



science  
& technology

Department:  
Science and Technology  
REPUBLIC OF SOUTH AFRICA

## DST BIO-ECONOMY WORKSHOPS

APRIL / MAY 2014

Submitted by:

Centre for Science, Technology and Innovation Indicators (CeSTII)  
Office of the Deputy CEO Research  
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27 February 2015

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## 1 EXECUTIVE SUMMARY

In recognition of the policy landscape to drive the bio-economy through strategic investment in biotechnology competencies, the Department of Science and Technology (DST) launched the South African Bio-economy strategy in January 2014.

A key concept entrenched in the National Bio-economy (NBS) is intensifying the shift in emphasis from developing biotechnology capabilities to developing bio-economy. This will allow the biotechnology sector to combine efforts with other sectors, including the Information and Communications Technology (ICT) and other technologies to develop holistic solutions and industrial applications for the agriculture, health and industry and environment sectors. The strategy is aligned with related policy instruments, such as the New Growth Path (NGP), the Agricultural Policy Action Plan (APAP) and the Industrial Policy Action Plan (IPAP).

The DST launched a series of workshops in order to identify and prioritise key programmes for the implementation of the strategy. The first workshop was held on 31 March 2014 to conduct the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis to inform the priorities. The second phase of the development of the strategy implementation plan involved convening two workshops with stakeholders from agriculture on 8 - 9 May 2014 and industry on 8 - 9 May 2014. As per their aim, the workshops presented and interrogated biotechnology concepts within agriculture and industry and environment in order to identify new programmes, sub-programmes, projects and key priorities in the bio-economy sector, with the outputs aimed at informing the drafting of the implementation plans for the agriculture and industry and environment sectors to be tabled and submitted to treasury for funding.

This report presents the proceedings of the workshops held with stakeholders from Agriculture, and Industry and Environment sectors.

A total of 106 concept notes were presented, 53 for the Agriculture sector and another 53 for the industry and environment sector. For each of the Agriculture and

Industry and environment sectors at the respective workshops, specialised task teams were formed and tasked with fleshing out the concepts, grouping them into themes/programmes and sub-programmes, and harmonising and prioritising these concepts. The Agriculture and Industry and environment Implementation Plans were then to be developed based on the outputs from these processes and presented and submitted to Treasury for funding.

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### 3 LIST OF ABBREVIATIONS

APAP	Agriculture Policy Action Plan
BMGF	Bill and Melinda Gates Foundation (BMGF) Methodology
CeSTII	Centre for Science, Technology and Innovation Indicators
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DST	Department of Science and Technology
GDP	Gross Domestic Product
GERD	Gross expenditure on R&D
HSRC	Human Sciences Research Council
ICT	Information and Communications Technology
IP	Intellectual Property
IPAP	Industrial Policy Action Plan
IPR-PFRD Act	Intellectual Property Rights from Publicly Financed Research and Development Act
NARDS	National Agricultural Research and Development Strategy
NBS	National Biotechnology Strategy
NDP	National Development Plan
NGO	Non-governmental Organisation
NGP	New Growth Path
NIPMO	National Intellectual Property Management Office
NSI	National System of Innovation
OECD	Organisation for Economic Co-operation and Development
R & D	Research and Development
SMME	Small Medium and Micro Enterprises
SWOT	Strength, Weakness, Opportunities and Threats
TIA	Technology Innovation Agency
TORs	Terms of Reference
VCA	Value Chain Analysis

## 4 BACKGROUND

### 4.1 INTRODUCTION

The South African Bio-economy strategy was launched by the Department of Science and Technology (DST) in 2014 in recognition of the policy landscape to drive the bio-economy through strategic investment in biotechnology competencies.

An imported development rooted in the National Bio-economy Strategy (NBS) is the drive to expand the change in focus from developing biotechnology capabilities to developing bio-economy, enabling the biotechnology sector to join forces with the Information and Communications Technology (ICT) sector, environmental agencies, the social sciences and other technologies to develop holistic solutions and industrial applications for the agriculture, health and industry and environment sectors, creating a world-class innovation system of biotechnology. This also promotes the value chain approach in which the novelty of biotechnology is crafted to address a market need opportunity and, at the same time, encouraging collaboration and partnerships. The strategy is also aligned with related government policy instruments, such as the New Growth Path (NGP), the Industrial Policy Action Plan (IPAP) and the Agricultural Policy Action Plan (APAP) among others.

It is against this backdrop that the DST embarked on a series of workshops towards identification and prioritisation of key flagship programmes for the implementation of the Bio-economy Strategy. The first workshop was held on 31 March 2014 to conduct the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis to inform the priorities. In addition to this the DST initiated the second phase of the development of the strategy implementation plan by convening two workshops with stakeholders in agriculture and industry and environment. These two sectors, together with the health sector, had been identified as being the key economic sectors to contribute and benefit from a comprehensive Bio-economy Strategy.

