RAPID IMPLEMENTATION EVALUATION OF THE AGRICULTURAL BIOECONOMY INNOVATION PARTNERSHIP PROGRAMME

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Abbreviation	Definition
ABIPP	Agricultural Bioeconomy Innovation Partnership Programme
ARC	Agricultural Research Council
CBD	Convention on Biological Diversity
DAC	Development Assistance Committee
DSI	Department of Science and Innovation
EIP	European Innovation Partnerships
GDP	Gross Domestic Product
IDC	Industrial Development Corporation
ICT	Information Communication Technology
FAO	Food and Agriculture Organisation
PMU	Project management unit
OECD	Organisation for Economic Cooperation and Development
NDP	National Development Plan
NEPF	National Evaluation Policy Framework
NGO	Non-Governmental Organisations
SMMEs	Small, medium and micro enterprises
TIA	Technology Innovation Agency
ToC	Theory of change
UFD	Ukhanyo farmer development

1. INTRODUCTION

When the Technology Innovation Agency (TIA) commissioned a rapid implementation evaluation of the agricultural bioeconomy[1] innovation partnership programme (ABIPP), Citofield was appointed as the service provider for the evaluation on 17 November 2022.

The terms of reference specified that this evaluation should provide information and evidence to the TIA, the Department of Science and Innovation (DSI), project partners and other programme stakeholders regarding results achieved so far, identify what has been working or not working, and provide lessons learned in terms of resources allocated over the years of implementation. In summary, the main objective of this implementation evaluation has been to assess the progress of the project's implementation to date and to identify lessons learned and/or remedial actions needed to achieve the desired results.

1.1. Background to the intervention

The ABIPP is a collaborative initiative aimed at promoting innovation and technological advancements in the agricultural sector (TIA, 2021). The programme focuses on supporting research, development and implementation of bio-innovations to enhance agricultural productivity, food security, sustainability, and competitiveness. According to FundsforNGOs (2022),[2] the ABIPP brings together various stakeholders, including government agencies, research institutions, industry associations, farmers and technology providers, to foster collaboration and exchange knowledge. This is done by leveraging cutting-edge biotechnologies, genetic engineering, precision agriculture and other emerging tools. The programme aims to address key challenges faced by the agricultural sector, such as improving crop yields, reducing environmental impact and

[1] Bioeconomy refers to the application of science, technology, and innovation to the sustainable production and use of biological resources to create innovative products, processes, and services for all economic sectors (Malabo Montpellier Panel, 2022, p. viii).

[2] https://www2.fundsforngos.org/agriculture-food-nutrition/agricultural-bioeconomy-innovation-partnership-programme-in-south-africa/

enhancing food security. By fostering collaboration, innovation and technology transfer, the ABIPP aims to contribute to the long-term sustainability, profitability and resilience of the agriculture sector while addressing environmental and societal challenges. In addition, the ABIPP targets a number of areas in agriculture, including crop improvement, livestock management, soil health, pest and disease control, and agricultural waste management. It supports projects that demonstrate the potential for significant impact, scalability and commercial viability.

Notably, the ABIPP was established in response to the growing need for innovative solutions in the agricultural sector to grow agricultural Gross Domestic Product (GDP) by supporting productive value chains, new niche products, and small-scale farmers to become more commercialised, consequently ensuring inclusivity and rural economic development. Nhamo (2022) observes that the agricultural sector faces numerous challenges, including climate change, resource constraints, market demands and the need for sustainable practices.[3] To address these challenges, governments, research institutions and industry stakeholders recognised the importance of investing in research and development of bio-based technologies and practices. Bio-innovation refers to the application of biological knowledge, processes and materials to develop innovative solutions for agricultural productivity, sustainability and resilience (Mabhaudhi et al., 2022).

In this way, the ABIPP builds on the advancements in biotechnology, genetic engineering, precision agriculture and other related fields. It recognises the potential of bio-based solutions such as biofertilizers, biopesticides, genetic modifications and precision farming technologies, to revolutionise agricultural practices and improve productivity while minimising environmental impact. The ABIPP operates in a policy framework that emphasises the importance of collaboration, knowledge-sharing and public–private partnerships. It seeks to bridge the gap between scientific research and practical application, ensuring that bio-innovations are accessible, adaptable and commercially

[3] https://www.dailymaverick.co.za/article/2022-10-12-achieving-food-security-demands-that-we-look-at-new-agricultural-pathways/

viable. According to the TIA (2018), the ABIPP is typically supported by government funding, grants, and strategic partnerships with industry stakeholders. In turn, it provides financial assistance to farmers, as well as technical expertise and resources to support research projects, technology development, pilot demonstrations and knowledge dissemination.

Through the ABIPP, the TIA and stakeholders aim to drive innovation, enhance competitiveness and create sustainable pathways for the agricultural sector. By investing in bio-innovations, the programme seeks to address pressing challenges, improve agricultural productivity, reduce environmental footprints and contribute to the overall development and resilience of the agriculture industry. In simpler terms, Figure 1 depicts the objectives of the ABIPP.

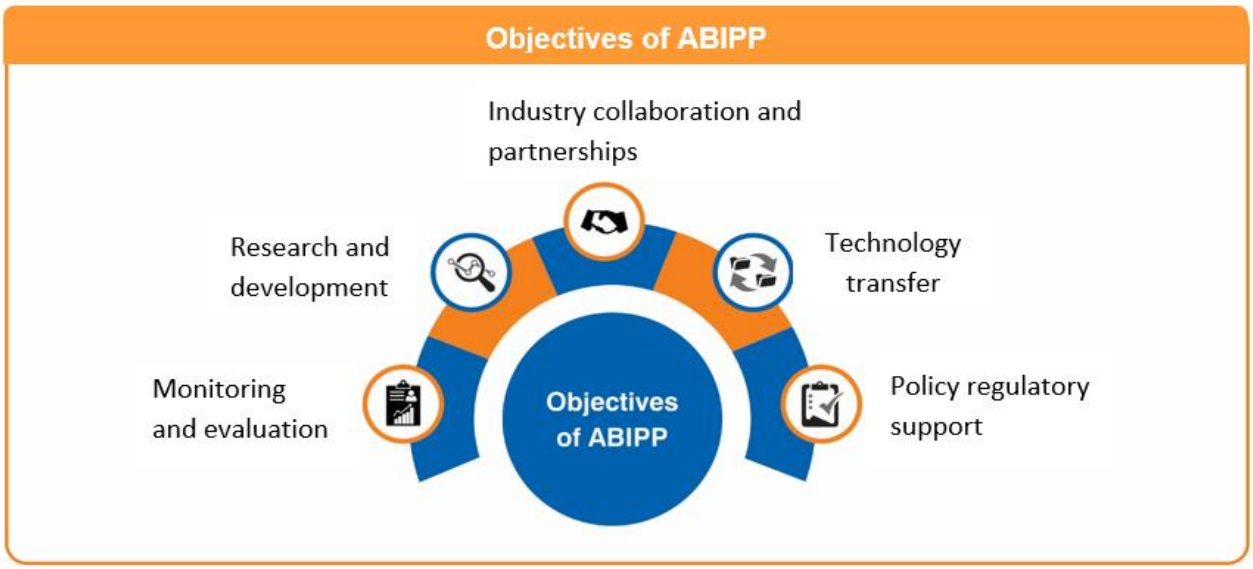

Figure 1: Objectives of ABIPP

The ABIPP serves as a catalyst for research, development and innovation by providing financial support to research initiatives, creating research platforms, and promoting partnerships between academia and industry. Moreover, it plays a pivotal role in facilitating the dissemination of bio-innovations, conducting training programmes and establishing networks for technology transfer and access to technology. The ABIPP maintains a close partnership with regulatory agencies and policymakers to ensure that the necessary frameworks are in place to support the safe deployment of bio-innovations.

The programme's commitment to effectiveness is evident through its establishment of robust monitoring and evaluation mechanisms which enable continuous assessment and improvement of its initiatives. Ultimately, the ABIPP's mission is to drive innovation in the agricultural sector, promote sustainability and contribute significantly to the overall growth and development of agriculture.

