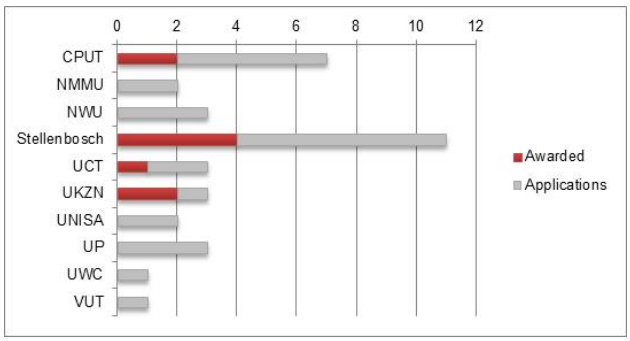
2.1 Human Capital Development

Human capital development is one of the three main pillars of the Waste RDI Roadmap. Scholarship Calls for post-graduate studies aligned with the Roadmap, were issued by the WRIU in September 2015, for the 2016 academic year.

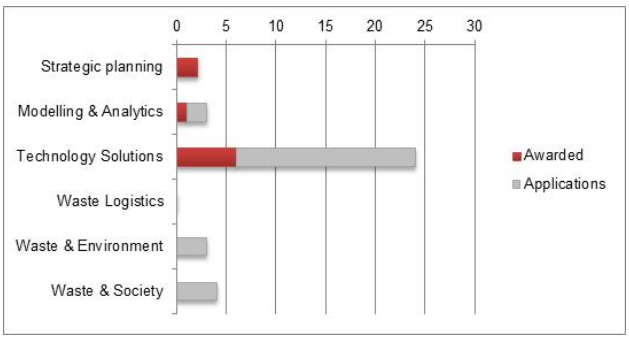
A total of 28 Masters Scholarship applications were received. The majority of the Masters applications received focused on “Technology solutions” (61%) and “Organic waste” (57%). The emphasis on organic waste in the applications was not surprising, as it aligns directly with the findings of the Capability Mapping initiative completed by DST in 2014 (DST, 2014b), which showed the highest research activity levels across South African Universities and Science Councils to be in organic waste.

A total of 8 Doctoral Scholarship applications were received. As with the Masters applications, the majority of Doctorate 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 Doctorate applications, with the focus being predominantly on the informal waste and recycling sector.

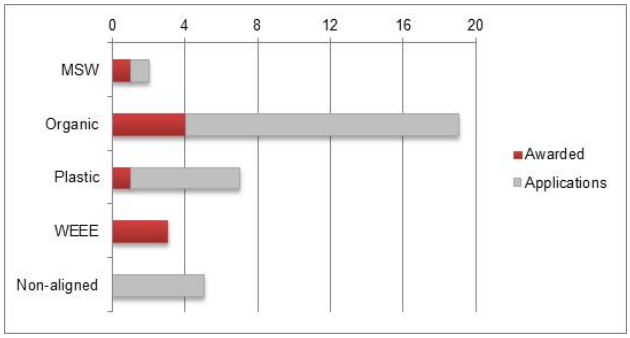
Of the 36 scholarship applications received, nine scholarships were awarded for 2016 (8 Masters Scholarship and one Doctoral Scholarship). The majority of the awarded scholarships (44%) are in organic waste valorisation (value recovery).



(a) By host institution



(b) By Waste RDI Roadmap cluster



(c) By Waste RDI Roadmap priority waste stream

Figure 1. Overview of all post-graduate scholarship applications and awards (2016)

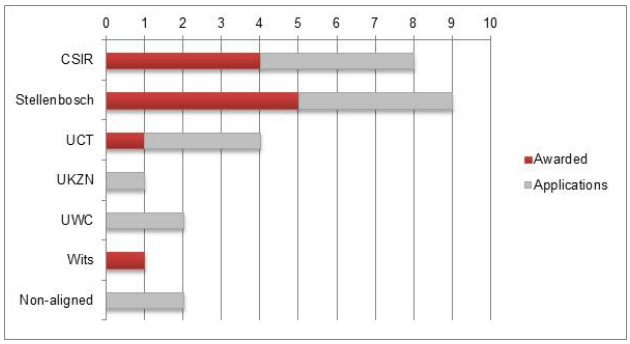
2.2 Research and development

An Open R&D Call was issued by the WRIU in October 2015, for projects starting April 2016. The calls were open to all public research institutions. Proposals needed to align with the six clusters and five priority waste streams of the Roadmap. A total of 22 Grant applications were received under the 2015 Open R&D Call – a total funding ask of R29.5m. 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 to not only the DST's 10-year Waste RDI Roadmap, but also the South African Bio-Economy Strategy. 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, including a strong focus on biorefinery. The remaining projects awarded under the call, focussed on municipal solid waste and waste electrical and electronic equipment (WEEE).