## 4.2 AIMS / OBJECTIVES

In order to develop a strategic implementation plan for the bio-economy sector, the DST hosted two workshops in Pretoria; one with the stakeholders in Agriculture on 8 - 9 May 2014 and the other with stakeholders from Industry on 26 - 27 May 2014. Stakeholders were invited to draft and submit concept notes aligned with the Bio-economy Strategy and other policy instruments.

The aim of the workshops was to present and interrogate biotechnology concepts within agriculture and industry and environment with the intention of identifying programmes, sub-programmes, projects and key priorities in the bio-economy sector. These new programmes or projects would be the proposed vehicles for providing a new economic growth engine and socio-economic benefit through strategic investment in biotechnology competencies. The outputs of this interrogation were aimed at informing the drafting of the implementation plan for the agriculture and industry and environment sectors to be presented and submitted to treasury for funding.

This report presents the proceedings of the workshops held with stakeholders in Agriculture and Industry and Environment sectors.

## 5 METHODOLOGY

*Adapted from notes by Dr Jasper G Rees based on Bill and Melinda Gates Foundation (BMGF) Methodology*

### a) Presentation of concepts

Each person presented his/her half-page concept using a flip chart or one Powerpoint slide to the Committee over about 2 - 3 minutes. During the presentation, the Committee recorded their comments in three categories: "Positive", "Potential" and "Concerns, phrased as a question" (not as a negative) on one post-it per category. Each category was assigned a certain post-it colour, for example, green for "Positive", blue for "Potential" and red for "Concerns". A big supply of post-it leaves, thick black or blue marker pens and flip charts were required for this activity.

#### b) Collation of comments

At the end of the presentation the post-it leaves were collected and stuck on the flip-chart for that particular concept note. All the Committee's comments were then collated by concept and category and captured electronically in a MS Word file and Excel sheet at the end of the session on the presentation of concepts (see *Annexures 2, 3, 5 and 6*).

#### c) Discussion

The discussion session was meant to follow once all concepts had been presented but some of the discussions happened in conjunction with the presentations of the concepts. Each concept was discussed to tease out potential projects within the programmes and sub-programmes. The discussion included identification of suitable implementing and funding agencies to ensure optimal benefits from the implementation of these projects. It was also intended to tease out the full value chain, identifying the industry, producer, processor, retailer and consumer, and investigated the expected overall effect, which includes objectives, impact and outcomes. The overall effectiveness of the implementation plan of the projects was assessed through a SWOT analysis of the concepts. The concepts were also evaluated for alignment to the Bio-economy and other strategies such as NDP, IPAP, APAP, and other relevant policy instruments. Mechanisms to promote collaboration and buy-in, including incentives and funding imperatives were also teased out. The discussion aimed to identify gaps in the value chain(s)/ sub-sectors and ways of addressing them. An Excel sheet template has been designed for the facilitation of these discussions, as well as for the capturing the resultant information (see *Annexure 7*).

#### d) Prioritisation strategy

A draft prioritisation strategy containing proposed criteria for prioritising the projects was presented, followed by the formation of a task team for this task. The task team would, after the meeting refine the strategy through consultations and meetings. The refined strategy would be presented in a special meeting where the prioritisation of the projects would be finalised.

## **6 RECORD OF PROCEEDINGS**

In order to develop a strategic implementation plan for the bio-economy sector, the DST hosted 2 workshops at the CSIR Convention Centre, Pretoria. The first workshop included stakeholders in Agriculture (8, 9 May 2014) and the second workshop included stakeholders from Industry and Environment (26, 27 May 2014). This report summarises the workshop held with both stakeholder groups.

### **6.1 WORKSHOP 1: AGRICULTURAL SECTOR PRIORITISATION WORKSHOP**

#### **6.1.1 Opening remarks**

Mr Ben Durham opened the workshop welcoming all participants as well stating the purpose of the meeting. The purpose of the workshop was to liaise with the stakeholders to develop a strategic plan comprising of bio-innovative concepts as a proposal for submission to Treasury.

The plan was to identify programmes in key areas in the bio-economy field and to develop support mechanisms in order to build an efficient system. Innovation is a collective process that requires collaboration and would thus require institutions and individuals to work together and break away from the existing “silo’s”.

A draft implementation plan would be presented to the DST EXCO by end of August 2014, and would then be submitted to the Treasury. A clear and concise document that treasury would understand including budgets for the various concepts was to be developed.

A question was posed regarding other stakeholders e.g NGO’s, etc who were not present at the meeting. Response was that the meeting was intended to be a leadership committee consisting of different people to help develop the implementation plan. If there were “sector experts” who could contribute not present, they were most welcome to attend the meetings.