1.2. Background to and purpose of the evaluation

According to South Africa's National Evaluation Policy Framework (2011), implementation evaluations aim to evaluate whether an intervention's operational mechanisms support the achievement of the objectives or not and understand why. Evaluation also helps to provide evidence for continued support for a programme, to determine whether a programme is appropriate for the target population, and to establish whether there are any challenges with its implementation. The focus of this evaluation was to use available evidence to present an in-depth and comprehensive understanding of the quality of service delivery of the ABIPP.

The evaluation team understood that the overall purpose of this evaluation was to provide information to the TIA, DSI, project partners and other stakeholders with evidence of the programme results achieved so far, to understand what is working or not working, and what lessons have been learned in terms of the resources allocated over the past years of implementation. In simpler terms, the main objective of this implementation evaluation was to assess the progress of the programme's implementation to date and to identify corrections needed to achieve the desired results.

1.3. Key evaluation questions

The overarching evaluation questions were as follows:

1. To what extent is the design of the ABIPP relevant in enhancing the capacity of South African science in research and development, and innovation in agriculture?
2. How does the ABIPP contribute to the mandate of the DSI and the TIA to support the theory of change on how innovation can drive the growth of the agricultural sector and/or how does the programme contribute to a sustainable bioeconomy?
3. Is the ABIPP, as an intervention, being implemented according to design?
4. To what extent has the ABIPP been efficient in implementing projects?
5. What are the barriers to the success of the programme?
6. Are stakeholders aware of ABIPP support for innovation in the agriculture sector?
7. What were the geographical markets for goods and services from the ABIPP?
8. Has the ABIPP achieved the intended outcomes of its objectives?
9. To what extent has the DSI funding enabled the ABIPP to leverage additional funding?
10. How can the programme be strengthened and upscaled?

2. METHODOLOGY

This section discusses the purpose and methodological approach that was employed in carrying out this rapid implementation evaluation. The evaluation uses a pragmatic paradigm in which the evaluation team argues that quantitative data alone cannot holistically explain the impact and implementation processes of the ABIPP. The paradigm blends the philosophical underpinnings of the interpretivist paradigm (there are as many realities as the number of individuals – each individual and/or family has their own story to tell) with those of the positivist paradigm (we can quantify and generalise the impact to the rest of the population). The methodological approach, therefore, combines qualitative methods (sampling, data collection and analysis techniques) with quantitative methods. The attractiveness of the mixed method approach lies in the fact that it allows a combination of inductive and deductive thinking to respond to the evaluation questions while making use of various types of data.

Mixed methods research can be defined as "the collection or analysis of both quantitative and qualitative data in a single study in which the data is collected concurrently or sequentially, is given a priority, and involves the integration of the data on one or more stages in the process of research (Creswell et al pg 38., 2003). This definition is supported by Bamberger (2010) who writes that mixed methods research is an approach to research that involves the simultaneous or sequential collection, analysis, and integration of both quantitative (numerical) and qualitative (non-numerical) data in a single study.

This approach combines the strengths of quantitative and qualitative research methods to provide a more comprehensive and nuanced understanding of the research problem or question. In this evaluation, quantitative data refers to the collection of numerical data through methods such as the analysis of existing datasets. Quantitative data is often used to quantify relationships, patterns, and trends (Leeuw & Vaessen, 2009). On the other hand, the qualitative approach involves the collection of non-numerical data through interviews, focus groups, observations, or content analysis. According to Tashakkor and Teddie (2003), in mixed methods research, researchers can integrate quantitative and qualitative data at various stages of the evaluation process during data collection, data analysis, interpretation and reporting. Having a proliferation of data and meanings contributes to a complex understanding and improves the validity of the programme representations, findings and methodology that underpin the analysis presented in this report.

Ultimately, the evaluation team aimed to provide a more comprehensive and holistic understanding of the evaluation objectives by triangulating findings from quantitative and qualitative data. Figure 2 offers a pictorial overview of the methods used in this evaluation.

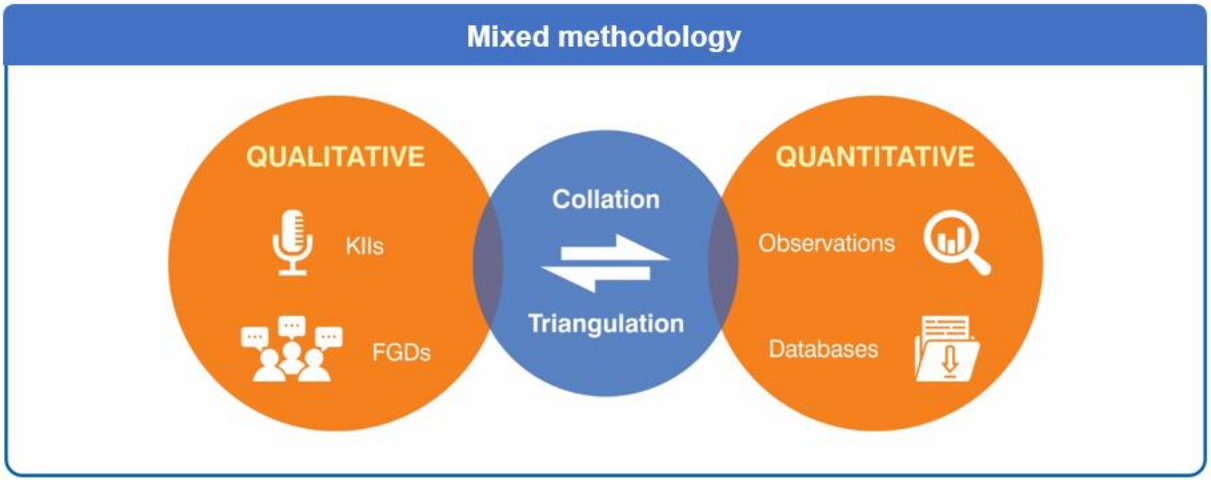

Figure 2: Mixed methodology approach used in the evaluation

It is important to note that this evaluation was originally conceived as a rapid evidence assessment, an approach to deliver a relatively quick synthesis. The methods explained in this section present a portrait of intellectual inquiry processes that resemble an interlocking system of levers typical of the internal mechanisms in a clock, controlling the evaluation and finding justification. Consequently, each method was used to reveal different facets of the same symbolic reality under evaluation.

2.1. Evaluation methods

The approach used in this evaluation was the utilisation-focused evaluation approach (Patton, 2008), whereby the work was engaged extensively with all the relevant stakeholders envisaged to utilise the results. The evaluation team complemented this with a theory-based approach as it set out to describe and test the theory of change for the ABIPP and validate the connections and assumptions across each level of the underlying results chain.

2.2. Evaluation framework and evaluation criteria

Drawing on the Development Assistance Committee (DAC) evaluation model from the Organisation for Economic Cooperation and Development, the evaluation criteria are linked to the purpose of this evaluation. In the case of ABIPP rapid implementation

evaluation, these criteria have been used to enable the evaluators to determine the merit, worth or significance of the methodology. Each criterion is a different lens through which the programme can be viewed. Together, the criteria provide a comprehensive picture of the programme interventions, the process of implementation, and the results. They describe the desired attributes of interventions, all of which should be relevant to the context, coherent with other interventions, achieve their objectives, deliver results in an efficient way, and have positive impacts that are sustainable.

The evaluators worked with these criteria to assess how the ABIPP could, based on the outcomes already achieved, be made more strategic and which technical areas of operation could be improved. These criteria facilitated the identification of evidence gaps and generated findings and recommendations that support a more effective implementation of the National Development Plan (2030) imperatives. Applying the DAC evaluation criteria unveiled issues that help to indicate how the ABIPP can enhance learning about bioeconomy and involve a range of stakeholders in participating in the evaluation. Figure 3 below summarises the criteria applied in this evaluation.