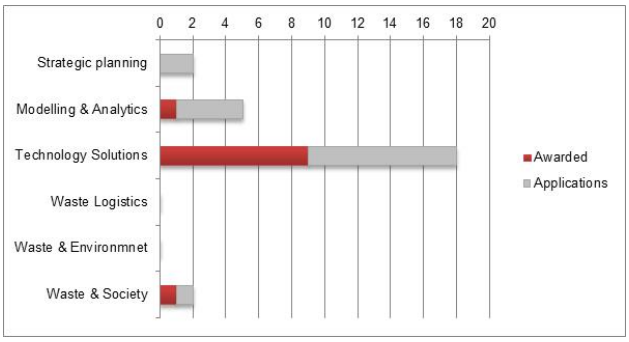
Growing interest in WEEE R&D and Innovation was evident in both the 2015 Scholarship and Grant applications. This is encouraging given that it was an area identified in the Capability Mapping initiative completed by DST in 2014, as having low research activity levels. From the review of the applications received in 2015, it was evident that work needs to be done to inform the 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 (RFP) 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.

2.3 Innovation

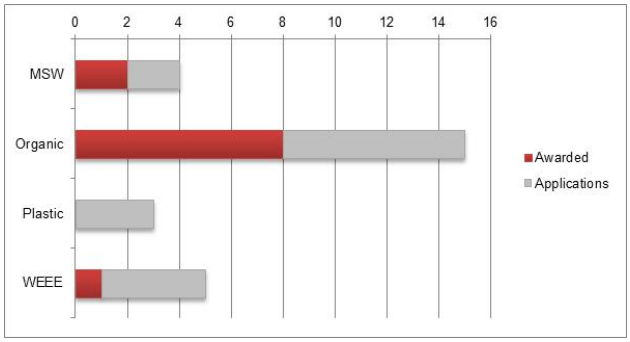
An Open Innovation Call, for upscaling technologies from Technology Readiness Level (TRL) 3, was issued by the WRIU in October 2015, for projects starting April 2016. The calls were open to all public research institutions. Proposals needed to align with the six clusters and five priority waste streams of the Roadmap. 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 a 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%). 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.



(a) By host institution



(b) By Waste RDI Roadmap cluster



(c) By Waste RDI Roadmap priority waste stream

Figure 2. Overview of all R&D and Innovation Grant applications and awards (2016)

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.

3. INTERNATIONAL RDI PARTNERSHIPS

International waste RDI collaboration is an important component of growing South Africa's capability in integrated waste management and associated waste valorization. An analysis of current waste RDI partnerships showed that South African public research institutions are currently participating in collaborative waste-related research projects with institutions from 21 different countries across the world, with strong links to researchers in the European Union member states (10 participating EU countries) followed by Africa (5 participating countries). Germany ranked the highest, with the greatest number of collaborative waste RDI projects, followed by Denmark, USA and Malaysia. These countries provide potential points of engagement for expanding country-to-country bilaterals and for strengthening international waste RDI collaboration. Further supported by the Joint European and African Research and Innovation Agenda On Waste Management (EC, 2013).

4. CONCLUSIONS

The DST has achieved good results in the first year of implementation of the Waste RDI Roadmap, however, there is much still to be done in achieving the long-term goals of the Roadmap. The focus for the coming year therefore remains firmly on –

- Close monitoring of currently funded post-graduate 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 supporting impact and 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 amongst others, country-to-country bilateral agreements and industry partnerships
- Supporting local government in the evaluation and demonstration of alternative waste treatment technologies

However, South Africa, as with most emerging economies, face a difficult economic climate for the foreseeable future, with government and business cutting back on expenditure. This has a direct impact on the public and private sectors' 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. This is also reflected in the latest figures for the national gross expenditure on research and development (GERD), recently released by the DST, which remained unchanged at 0.73% for the third consecutive year, well below the target of 1,5% of GDP (DST, 2016). It remains uncertain as to whether new seed funding for the Waste RDI Roadmap will be made available by Government for 2016/17, over and above the existing financial commitments for post-graduate scholarships and Grant Agreements.

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

- Calls for post-graduate scholarships
- Calls for R&D and Innovation grants, and
- Targeted research to gather evidence to support the sector

ACKNOWLEDGEMENTS

The CSIR acknowledges the leadership provided by the Department of Science and Technology in the development and implementation of the Waste RDI Roadmap; the input provided by the waste sector in the development of the Waste RDI Roadmap; and the support from the national system of innovation in giving effect to the Roadmap.

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