Dr Maneshree Jugmohan-Naidu also reiterated statements made by Mr Durham. She presented a summary of progress to date. She reported that a meeting was held on 31 March 2014 to undertake a SWOT analysis of the Bio-economy Strategy. Following that meeting, the Bio-economy workshops were planned for 8-9 May 2014 (Agriculture) and 26-27 May 2014 (Industry and Environment) to present and discuss concepts and corresponding programmes/projects for the development of an implementation plan of the Bio-economy Strategy to be submitted to the Treasury for funding. The Proceedings from the SWOT analysis meeting were then circulated, checked for correctness and errors corrected, and adopted as the true record of the meeting.

Stakeholders were tasked to produce half page concept notes which would be presented at the workshop. The concept notes received were circulated to all the members. Several rounds would follow to ensure that all concept notes were included and recorded.

### 6.1.2 Invited presentations

Presentations were made by 3 invited guests:

- Dr Henry Roman, DST

*Water Roadmap, Waste Roadmap, & and its implications for the Bio economy*

Dr Roman's presentation included an overview of the National System of Innovation (NSI) and the various stakeholders in the NSI. The presentation also expanded on the Waste R&D & innovation roadmap with the following key issues: re-defining waste, reducing waste going to landfills, waste in agricultural processing, recycling, etc. Development in SMMEs, developing Master's degrees in waste management, fostering a multi-disciplinary approach to waste management and the need to set ambitious targets to reduce industrial and domestic waste were also mentioned.

The water R&D & innovation roadmap was also presented, highlighting the facts on water availability, access to water and the strategy needed to carefully manage water resources. During the presentation potential synergies between the waste roadmap presented and the proposed bio-refinery were identified.

- Dr Somila Xosa, DST

*Biofuel strategy and implementation*

Dr Xosa presented on the government's development of the bio-fuel strategy. He presented on the feasibility of bio-fuels, commercialising barriers (challenges). His presentation expanded on examples of technologies used in bio-fuels as well as examples of commercialisation of certain bio-fuels. He also referred to the DST group's intention of mapping the resources in South Africa to develop a bio-energy atlas for South Africa (looking at supply and demand for bio-fuel resources). He also spoke on the agriculture link with bio-fuels – which was in much sense a controversial issue as it could be linked to inclusion/exclusion of certain crops.

- Dr Caiphus Ramoroka, TIA

*Value Chain view as a sustainable model for innovation in developing economies*

Dr Ramoroka presented on the role of innovations in economic development and the huge role it plays in economic growth. He also described the basic value chain concept ranging from basic research to applied research, to technological development and finally commercialisation. He spoke on the “Cluster development cycle” and used examples (Cassava value chain for industrial application: from discovering a market, processing facilities to produce product, collaboration and financial perspective) to further explain and elaborate on the said matter. Dr Ramoroka also discussed funding and the limitations associated with it as well as how different incentives are for young entrepreneurs versus young researchers. Another complexity listed was the example of how you can have very good technologies produced within a university but no clear method of taking the technology outside the institution and carry it through to a successful and viable commercial product.

- *All guest presenters agreed to make slides of their presentations available and will be circulated to members of the committee.*
- *Further details can be obtained from the slides attached in Annexure 1*

### 6.1.3 Presentation of concepts

Summary of all the concepts

**A total of 53 concepts were presented.** All the concepts presented are captured in Ms Word (Annexure 2).

The concepts would be clustered into Programmes and sub-programmes and a comprehensive table including this information would be created in a table in Excel (Annexure 3).

The Excel table was discussed and modified to insure all areas were included. One concept note was used as an example to populate the spreadsheet, to serve as a guide on how to populate the rest of the concept notes.

### 6.1.4 Actions and outcomes

Two task teams were formed to perform the following tasks:

#### **Task team A**

Members: Michael Peter, Jasper Rees, Marinda Visser, Eugenia Barros, Caiphus Ramoroka, Mark Laing and Blanch Ting

Actions:

- Flesh out the half page concepts for more detail and focus.
- Populate rest of the concepts in the Excel table with the agreed headings.
- Classify or group the various concepts into specific groups/ programmes and further identify sub-programmes and potential project areas.
- This activity was expected to clustering and identifying gaps and overlaps

- The team would meet for one day to do the actions identified. DST would arrange the logistics (provide venue and arrange flight & accommodation).

Date: 28 May 2014

Time: 9 am

Venue: DST, Pretoria

### **Task team B**

Members: DST

### Actions:

- To develop a document defining and describing the systems approach that would be followed in preparing the implementation plan for the bio-innovative programme/project.
- The proposal was to include what is new about the programme?
- What are we doing differently?
- The DST would take the lead for this activity. There may be a need to call on specific individuals to assist with this task.
- Task Team will also have to develop a concept plan on the complete Value Chain Analyses (VCA) via Case Study approach.