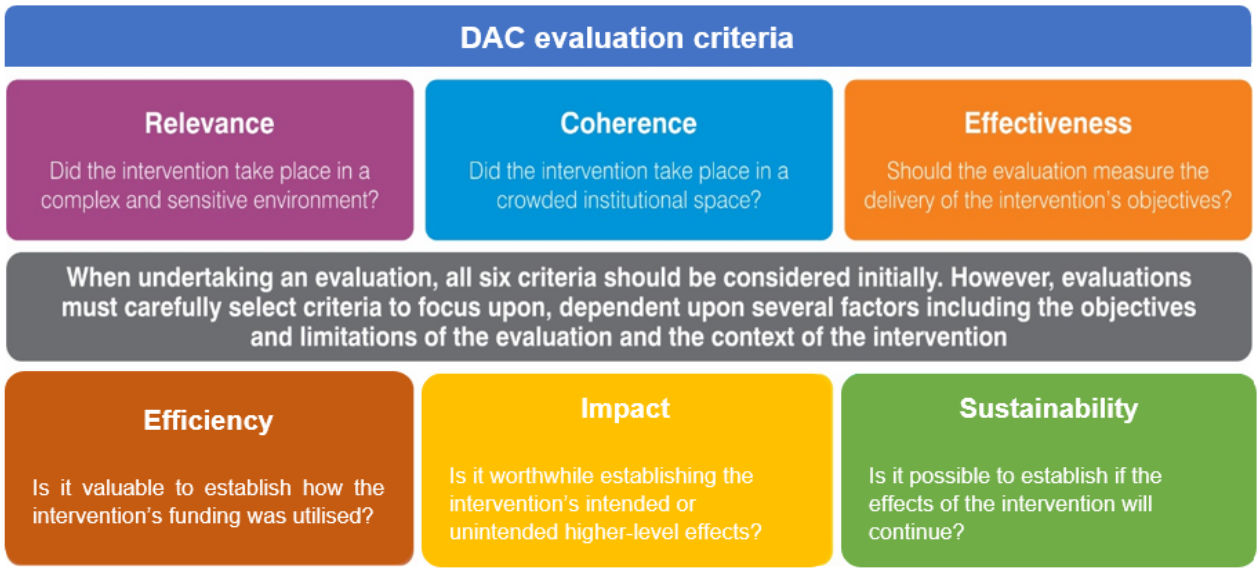

Figure 3: DAC evaluation criteria

Source: Organisation for Economic Cooperation and Development (2019)

The evaluation team was aware that the definitions of the criteria should be understood

in the broader context of South Africa's public sector. The following principles guided the use of DAC criteria in implementing the evaluation:

Principle One: The criteria were applied thoughtfully to support high quality, useful evaluation. They were contextualised, in other words, understood in the context of the evaluation, the intervention being evaluated, and with regard to the stakeholders involved. The evaluation questions and what the team intended to do with the responses informed how the criteria domains were specifically interpreted and analysed.

Principle Two: The criteria were not applied mechanically. Instead, they were applied according to the needs of the relevant stakeholders, the context of the evaluation and with the aim of ensuring alignment with utilisation-focused approach principles. Data availability, resource constraints, timing and methodological considerations also influenced how (and whether) a particular criterion was applied by the evaluation team.

2.3. Sampling strategy

Purposive sampling, specifically targeting officials and various stakeholders directly involved with or previously engaged in the ABIPP, was an approach well-suited to this study. The methodological choice aligns with the study's specific objectives, as it seeks to gather insights and knowledge from individuals who possess direct experience and expertise related to the ABIPP. By focusing on this group of individuals, the research could access valuable first-hand information highly relevant to the programme's evaluation and its impact (Bamberger, 2010). The approach was useful for providing descriptive, interpretative and in-depth analysis of the phenomenon, a cost-effective and time-effective approach that accommodated working with a very small population (Wagner & Esbensen, 2012).

A list of 31 stakeholder respondents was shared with the evaluation team by the client (TIA). However, only 19 (61,3%) of these were available for the interviews, as shown in Table 1.

Table 1: Interviewed stakeholders

Interviewed stakeholders		
Project name/ ABIPP role	**Name**	**Organisation**
Ukhanyo Farmer Development Support Project	Sinelizwi Mbande	Ukhanyo Farmer Development
Strategic Innovation Partnership for Grains and Oilseeds	Petru Fourie	Grain South Africa
Strategic Innovation Partnership for Grains and Oilseeds	Miekie Human	Grain South Africa
Strategic Innovation Partnership for Grains and Oilseeds	Stefan Links	Grain South Africa
Strategic Innovation Partnership for Grains and Oilseeds	Godfrey Kale	Grain South Africa
Wet Carcass Syndrome	Pranisha Soma	Agricultural Research Council
Wet Carcass Syndrome	Giel Scholtz	Agricultural Research Council
Marula Value Chain Project	Daniel Matlhare	Industrial Development Corporation
Cape Aloe	Phatheka Ndzotoyi	Council for Scientific Industrial Research
Honeybush Research Development	Cecilia Bester	Agriculture Research Council
Cassava Feasibility Study	Moses Lubinga	National Agricultural Marketing Council
Upland Rice Evaluation trials	Toi Tsilo	Agriculture Research Council
Steering Committee Member	Maneshree Jugmohan-Naidu	Department of Science and Innovation
Steering Committee Member	Thabang Bambo	Department of Science and Innovation
Upland Rice Evaluation trials	Timmy Baloyi	Agriculture Research Council
Omos YY project	Francois Swanepoel	Omos YY project
Programme Management Unit	Vuyolwethu Gxotiwe	TIA
Programme Management Unit	Kholofelo Ledoka	TIA
Cotton SA	Asked for name not to be mentioned	Cotton SA

In addition, two focus group discussions were conducted, as shown in Table 2.

Table 2: Focus group discussions

Focus group discussions		
Implementing agent	**Number of respondents**	**Organisation**
Cotton SA	15 respondents	Matlereng Farmers
Ukhanyo Farmer Development Support Project	17 Respondents	Ukhanyo Farmer Development Support Project

The style of interviewing employed in this evaluation was semi-structured interviewing, which began with a shortlist of topics to be covered and a general understanding of what kinds of information were desired. Most interviews were conducted on the preferred online

platform such as Zoom or Microsoft Teams, which was a comfortable, non-threatening environment for the respondents. When interviews were conducted telephonically, the evaluation team had to make a particular effort to create rapport, especially in those instances where the interviewer and interviewee had not previously met.

The DSI Evaluation Unit supervised the fieldwork process. This approach guided and facilitated the document review and engagement process with the selected respondents for effective data collection and triangulation. This made the whole exercise easier as it provided a formal entry point for securing interviews. Some respondents guided the fieldwork team to key documents and resources which were relevant to and supportive of the findings of this evaluation.

2.4. Process of analysis

The collected data were analysed using both qualitative (AtlasTI) and quantitative (advanced Excel) techniques. The process of analysing qualitative data began with confirming the collected data. This was done by ensuring that all selected participants responded to all the interview questions and verifying that identified documents were analysed according to the evaluation criteria. In this evaluation, the process of collecting data was documented to ensure that each step had been adhered to, and the process concluded. Once the data were confirmed, detailed notes were made to decipher the valuable pieces of information as they emanated, leading to decoding themes, creating categories and subcategories.

The final stage in this evaluation was interpretation based on the front-end and reverse-process analysis. The aim was to establish reliability, dependability and credibility in a naturalistic sense by analysing and integrating the data yielded through the use of multiple methods. Front-end analysis involved data and time triangulation to link data and integrate the key themes from different data sources gathered at different times across all stages in the evaluation. This was followed by a process of verification involving reverse-process

analysis where themes identified in the final analysis related back to themes identified at previous stages in the analysis, and then back through previous stages of the evaluation design.

The main aim of decoding was to allow the associated data and thematic ideas to be examined together and enable the mapping of patterns and connections towards comprehensive data analysis. The themes were then related back to the literature. Based on the results of both front-end and reverse-process analyses, a conceptual framework encapsulating the core themes from the study was developed as a basis for judging the value of the ABIPP. This was then checked and further substantiated through interviews and presentation of findings.