### **Case Study:**

A Case Study mapping the value chain would be done using one of the concept notes as an example. The aim was to demonstrate a comprehensive breakdown of the value chain ranging from concept right through to commercialisation of a product.

- Outcome: Map out Value chain template including all aspects such as economic and socio-economic impact (3 pages).

Members: Maneshree Jugmohan-Naidu, Mark Laing & Caiphus Ramoroka

Due date: Mid June 2014

### 6.1.5 Prioritisation of concepts

Prioritisation of concepts was initially proposed as an outcome for the bio-economy workshop. The meeting decided that prioritisation may not be needed at this stage of the proceedings.

- The main idea at that stage was to sell the overall Programme to the Treasury and not specific projects.
- However, it was to be kept in mind that it was highly unlikely to receive the entire budget from the Treasury, so some form of prioritisation will have to happen at a later stage.
- This did not necessarily mean loss of some projects, but could just require re-defining of some concepts.
- Projects could also be staggered over different time frames.
- Concepts that were ready for roll-out were to be prioritised first and perhaps used as a motivation to the Treasury.
- As such, short-term, medium-term and long-term projects were to be identified and prioritised.
- Dr Moses Sithole would also provide some tools for prioritisation as part of the proceedings of the workshop.

### 6.1.6 Summary

- DST would take the final responsibility for drafting the implementation plan and do the necessary editing to shape it into a format document that is acceptable for the Treasury.
- The draft implementation plan was to be ready by August 2014 and would include the detailed list of all the concepts, budgets, case study and other supporting documents.
- Workshop report will be circulate to all when available

**Next meeting:            To be decided**

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## 6.2 WORKSHOP 2: INDUSTRY AND ENVIRONMENT PRIORITISATION WORKSHOP

### 6.2.1 Opening remarks

Mr Ben Durham opened the workshop by welcoming all participants as well stating the purpose of the meeting.

Various stakeholders who were present at the meeting had been invited to the Industry and Environment prioritisation workshop to share insight, knowledge, and expertise towards the implementation framework of the Bio-economy Strategy. All colleagues had been invited to create and present their concepts that would be in the range of national importance. The DST wished to, not just chair the meeting, but also actively participate and propose concepts and had, therefore, engaged the services of an independent facilitator, the HSRC.

The purpose of the workshop was to liaise with the stakeholders to develop a strategic plan comprising of bio-innovative concepts as part of a proposal for submission to Treasury.

Three main categories of concepts that the DST were looking for were: programmes, enabling initiatives to support the system, and coordination.

The DST was hoping to identify programmes that would ultimately develop commercial outcomes, and identify infrastructure or support mechanisms that would assist programmes reach their natural conclusion. Examples include: technology platforms which are offering a service of a particular technology or set of technologies to support a project which will be pursuing a commercial objective.

There could be technology platform support, regulatory support, financial support, programmes that are enabling initiatives that look at supporting a range of interventions that would help the system to be more effective at developing products and commercial outcomes.

In terms of coordination mechanisms, a key finding of the OECD review was that of fragmentation of the NSI – a major objective of the bio-economy strategy is to

encourage coordination across the value chain to ensure that resources are being used optimally.

The aim of the workshop was also to link concepts in order not to have too many random concepts. There could be a need for a prioritisation process where there could either be prioritisation or elimination of “pet projects” or projects that were not directly in the best national interest.

The aim was to create a convincing and influential document that would convince the Treasury to release funds to support the initiative. The idea was to have the implementation plan ready to present to the DST EXCO by the end of August 2014, explaining the key challenges and the solutions that were being sought. The best hope was to present the plan to the Treasury and obtain funding for 2015.

Discussion of the agenda concluded that the workshop would first look at the broader issues (guest presenters), followed by a presentation of the concepts and a review of the Excel table in which all concepts would be captured with the aim of synchronising and harmonising the various concepts and at the end of the workshop. Various task teams would also be formed to continue with tasks identified.

### **6.2.2 Invited presentations**

- Ms Blanch Ting, DST  
Trends in Industrial Biotechnology

Ms Ting presented on trends in industrial biotechnology. In her presentation she reported on indicators based on current data obtained from the 2011/12 National R&D survey such as the Gross expenditure on R&D (GERD) intensity, flows of funds as well as international trends. The core objectives of the the Industrial Policy Action Plan (IPAP) and the Agricultural Policy Action Plan (APAP) were discussed in the presentation. These instruments recognise the need for the creation of job opportunities, particularly within the manufacturing industry while also exploring a wealth of opportunities driven by the green economy. She

further spoke on the development of bio-products, bio-plastics, pharmaceuticals, cosmetics, etc. which all have the potential to contribute to enhanced industrial competitiveness and environmental sustainability. She also mentioned that many of these concepts can be linked to other strategic areas, e.g the Waste RDI roadmap.

- Dr Lungile Shoba, TIA

Value chain view as a sustainable model for innovation in developing economies

Dr Shoba's presentation focussed on the innovation "chasm" that exists from research, development up to production. She presented examples of the value chain concepts, e.g linear view of innovation and the non-linear innovation approach and observed that TIA were integrating these two views on innovation. Based on the "cluster development cycle", she presented the following examples: the KZN Bioprocessing Innovation Programme, Enzyme manufacture value chain. Examples to demonstrate the value chain included: different projects, funders, stakeholders, drivers, infrastructure and facilities.

- Dr Kerry Faul (NIPMO)

Presentation on the IPR Act and its implications for the Bio-economy

Dr Faul presented on the policy evolution within the intellectual property sphere in South Africa and the establishment of NIPMO. She also expanded on the legislative mandate, the purpose and objective of the Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008 (referred to as the IPR-PFRD Act) to provide a regulatory framework for the management of this type of IP. She noted that NIPMO was created to play a facilitator and to some extent regulator (compliance monitoring, review and enforcement) function, and also provides an administrative and supporting function in respect of the Act. NIPMO also provides incentives to reward recipients for pro-actively securing protection of IP and commercialising rights. It also provides assistance to institutions with the establishment of offices of technology transfer and related capacity-building. It provides appropriate standards and best practices in

consultation with recipients and develops guidelines for intellectual property transactions involving non-South African entities and persons. There were questions raised during the presentation regarding ownership and joint IP rights. Dr Faul advised that NIPMO developed clear and defined guidelines regarding ownership and facilitation of IP rights. Further questions were also raised regarding academic qualifications on IP management in terms of academic institutions that offer such courses. In response, Dr Faul pointed out that UNISA offers a national diploma (NQF level 8) and NIPMO intends to provide bursaries towards this field of study.

- *All guest presenters agreed to make slides of their presentations available and will be circulated to members of the committee.*
- *Further details can be obtained from the slides attached in Annexure 4*

### 6.2.3 Presentation of concepts

Summary of the concepts:

**A total amount of 53 of concepts was presented.** All the concepts presented have been captured in Ms Word (Annex 5).

Concepts would be clustered into Programmes and sub-programmes and a comprehensive table including this information would be created a table in Excel (Annex 6).

The Excel table was discussed and modified to ensure that all areas were included. One concept note was used as an example to populate the spreadsheet, and this would serve as a guide on how to populate the rest of the concept notes.

#### 6.2.4 Actions and outcomes

Four task teams were formed to perform the following tasks:

##### **Task Team 1: Bioprocesses & Bio-manufacturing**

Prof Sue Harrison, Dr Dusty Gardiner, Dr Lungile Shoba, *et al.*

##### **Task Team 2: Bio-refinery**

Prof Johann Gorgens, Dr Lungile Shoba, Prof Jannice Limson, Ms Blanche Ting, *et al.*

##### **Task Team 3: Waste and Water**

Mr Petrus van Staden, Dr Valerie Naidoo/ Dr Jo Burgess, Ms Blanche Ting, *et al.*

##### **Task Team 4: System Support**

Dr Sandile Ncanana, Dr Doug Sanyahumbi, Mr Rian, Dr Lungile Shoba, *et al.*

Committee Members who were not present at the Workshop would be contacted to indicate in which Task Team they would prefer to serve.

It was proposed that the next meeting date for each Task Team should take place within two weeks after the Workshop, i.e., between 2–18 June 2014. Members would liaise via email to set the most suitable date.

#### 6.2.5 Prioritisation of concepts

Dr Moses Sithole presented a method for prioritising the projects inherent in the bioeconomy concepts. The method makes use of the concept of a prioritisation matrix which is a planning tool that provides a way of ranking projects by order of importance based on criteria as determined to be important for this purpose.

Gosenheimer (2012) presents five simple steps that are involved in creating and using a prioritisation matrix. These are:

- 1) Determine your criteria and rating scale: First determine the factors you will use to assess the importance of each project. Then, for each of the criteria, establish a rating scale to use in assessing how well a particular project satisfies that criterion, e.g., 1-9, where 1 = not required/mandated and 9 = required or mandated.
- 2) Establish criteria weight: Assign a weight against each criteria according to its level of importance.
- 3) Create the matrix: List your criteria down the left column and the weight and names of potential projects across the top as the column labels.
- 4) Work in teams to score the projects: Review each project and rate the project on each of the criteria. Next, multiply the rating for each criteria by its weight and record the weighted value. After evaluating the project against all of the criteria, add up the weighted values to determine the project's total score.
- 5) Discuss results and prioritise your list: After scoring all the projects, have a general discussion to compare notes on results and develop a master list of prioritised projects that everyone agrees upon.