The logic of using multiple methods in analysis is that different methods increase validity and dependability. The evaluation team believes that the results of this evaluation are credible in so far as those reading the data and analysis will be able to recognise the same emerging patterns, which adds to the trustworthiness of this evaluation.

2.5. Triangulation

To ensure the validity of the results obtained during the evaluation, a triangulation methodology was employed. Triangulation involves the combination of different data sources and employs various techniques and methods in investigating the same phenomenon. The advantage of the triangulation method is that it provides for in-depth, rich data sets by integrating multiple data from various sources through collection, examination, comparison, and interpretation (Migiro & Magangi, 2011). As a result, triangulation helps to improve the validity of the results by reducing the risk of false interpretation of the collected information (Migiro & Magangi, 2011).

The evaluation team triangulated the results of the quantitative and qualitative approaches in and across both components of the evaluation. The team did this by grouping all the results around key analytical categories and carrying out a thorough

cross-cutting analysis. This allowed for a rigorous understanding of the aggregate outcomes, as well as the mechanisms explaining these. The triangulation strategy was synergistically integrated into the whole evaluation process, including the evaluation design, instruments, data collection and results.

In addition, the evaluation team used quantitative data drawn from programme reports, data set information drawn from a literature review, and qualitative data derived from interviews and discussions with a range of different participants with knowledge and experience of ABIPP. These sources of information, combined with iterative reflections in the team, comprised the three points of the triangulation process.

2.6. Ethical considerations

The rapid implementation evaluation of the ABIPP aimed to be transparent and accountable for the information provided by the respondents. At every key informant interview, respondents were briefed on the purpose of the evaluation and were aware that they had the right to withdraw from the interview at any time. This was done to ensure that consent from participants was offered voluntarily on the basis of an informed understanding of the scope of the evaluation. Clear agreements on the ground rules of attribution (e.g., whether the respondents can be personally identified, and whether they can be directly quoted or paraphrased) were requested and granted in all the interviews conducted.

2.7. Limitations of the evaluation

This evaluation has a number of limitations stemming from the staged design of the assessment, which is based on a combination of discourse analysis and theory-driven content analysis of data from a range of sources. Triangulation is used in and across different stages of investigation and different data sources. Each of these stages in the evaluation is potentially subject to errors and bias in interpretation. These limitations are

discussed in the following paragraphs.

2.7.1 Tight timelines

The evaluation process was conducted in a limited time frame (three months), which may have affected the depth and comprehensiveness of the data collection process. The condensed timeline could have restricted the ability to reach out to a wider range of participants and conduct more in-depth interviews or surveys. In addition, owing to time and resource constraints, the evaluation might not have allowed for extensive validation or cross-referencing of the data collected from multiple sources or perspectives. While the methodology generates useful evidence regarding the performance of the intervention, the levels of validity and reliability may be uncertain compared to a full-scale evaluation. This was further exacerbated by a delay in the early phases of the evaluation due to Christmas and New Year holidays.

2.7.2 Sample size

The sample size (61,3%) of respondents involved in the evaluation might not fully represent the diversity of perspectives and experiences in the population of interest. The composition of the sample could also have influenced the outcomes and generalisability of the results.

2.7.3 Non-responsiveness of respondents

Some participants who had been approached for the evaluation did not respond or engage fully, which resulted in a potential non-response bias. This could have introduced a level of self-selection, where only those with a specific inclination participated, potentially affecting the representativeness of the gathered data. In cases of non-response, the evaluation team sent follow-up emails, made calls, and asked the TIA and DSI to assist where necessary. Some targeted respondents were contacted several times

before setting up an interview time. These strategies worked in some cases and interviews were secured, but not in all cases.

In addition, the evaluation team continuously and systematically tracked all the information related to the fieldwork, including the names of people contacted, the stakeholder groups, the number of times people were contacted and the progress of interviews. There were cases where the DSI and TIA were requested to intervene.

2.7.4 Inadequate information for certain questions

Owing to the complexity of certain evaluation questions, some participants might have found it challenging to provide detailed or accurate responses. Insufficient contextual information or understanding could have hindered their ability to answer effectively, leading to incomplete or ambiguous data. Furthermore, some of the programme documents arrived after the validation workshop, prompting the revision of certain segments of the evaluation in response to the introduction of this fresh information.

2.7.5 Response bias

The responses collected might have been influenced by various biases, including social desirability bias or response bias, where participants provide answers that align with what they perceive as expected or desirable rather than their true opinions or experiences.

Despite these limitations, the evaluation aimed to gather meaningful insights and inform decision-making to the best extent possible in the given constraints. These limitations provide valuable consideration in interpreting the results and understanding their potential implications.

2.8. Capacity development element

The evaluation team organised a theory of change (ToC) workshop in collaboration the project implementation team. During the workshop, the evaluation team guided the implementation team and/or programme proponents through the various elements of the ABIPP's ToC. In addition, the DSI team were involved in the data collection process as part of interview and data analysis skills transfer.

3. THEORY OF CHANGE

The ToC for the ABIPP was designed to reflect the way in which applying a bioeconomy strategy in South Africa can address the country's socio-economic development goals of poverty reduction and improved quality of life while ensuring continued economic growth. The ToC is also a key strategic imperative for the Decadal Plan (2022) of the DSI in response to the new White Paper on Science, Technology, and Innovation (2019). The agricultural sector is a linchpin of the bioeconomy with great economic impact, offering opportunities for poverty alleviation, job creation, economic development and household food security in South Africa. The ABIPP is an instrument established by the Agricultural Biotechnology Unit of the DSI in 2017/18 to implement partnership programmes in support of a competitive and sustainable agricultural bioeconomy.

The goal of the programme is to foster innovation, partnerships, collaboration and sustainable growth in the agricultural sector, leading to enhanced resilience, sustainability and inclusivity, as well as improved food security, nutrition and social outcomes. To achieve this goal, the programme will implement a range of activities which include promoting research and innovation in the bioeconomy, providing training and technical assistance, and creating new value chains and markets.

By promoting research and innovation, the programme aims to contribute to the medium-term outcome of improved productivity and resilience in the agricultural sector, with reduced environmental impact. Through financial support for research and development programmes and initiatives that focus on developing new technologies, products and

practices, the programme will enable the adoption of sustainable agriculture and the bioeconomy. This will lead to increased availability and accessibility of nutritious and diverse food, ultimately leading to improved food security and nutrition for communities. The programme will also create new entrepreneurs, small, medium and micro enterprises (SMMEs) and job opportunities to encourage sustainable rural economic growth and development.

To enhance the capacity of stakeholders in the agricultural sector, particularly small-scale farmers and rural communities, the programme will provide training, skills development, and technical assistance. This will empower rural communities and small-scale farmers to adopt sustainable agriculture practices, including established farmers, and provide support to black and coloured students (who are studying to obtain high-end skills, doctorates and other qualifications). The dissemination of knowledge and information through channels such as online platforms, publications and workshops will increase the understanding and of sustainable agriculture practices and the bioeconomy by stakeholders in the agricultural sector, including rural communities.

The programme will also create new value chains and markets related to the bioeconomy, with a focus on rural areas. Through stakeholder collaborations and partnerships, the programme will foster innovation and development in the agricultural sector. The building of partnerships with other organisations, both locally and internationally, will bring expertise, funding and resources. Furthermore, the programme will increase access to and/or awareness of funding opportunities and investment in research and development initiatives that promote sustainable agriculture and the bioeconomy.

Through the implementation of these activities, the programme will create a responsive, coordinated and efficient national system that will enable the adoption of sustainable agriculture practices to promote the growth of the bioeconomy. In the short term, this will encourage new technologies, products and practices. It will also bring efficient and/or new productive value chains and enhance capacity and skills development among stakeholders in the agricultural sector. In the long term, the programme aims to empower

black farmers in low-income communities and more farmers overall to become commercialised, leading to improved access to markets and value chains for small-scale farmers, which will bring increased income generation and livelihoods. This will result in sustainable rural economic growth and development, improved food security and nutrition outcomes for communities, and reduced poverty in rural areas.