Dr Sithole noted that methods were available in the literature for determining a standardised rating scale (0-1) and, simultaneously, scoring on this standardised scale (in Steps 1 and 4), as well as determining standardised weights for each criterion (in Step 2). For example, Carpenter (2010) suggested the following methodology:

- 1) Determine standardised scoring for each project: For each criterion, create a 'symmetric' matrix where all the projects are listed down the left column and the same projects are listed across the top in the same order as they appear down the left column. Across each row of the matrix, compare the project on this row on this criterion to each of the other projects as they appear across the top row by choosing the most appropriate value from the values: 10 = much more value, 5 = more value, 1 = equal value, 0.2 = less value, 0.1 = much less value; that best describes how the project fares according to this criterion compared to the other projects. Put an X in each cell representing a project compared with itself, as such as comparison will not be considered in

the final scoring. Then, starting immediately after each X and running across each row representing each project, calculate the row total. Finally, calculate the standardised score for each project on this criterion by creating an extra column in which each row total is divided by the grand total, obtained by adding all the row totals together. The sum of the standardised scores will equal to one, necessarily.

- 2) Determine standardised criteria weight: Create a 'symmetric' matrix where all the criteria are listed down the left column and the same criteria are listed across the top in the same order as they appear down the left column. Across each row of the matrix, compare the criterion on this row to each of the other criteria as they appear across the top row by choosing the most appropriate value from the values: 10 = much more value, 5 = more value, 1 = equal value, 0.2 = less value, 0.1 = much less value; that best describes how the project fares compared to the other criteria. Put an X in each cell representing a criterion compared with itself, as such as comparison will not be considered in the final weights. Then, starting immediately after each X and running across each row representing each criterion, calculate the row total. Finally, calculate the standardised weight for each criterion by creating an extra column in which each row total is divided by the grand total, obtained by adding all the row totals together. As in the case of the calculated scores as presented above, the sum of the standardised weights will, necessarily, equal to one.

Dr Sithole further noted that the approach to implementing the Prioritisation Matrix method by Carpenter (2010) as outlined above can be automated using an Excel template (see attached example template). The approach was recommended for the prioritisation of the Bio-economy concepts/projects. However, it was agreed that, at that stage, prioritisation would not be implemented to avoid losing important concepts. Instead, a harmonisation exercise would be undertaken, whereby similar concepts would be combined into single concepts, gaps would be identified and filled and then, if necessary, prioritisation would be carried out on the harmonised concepts.

## 7 KEY FINDINGS

### 7.1 List of priority areas:

A total of 106 of concepts were presented at the both the agriculture and industry and environment workshops

- The main thematic areas of the concepts presented could be mainly classified into the following categories:
  - Agronomic systems / agro-processing;
  - Plant and animal improvement;
  - Food quality and food safety;
  - Bio-refinery / Biocontrol and Bio products;
  - Crop improvement / development / crop protection;
  - Genomics;
  - Commercialisation and
  - Technology Platforms.

### 7.2 Bottlenecks and regulatory framework that exist as either enablers or barriers

The following bottlenecks and regulatory framework were identified for the within the Agriculture sector:

- Environmental impact assessment. National Environmental Management: Biodiversity Act, (NEMBA).
- Transport links; social infrastructure (schools, shops etc);
- Collection of crop and animal production data;
- Barrier: access to sufficient or commercial data (e.g. climate).
- GMO Act; Agricultural Pest Act; Plant Improvement Act:
  - Application of the legal frameworks when GMO technology is used;
  - Explore deregulation of technologies within GMO Act;
  - The role of DAFF is critical for the successful registration of GMO based products;
  - Guidance from role-players such as DAFF, TIA, MRC, NICD;
  - Biovac Guidance on policy and product registration is essential.

### 7.3 Gaps in the value chain

- Definition of the value chain is needed, keeping in mind the different value chains for the various sectors, e.g. industry value chain, and innovation value chain.
- Incentives for industry are very different from incentives for HEIs, Science councils and government institutions and therefore one of the gaps in the value chain associated with it may be the limitations in terms of acquiring funding.
- Linking concepts to commercialisation. Infrastructure and mechanisms should be put in place to ensure that the implementation of the concepts generates products (goods or services) that have a high demand in the market.
- Marketing – demand versus supply as well as an inability to market are gaps identified in the value chain. The demand versus supply gap refers to customers' needs versus what can be produced to meet that demand. The inability to market gap opens up when the skills to do the marketing are lacking.
- Sharing of facilities, expertise and IP (e.g. new technologies for plant breeding) is usually restricted to the owner, creator, or funder.
- The value chain for the veterinary industry is well defined within the veterinary vaccines concept note with role players included. However, the progress along this value chain needs to be monitored and governed efficiently. This process can be facilitated by TIA but should include all role players in the veterinary industry.
- A large integrated campus environment needs to be created as part of the implementation of the Dinokeng Biocity concept to drive value chain promotion.
- As part of the implementation of the concept on integrated research and technology centre, there should be shared access to facilities and collaborations within campus and nationally.
- For the informatics for Agriculture concepts, there should be free provision of services to SHF.
- For the Bio-farming concept, role players should be incorporated across the value chain. Gaps in the value chain should be identified and new enterprises may need to be established.
- All stakeholders in the value chain will be involved in the implementation of the livestock improvement concept. In addition, there should be provision for extension work to cater for small-scale farmers.