Implementation of the ABIPP assumes that certain enabling factors are in place to strengthen agricultural bioscience innovation in South Africa. The ABIPP is founded on the principles of coordination, partnerships, co-funding, inclusivity and a value chain approach. The successful application of these principles will ensure increased socio-economic impact from investments in new technologies. However, innovation is the nexus of these principles, the engine to drive the sector's growth. The National Development Plan (2030) points out that "innovation is the primary driver of technological growth and drives higher living standards". In this context, the intention is to determine how bioeconomy in the agricultural sector best supports the development of technologies and innovative solutions that not only increase productivity but also provide sustainable service delivery solutions; create an inclusive economy and transfer technologies and knowledge to people experiencing poverty and the informal economy; enhance high-end capabilities of institutions to develop innovations for inclusive development, and reduce household food insecurity and increase sustainability.

The ToC for the ABIPP is illustrated in Figure 4.

Reconstructed initial theory of change for ABIPP

Goal: To foster innovation, collaboration, and sustainable growth in the agricultural sector, leading to enhanced resilience, sustainability, and inclusivity, as well as improved food security, nutrition, and social outcomes.

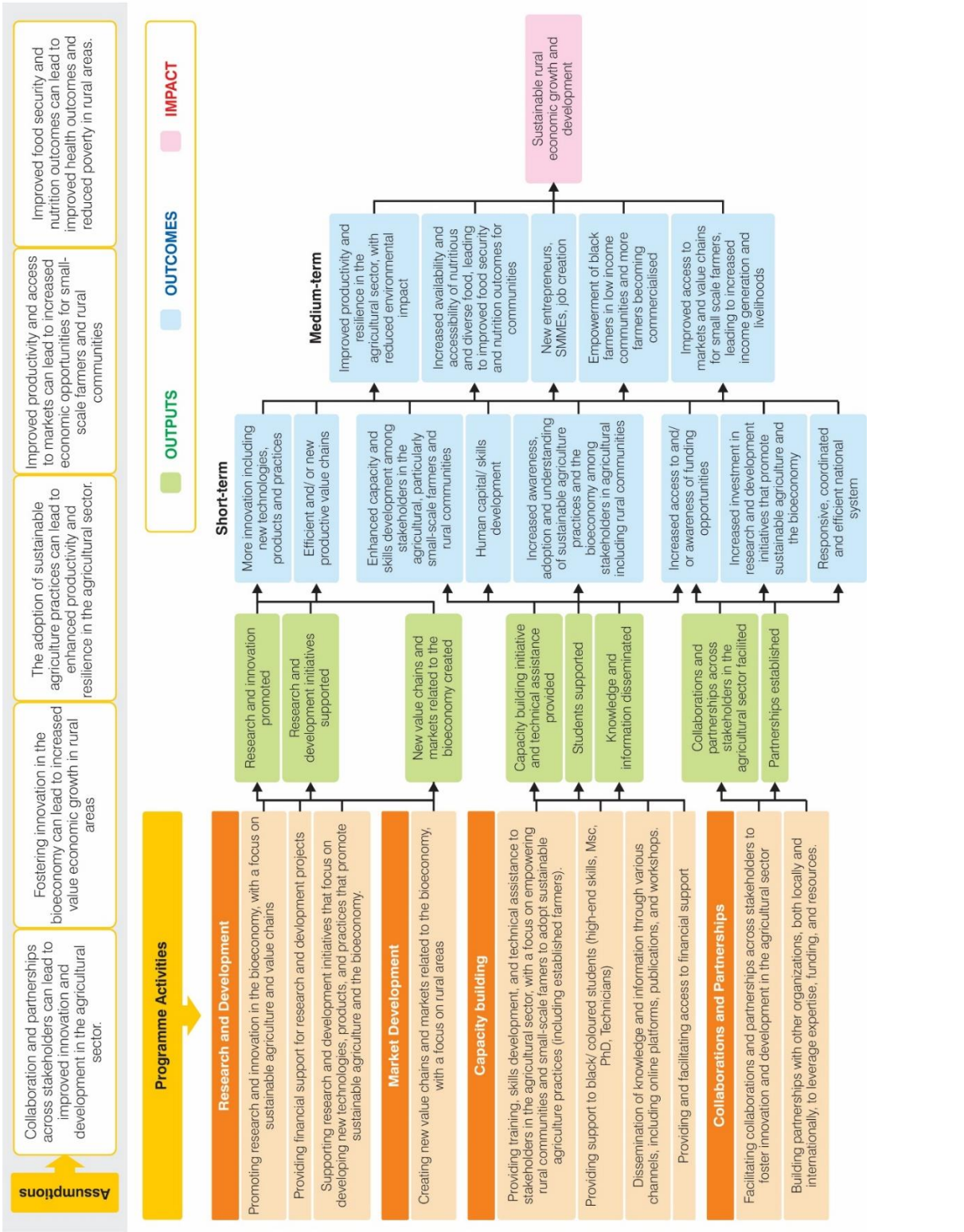

Figure 4: Reconstructed initial theory of change

4. LITERATURE REVIEW AND BENCHMARKING STUDY

The axiomatic point of departure in this section is to provide an overview of the data sources and literature that underpin the analysis presented in this report. Further to this broad task, a brief outline of the fieldwork conducted by the evaluators is provided. The evaluators then introduce the different streams of evidence collected that inform this report. The evaluation questions have been addressed through an amalgamation of desktop analysis and consultations with key stakeholders and are presented using the components of the DAC evaluation criteria. The evaluators used a range of bibliographic databases including Scopus, Web of Science, web search engines (Google Scholar), institutional websites for various development organisations, think tanks and research institutes. Following trial searches, the evaluators selected the search string "ABIPP" and "bioeconomy" and "TIA". Collectively, more than 30 sources of evidence were derived from this approach.

Over the years of its programmatic work, the ABIPP has generated a substantial quantity of documentation including quarterly reports, monitoring and evaluation reports, programme-related reports and other governance-related material. In conducting the traditional literature review, the evaluation team built up a set of relevant resources that informed the literature review. The meta-synthesis type of literature review is the "non-statistical technique used to integrate, evaluate and interpret the findings of multiple qualitative research findings. This approach allowed the evaluation team to combine the findings of the studies and identify their common core elements and themes.

The only limitation of the literature review was the fact that while the Internet offers enormous possibilities for accessing documents (solicited and unsolicited), evaluators had to exercise critical reflexivity. This was necessary because many of the documents on the Internet are produced by powerful political, cultural and economic groups who want to ensure that particular images reach the public domain and wish to counter negative images with more favourable representation. In addition, authors of documents inevitably decide to record and leave out information in accordance with their assumptions and their own social, political and economic environments.

In collecting information for analysis, the evaluation team consulted various sources, including the publications of governmental and multilateral organisations, journals, books

and think tanks. Moreover, the literature review process included papers retrieved from academic journals, research theses and grey literature (such as published government reports and publications from Non-Governmental Organisations (NGOs) and internal ABIPP publications). The publications listed in Table 3 are not exhaustive and serve as examples of literature sources identified during the project inception phase for evaluation. Historical documents are open to manipulation and selective influence, which is why it was pertinent for the evaluation team to consult a range of documents as shown.

Table 3: Documents reviewed

Category of documents reviewed for the evaluation		
Category	**Source**	**Usage**
Bioeconomy background	Malabo Montpellier Panel report	This assisted with some background information relating to bioeconomy within the African context.
ABIPP background	TIA Website DSI Website Online Bioeconomy Strategy document	This assisted the evaluators to have an acute understanding of the ABIPP and what it stands for.
Programme background and implementation	The ABIPP progress reports and slides TIA Strategic and Planning documents	This was reviewed to understand the institutional, contextual, and other factors of the programme and comprehend the issues the programme is aiming to address.
Literature review	Google scholar search TIA and DSI website TIA Strategic and Planning documents	This assisted the evaluators to fully understand the intervention under study and informed the design of the evaluation.