- In order to add value, access, subsidisation and publicity should be considered in the implementation of the concept on National Centre for Phenomics.
- For the crop protection concept note, there should be close collaboration needed between plant breeders, bio-control researchers and primary producers.
- Similarly, close collaboration between plant and animal breeders, bio-control researchers and primary producers should be integrated into the Biopesticides and Biofertilisers concept.
- The Harnessing spatial technology concept will require mechanisms/incentives to ensure collaboration among industry and government actors, as much of the attribute data is held separately in many different institutions and companies.
- Forest engineering innovations will need collaboration between Transnet Freight Rail, primary producers and processors to ensure innovative logistic responses.

#### **7.4 Mechanisms to promote the value chain:**

- All stakeholders in the value chain need to be involved to allow mechanisms for all the stakeholder types involved to meet and identify their joint challenges and determine how they can all contribute, each according to their capabilities,
- The innovation commercialisation value chain need to be unpacked and all key components identified and put into place i.e. Inventors, technology agents, IP practitioners, commercialisation agents, funders, companies willing to buy new inventions and agents able to negotiate the licenses. This principle needs to be applied to all potential concepts or programmes identified to be supported through the Bio-economy Strategy Implementation Plan.
- Important to link concepts to commercialisation. Infrastructure and mechanisms should be put in place to ensure that the implementation of the concepts generates products (goods or services) that have a high demand in the market.
- Rank project proposals by their technology readiness level (TRL) i.e. their position along the value chain (relevant to market-readiness, and the developmental budget magnitude)
- Development of ICT strategies to ensure widespread access (eg apps loaded on all phones distributed by national carriers)."

- Sharing of facilities, expertise and IP (e.g. new technologies for plant breeding) is usually restricted to the owner, creator, or funder. Under the concept of open innovation, sharing of IP should be encouraged to promote further innovative activities and commercialisation.
- Access, subsidisation and publicity should be considered for value addition
- The case study to map out the value chain done by one of the task teams would be a valuable tool to apply. The purpose of the case study was to take a concept, map the value chain from concept right through to a commercial product, identifying all the potential phases and role players.

## **7.5 Mechanisms to promote collaboration and buy-in, including incentives and funding imperatives:**

### **7.5.1 Mechanisms to promote collaboration identified were:**

- Collaboration should not always be left to chance if it is to be effective and efficient. Therefore it may be more feasible to encourage collaboration to be more structured and coordinated. This could include processes such as identifying a plan which details the projects, individuals and entities to collaborate with based on expertise and main activities.
- Mechanisms/incentives need to be put in place to ensure collaboration among industry and government actors, as much of the attribute data is held separately in many different institutions and companies.
- Close collaboration is needed between plant and animal breeders, bio-control researchers and primary producers. This can be achieved by creating fora and platforms where plant breeders and animal breeders that are working on related breeding problems can meet and discuss challenges and champion solutions cooperatively. Examples include plant breeders working on developing new technologies for animal feed cooperating with animal breeders in developing those technologies with the aim of developing the best feeds for given livestock breeds.
- Collaboration is required between Transnet Freight Rail, primary producers and processors to ensure innovative logistic responses. To achieve this associations and cooperatives within the associations of primary producers and processors for

given cash crops could be formed, and platforms could be created between these associations/cooperatives and Transport Freight Rail to facilitate cooperative solutions to challenges of transporting the produce and innovations for transport cost reduction and increase transportation efficiency.

- Improved cooperation between government departments involved in water, agriculture and food. Poor cooperation between departments may result from a number of reasons including physical distance and members of one department viewing projects and objectives from not only a different perspective but also as unrelated to those of other departments. Ways improving cooperation between departments may include designing and working on interdisciplinary projects, hosting interdepartmental meetings once or twice a month, encouraging departmental managing heads to meet more frequently on matters of common interest, sharing notes from departmental meetings, encouraging members of one department to interact with members from another department. The meetings and other interactions can be achieved through cost-effective ways, such as video or teleconferencing, skype, and email.
- Improved cooperation between industries and Government. Both industry and government must work together in finding solutions to the problems that they face/raise, such as the decline in economic growth and dealing with regulations to protect our environment, safety and health. This will demand more effective communication and more effective action programmes than have been put in place today.
- Incorporate role players across the value chain. Individuals or companies or other entities that have demonstrated success and have a good track record in adding value to products could add to the value chain to enhance the quality of the products.

#### **7.5.2 Incentives and funding imperatives:**

- Enhance funding from industry, DST, DTI, DAFF, science councils and provincial departments. One way of achieving this would be through enhancement of collaborative research with and on behalf of these entities on research projects of common interest.

- Strong links between industry and academia which will be able to support bio-innovative projects. This can be achieved by strengthening the link between industry and university research, particularly the research link between industry and the CSIR. Universities play a role as a hub of innovation and technology research. However, translating university research into successful products and solutions has its challenges. Research links can be achieved by building strong relationships between universities and firms. Both universities and industry need to be creative and flexible when approaching collaborations to achieve stronger results, as, although universities and industries have different missions and cultures, there are mutual benefits to these collaborations. From the university perspective, this can be accomplished through building a university-innovation ecosystem where campus policies encourage and reward industry collaborations.
- Can get more industry funding with a better integration of the value chain. As mentioned above, this can be achieved by increasing more industry-related R&D.
- Need subsidy of costs to access the technology. One way of achieving this is to creatively adapting technologies, by, for example, developing cheaper prototypes.
- A good opportunity to exploit available local resources. South Africa is rich in natural resources whose biotechnological properties maybe explored to be used for development of new technologies to socio-economic benefits, such as developing vaccines for currently incurable diseases.
- Funds would be need to come from government in certain cases as the industry of specific concept notes is too small.

## **8 RECOMMENDATIONS ON THE WAY FORWARD**

- Analyses of the concepts submitted was aimed at identifying whether any overlaps exist between the concepts and how these can be harmonised, whether they are aligned to policy, what the socio-economic benefits will be, and what legislative frameworks exist in either the form of an enabler or as a barrier.
- During the workshops specialised task teams were formed and mandated to further flesh out the concepts presented and cluster them into specific

themes/programmes and sub-programmes. The concepts would then need to be harmonised based on overlaps and similarities and a more refined list of concepts/ programmes will then be identified to which prioritisation criteria can be applied.

- Initially the prioritisation of the concepts was going to be part of the exercise when presenting the concepts during the workshop. However, it was felt that this was too early a stage to conduct the prioritisation exercise as there was concern that some of the concepts may be lost.
- A recommendation was made that a “draft prioritisation” could be based on project readiness of certain concepts as well as relevance. Short, medium and long term nature of projects as well the staggering of roll-out of projects could also be used to aid the prioritising process.
- Once all the concepts had been thoroughly investigated and harmonised, the programmes and concepts that would emerge could then be subjected to prioritisation criteria. The formal prioritisation methodology is described in detail in section 6.1.5 and may be applied if to the resultant concepts.
- These finalised programmes /concepts /projects would then be incorporated in the bio-economy implementation plan which would be submitted to the Treasury and other relevant entities with the aim of securing funding for these bio-economy initiatives.
- The DST noted that it reserves the right to edit and format the final document of the implementation plans according to its view of the needs of the National System of Innovation.

## 9 REFERENCES

Carpenter, E.D. (2010). Prioritization Matrix Is Made Easier with a Template. Last accessed on 25 September 2014 on: <http://www.isixsigma.com/tools-templates/templates/prioritization-matrix-made-easier-template/>

Gosenheimer, C. (2012). Project Prioritization: A Structured Approach To Working On What Matters Most. Last accessed on 25 September 2014 on

[http://oqi.wisc.edu/resourcelibrary/uploads/resources/Project\\_Prioritization\\_Guide\\_v\\_1.pdf](http://oqi.wisc.edu/resourcelibrary/uploads/resources/Project_Prioritization_Guide_v_1.pdf).

## **10 ANNEXURES**

### **Annexure 1: Presentation slides from invited guest presenters (Agriculture)**

*See attached Zipped file containing presentations from: Dr Henry Roman, Dr Somila Xosa and Dr Caiphus Ramoroka*

### **Annexure 2: Concept notes (Agriculture)**

*See attached Ms Word file*

### **Annexure 3: Analysis of concept notes (Agriculture – Excel sheet)**

*See attached Excel file*

### **Annexure 4: Presentation slides from invited guest presenters (Industry)**

*See attached Zipped file containing presentations from: Dr Lungile Shoba and Dr Kerry Faul*

### **Annexure 5: Concept notes (Industry)**

*See attached Ms Word file*

### **Annexure 6: Analysis of concept notes (Industry – Excel sheet)**

*See attached Excel file*

### **Annexure 7: Analysis of concept notes with input from Task teams (Excel sheet)**

*See attached Excel file*