4.1. Literature review

4.1.1 Background to the ABIPP

Agriculture is one of the three sectors of the bioeconomy with the highest economic impact as it remains key in creating employment opportunities, economic development, and household food security (Convention on Biological Diversity [CBD], 1992). Unfortunately, despite its economic potential, the food and agriculture sector faces multiple challenges. These include meeting the growing global demand for food and agricultural products emanating from skyrocketing population and income growth and associated dietary changes, as well as the growing demand for the supply of biomass to satisfy the needs of the energy and industrial raw materials sectors (Food and Agriculture Organisation [FAO], 2021a). Moreover, the sector needs to adapt to climate change, supply chain disruptions, global wars and rising inflation (Malabo Montpellier Panel,

2022, p viii). Meeting these demands will place augmented pressure on the agro-food sector to supply food and raw materials from scarce natural resources while preserving the environment in the context of climate change.

Meeting these challenges in a sustainable way demands developing new products and improving existing technologies and practices to mitigate the ramifications of climate change. The bioeconomy – based mainly on harnessing bio-innovation for economic growth and social development – is gaining prominence in the policy debate. It is often argued that the bioeconomy can be a key part of the solution to multiple societal challenges, and several strategies have been developed at international, national, and regional levels.

Technology Innovation Agency (TIA)

The TIA's mandate is derived from the Technology Innovation Act (Act 26 of 2008). The Act established the TIA as an agency with a specific mandate to promote and stimulate technological innovation in South Africa. The TIA is envisioned to specifically focus on improving the quality of life and economic growth contribution in South Africa through the exploitation of creative new ideas, inventions, discoveries, and processes with the potential for the development of new products and services derived from these. It is the organ of state that serves as a key institutional intervention to bridge the innovation chasm between research and development from higher education institutions, science councils, public entities, and private sector, and commercialisation (TIA, 2022)

The ABIPP is an instrument established by the Agricultural Biotechnology Unit of the DSI to contribute to the objectives of the DSI's bioeconomy strategy, specifically those relating to the agricultural sector (TIA, 2022). The programme is implemented through the TIA and is premised on the key principles for the development of the Agricultural Bioeconomy, including coordination, partnerships, co-funding, value-chain-based approaches and inclusivity (TIA, 2022). Accordingly, the ABIPP has evolved into a mega-programme that currently funds, co-funds, coordinates, facilitates and actively manages multi-disciplinary, multi-institutional research programmes focusing on agricultural bio-innovation, product processes and services contributing to increased productivity, food security and sustainable rural development (TIA, 2022, p 3).

The ABIPP relies on a wide range of partners, as indicated in Figure 5, with industry partnerships playing a critical role.

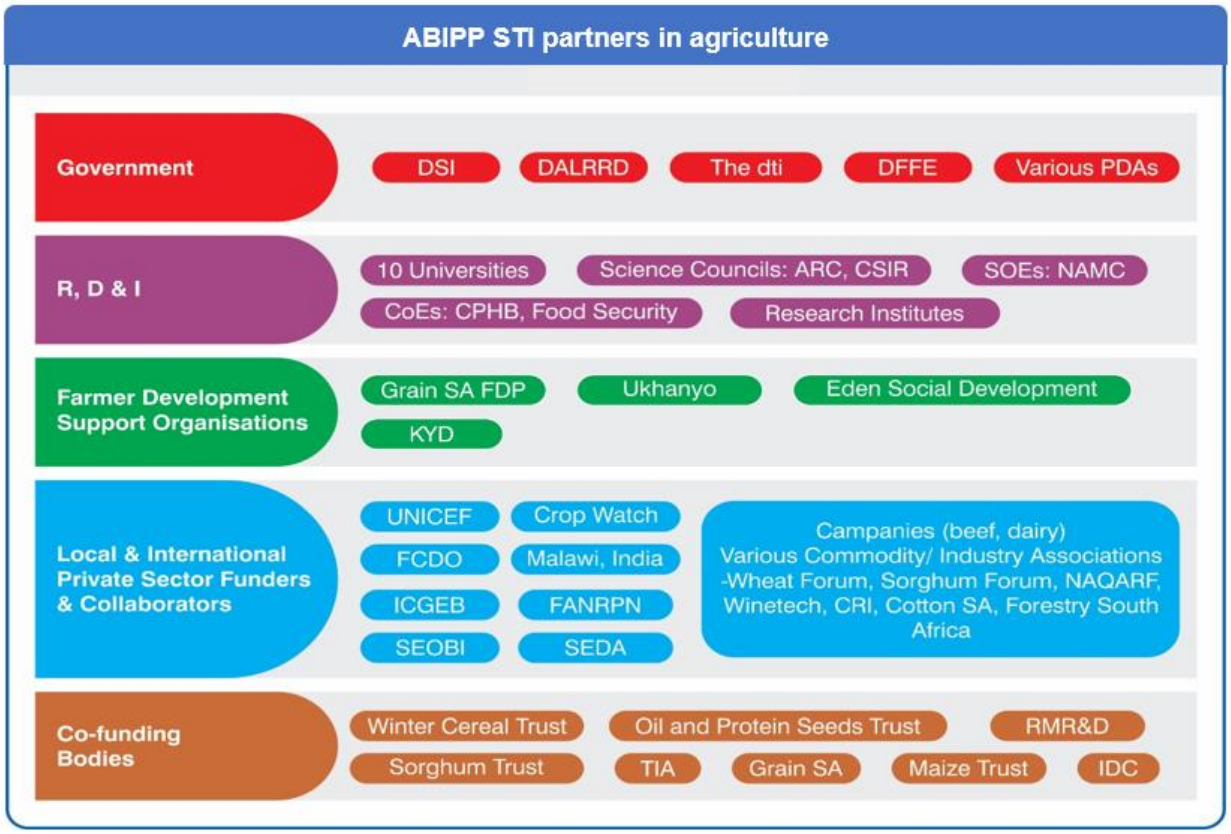

Figure 5: Key partners

Source: Department of Science and Innovation

Apart from the interventions, the ABIPP is further reported to be a vehicle that boosts collaboration on identified national imperatives. Consequently, it also actively promotes global competitiveness of the local agricultural sector.[4] Thirteen objectives of the ABIPP are outlined in the terms of reference for this study (see Table 4).

[4] Minister_of_Higher_Education_Science_and_Innovation_DSI_Annual_Report_2021–2022.pdf (pmg.org.za)

Table 4: Objectives of ABIPP

	Objectives of ABIPP
1	To actively manage and coordinate agricultural bio-innovation in South Africa within the strategic agricultural innovation intervention/focus areas
2	To provide strategic scientific leadership, through the scientific advisory committees, for each commodity or group of commodities/area
3	To seek, manage and fund multi-disciplinary, multi-institutional product research, development, and innovation projects from discovery to proof of concept
4	To support multi-stakeholder and public-private partnerships, and in line with the principles of the agricultural bioeconomy
5	To attract, public, private, and international funding partners to the agricultural innovation initiatives
6	To enhance the capacity of South African science in the research and development (and innovation) of novel or improved agricultural technologies, products, processes, and services in the identified strategic agricultural innovation intervention areas
7	To facilitate the transfer of technology and skills from abroad to South African institutions thereby building local expertise
8	To work closely with the technology transfer officers if collaborating universities, Agricultural Research Council (ARC) and other science councils on the protection of the developed Intellectual Property (IP) within the scope of the Intellectual Property Rights (IPR) Act
9	To develop pathways to facilitate the seamless movement of new products and services from the laboratory to the marketplace and to farmers where applicable
10	To facilitate through partnerships with local universities, science councils, and the private sector, the transfer of research outputs into improved agricultural outcomes and/or social benefit
11	To facilitate local and international networking and knowledge sharing within the framework of innovation and enable and facilitate collaboration (locally, nationally and internationally) between knowledge-intensive institutions and industry players
12	To leverage access to international infrastructure not available in South Africa
13	To coordinate agricultural innovation specific research in Southern Africa and be a focal point for interactions with Pan-African and international groups involved in agricultural research and innovation

4.1.2 Programme governance

The governance framework of the ABIPP is described in several documents created in conjunction with the programme. The framework was initially defined in the 2017 DSI–TIA project funding agreement (particularly in the ABIPP concept document and Annexure A1) which provided the initial guidelines for the ABIPP steering committee and other key programme structures. Subsequent programme documents elaborated on the governance framework, in particular the ABIPP "Standard Operating Procedures Review", the ABIPP "SteerCo Terms of Reference", and the ABIPP "Programme Management Unit Structure" documents.

The ABIPP concept document incorporated as part of the DSI–TIA project funding agreement defined the programme's initial governance structures. Some of the key structures identified included the programme's steering committee to be comprised of

the DSI, TIA, other government departments and co-funders from trusts, funding agencies, and research and industry spaces. According to current ABIPP documents, the ABIPP steering committee consists of representatives from the TIA, DSI, Grain South Africa (Grain SA), and the Department of Agriculture, Land Reform and Rural Development who are nominated in writing. Notably, steering committee membership can be extended to other stakeholders based on co-funding. The reviewed concept document further specifies that the ABIPP steering committee must have between five and eight members including a chairperson and a secretariat, the latter function to be rendered by the TIA. Two important governance considerations for the ABIPP, as noted in the concept document, are the following:

1 Conflict of interest mitigation: The document recognises the necessity of ensuring that the ABIPP steering committee chairperson does not have any conflict of interest. This is a critical step in maintaining the integrity and impartiality of the committee's decision-making process, especially in matters related to project selection and fund allocation.

2 Sub-committees or advisory committees: Another crucial aspect of governance outlined in the concept document involves the establishment of sub-committees or advisory committees. These committees are intended to be created for each of the ABIPP's focus areas. They are envisioned to consist of recognised experts from the relevant fields and industry stakeholders. Their primary role is to provide project oversight by reviewing and approving projects to receive support. They also assist the steering committee by offering recommendations regarding the allocation of funds.

In addition, a 2021 ABIPP document regarding the project management unit (PMU) structure specifies that the role of the subcommittees is to assess the innovative integrity of projects across the value chain from technology readiness levels 3 to 9, and to review progress on supported projects. The initial terms of reference for the ABIPP steering committee (included as part of the 2017 DSI–TIA project funding agreement) recommend that the chairperson of the abovementioned subcommittees should be a member of the ABIPP steering committee. Information gathered from engagements with ABIPP representatives, however, shows that this has not always been the case. There is a need to fully action the recommendation as articulated above.

Besides the steering committee and the subcommittees, the TIA is another important ABIPP governance entity. Overall, the TIA is responsible for all contractual obligations and the provision of the required infrastructure for the ABIPP. The reviewed documents reveal such TIA responsibilities to include "staffing, office and IT infrastructure, legal, procurement, information and financial management and support". In the TIA, the agricultural business unit specifically carries the mandate to manage the ABIPP. The responsible parties include the head of the unit, portfolio managers, and the ABIPP PMU's programme manager and coordinator, and programme managers. Overall, the PMU and the reporting structures of ABIPP are illustrated in Figure 6.

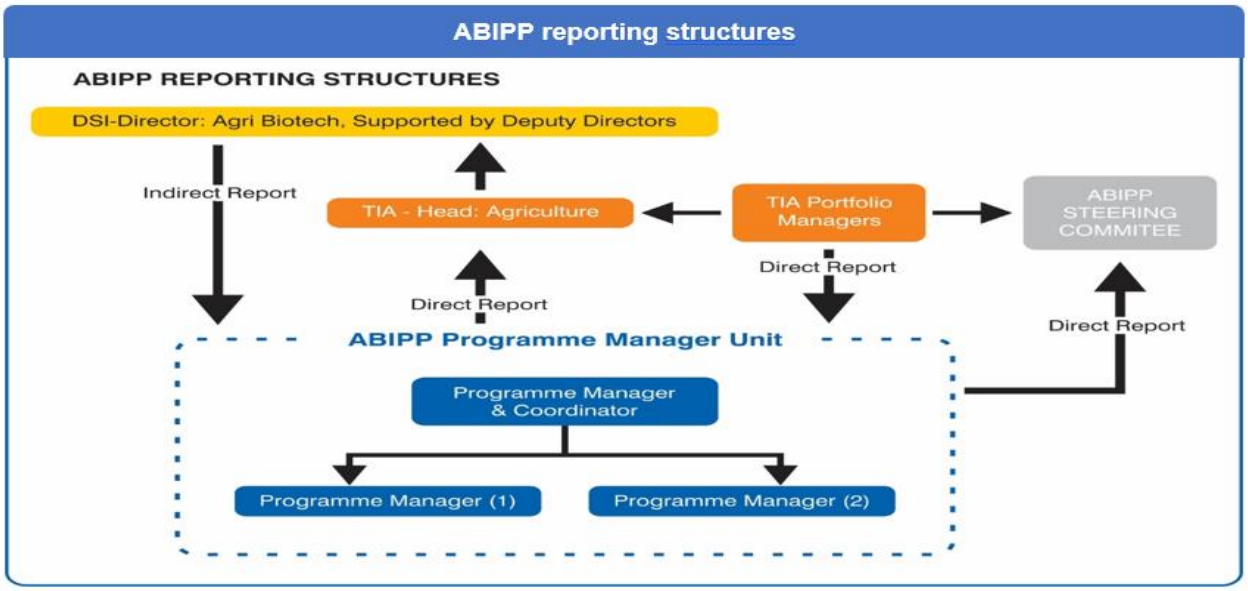

Figure 6: ABIPP reporting structures

The roles and responsibilities of each of the above establishments and parties are clearly articulated in various ABIPP documents, including the ABIPP PMU structure document. The document clearly defines what the involvement and mandate of the different parties should be. The different mandates and responsibilities are highlighted in the Table 5:

Table 5: Roles and responsibilities

Roles and responsibilities of parties within the TIA	
Authority	**Roles and responsibilities**
DSI	✪ Providing strategic guidance for the ABIPP ✪ Supporting with Business Plans, facilitating signing-off on workplans, KPIs, contracts, reports and all other M&E. ✪ Supporting strategic alignment in all supported projects.
ABIPP Steering Committee	✪ Providing strategic direction to the management of ABIPP and on implementation of programmes and projects. ✪ Ensuring alignment of the programme with the Bio-economy Strategy and other national agriculture priorities.
Head of Agriculture Business Unit (in charge of the TIA unit responsible for ABIPP)	✪ Ensuring the implementation of the ABIPP contract and allocation and disbursement of the funding within the respective financial year as per the given implementation plan. ✪ Overall oversight of the ABIPP contract. ✪ Ensuring the overall functioning of all TIA related parties involved in the ABIPP, including the PMU and the portfolio managers.
ABIPP Programme Manager and Coordinator (forms part of the PMU)	✪ Supporting and driving the overall implementation of the ABIPP as per the DSI – TIA contract. ✪ Working with the Director: Agricultural Biotechnology (DSI) and the Head of Agriculture BU to ensure that the implementation of ABIPP aligns with the requirements of the Agriculture sector and the priorities of the nation. ✪ Providing strategic alignment of the ABIPP with the BioEconomy Strategy by formulating and executing the Annual Work Plans ✪ Providing strategic leadership and support to the different committees of the ABIPP, including the steering committee and sub-committees. ✪ Ensuring the completion and timeous submission of programme related reports. ✪ Coordinating the overall project management, contracting and disbursement. ✪ Undertaking programme financial planning and the implementation of operational plans. ✪ Exploring new co-funding opportunities, including liaising with co-funders with the assistance of the DSI. ✪ Oversight of the PMU, including the managing of programme managers.
Programme Managers (forms part of the PMU)	✪ Executing the programme in line with the signed DSI-TIA contract. ✪ Overseeing the allocated ABIPP projects. ✪ Project planning. ✪ Interfacing with TIA portfolio managers. ✪ Compiling relevant reports for allocated projects. ✪ Contract management. ✪ Supporting the Programme Manager and Coordinator to implement decisions from the steering committee. ✪ Facilitating the feasibility and scoping of new projects in collaboration with other relevant authorities.
Portfolio Managers (defined as TIA employees with a dedicated responsibility towards ABIPP projects)	✪ Establishing relevant communication schedules. ✪ Developing workplans for the projects they are involved in. ✪ Overseeing all facets of stakeholder involvement within a designated timeframe and discovering additional industry partners as needed for projects. ✪ Setting up sub-committees. ✪ Conducting peer reviews where required. ✪ Preparing calls for proposals and reviewing panels where required. ✪ Managing and conducting due diligence on received project proposals. ✪ Completing risk assessment reports. ✪ Presenting recommendations to steering committee. ✪ Implementing and managing projects as per the ABIPP SOPs. ✪ Managing project progress processes. ✪ New project area identification. ✪ Provision of relevant information to the PMU. ✪ Monitoring and evaluation of supported projects.

The reviewed ABIPP PMU structure document highlights the critical importance of having a fully functional PMU. However, it also candidly acknowledges that the ABIPP has been grappling with capacity-related challenges, primarily due to an under-capacitated PMU. This admission underscores the significance of addressing the issues which must be addressed. The mention of having had only one programme manager in the past suggests a lack of adequate human resources in the PMU. This can be a significant constraint in handling the various tasks and responsibilities associated with managing a complex programme like the ABIPP.

In summary, a well-functioning PMU is crucial for programme management, coordination and the successful execution of the ABIPP's goals. It plays a pivotal role in ensuring that resources are allocated effectively and that projects are implemented efficiently. As the ABIPP continues to grow and expand its initiatives, addressing capacity constraints becomes even more critical. A robust PMU can adapt to the evolving needs of the programme.

4.2. Programme implementation

Generally, the implementation of the ABIPP is carried out in phases. To date, two phases have already been supported. The first phase (Phase 1) of the ABIPP ran from 2017/18 to 30 June 2020, but the contract had to be extended by a year. A total of R46 058 908 was allocated to Phase 1. By 2022, almost 99% of the allocated funds were reported to have been committed to the approved and contracted projects, and the remaining 1% had been reprioritised to other ABIPP projects. In all, the Phase 1 investment was reported to have attracted R163 592 949 of co-funding from other partners involved in the programme. Phase 2 of the ABIPP commenced in 2021 with an allocation of R22 584 000.

Phase 1 of the ABIPP which commenced in 2017/18 comprised six different programmes, all of which were aligned with the ABIPP's overarching objectives as detailed in Figure 7.

Figure 7: ABIPP Phase 2 focus areas

The projects that received support and were executed under the ABIPP have led to significant advancements. These initiatives have played a pivotal role in ensuring that the outcomes of research not only serve the industry but also empower farmers to enhance food security through the adoption of improved cultivars. Some of the programmes under the ABIPP are discussed in the following paragraphs.

4.2.1 The strategic innovation partnership for grain and oilseeds

The strategic innovation partnership for grain and oilseeds represents a collaboration between Grain SA, the DSI and the TIA. This partnership is dedicated to enhancing innovative endeavours in the sphere of grain and oilseed research. The initiative aims to achieve this goal by streamlining efforts, fostering synergies and establishing partnerships to concentrate on strategically significant domains of the DSI's agricultural bioeconomy framework and of Grain SA's research portfolio. The priority focus is on crop improvement, crop protection and climate resilience, with two additional focus areas: human capital development – which is critical for each consortium – and AgriParks, which is a project driven by the Grain SA Farmer Development Programme, aiming to empower black subsistence, smallholder, potential commercial and new era commercial farmers. The partnership serves as a notable demonstration of how the DSI and TIA are effectively motivating prosperous initiatives through strategic co-funding and collaborations to attain broader influence, thereby facilitating targeted governmental goals such as transformation and outreach. Sub-programmes included under the programme are outlined in Table 6:

Table 6: Grain and Oilseeds sub-programmes

Grain and Oilseeds sub-programmes	
Sub-programme	**Description**
Wheat Breeding Platform	The national Wheat Breeding Platform (WBP) was established in 2014 and consists of a pre-breeding programme housed at Stellenbosch University, which is strengthening local breeding programmes. High yielding germplasm adapted to local conditions and containing traits of interest is provided to the Agricultural Research Council (ARC), Pannar and Sensako (the only three seed companies in South Africa) on an annual basis.
Maize Breeding Programme: Climate Change Adaptation	The Maize Breeding Programme is implemented under the Climate Resilience Consortium. The focus of this consortium is to build resilience and adaptive capacity in the South African grain and oilseeds sector to develop and improve responses to climate risks and vulnerability. A specific objective is to increase the rate of genetic gains for yield, heat and drought tolerance while maintaining resistance to pathogens and pests to ensure a safe, sustainable, and nutritious food chain.
Soybean Plant Improvement Programme: Crop protection -Soil borne diseases	The Crop Protection Consortium was established to improve management of economically important pests, diseases, and weeds with a cosmopolitan distribution, as well as to respond to the threats presented by quarantine pests and pathogens.
Human Capital Development (HCD)	Human capital development remains critical for the sustainability of the grain industry. The identification and prioritisation of scarce skills and capacity-building programmes remain key in this regard while workshops and international engagements are vital to remain relevant nationally and internationally. This initiative invests in human resources – especially in scarce skills areas such as breeding, plant pathology and agronomy – to provide training to black South African postgraduate students as per the needs of industry and government.

4.2.2 Agro-processing niche commodities programme

The programme focused on funding and supporting the development of three niche crops, namely Cape aloe (*Aloe ferox*), marula and honeybush. The sub-programmes are outlined in Table 7.

Table 7: Agro-processing Niche Commodities sub-programmes

Agro-processing Niche Commodities sub-programmes	
Sub-programme	**Description**
The Honeybush Research and Development project	It is managed by the Agricultural Research Council (ARC), aims to enhance the sustainability and beneficial socio-economic impact of the commercial honeybush industry by expanding participation in the industry and developing and incorporating new and cost effective technologies for optimal use while also conserving natural resources and indigenous knowledge. The project is divided into two parts, one part focuses on community development to stimulate the production of the raw material and the second part focuses on processing the raw material into high quality tea. The processing of the tea is the novel technology the project brings forth, it involves the development of a safe, novel accelerated fermentation process for the production of high quality honeybush tea.
Marula Value Chain Project	The Marula Value Chain Project was initiated in early 2018 starting with a discussion with the Industrial Development Corporation (IDC). The IDC was identified as a partner in the project to jointly fund and manage the project. There are three elements to the project: the development of the raw material, the processing of the Marula crop into products such as oils and lotions, and lastly, the marketing of those products.
Cape Aloe	This project was initiated by the Council for Scientific and Industrial Research (CSIR) for the processing of Aloe Ferox crop into products for the cosmetic industry.

4.2.3 Aquaculture bio-innovation programme

The long-term strategic goal for aquaculture is to enable black individuals to benefit from knowledge and technology transfer to further grow the industry. Table 8 highlights the six sub-programmes supported as part of the Aquaculture bio-innovation programme:

Table 8: Aquaculture Bio-Innovation sub-programmes

Aquaculture Bio-Innovation sub-programmes	
Sub-programme	**Description**
Aquaculture Incubation Programme	The project focuses on the further development, refinement, and commercial production of innovative fish-based shelf-stable ready-to-eat meals. The technological innovation lies in the application of scientific knowledge to the base raw material (freshwater fish) and the value-add production process (canning) in order to increase the portion of each fish which can be utilised for human consumption by 50%. This is possible through the inclusion of finely minced bones which disintegrate during the cooking process and serve to improve the calcium component of the product, which is particularly good for healthy bones and teeth.
Osmos YY	The technology of breeding YY supermales is developed by Fishgen UK to produce all male offspring to facilitate better production in culture systems be it in open pond systems or Recirculating Aquaculture Systems. Producin all male fingerlings are also poised to eliminate spontaneous breeding in systems which have a detrimental effect on growth, pond biomass and eventually negative financial implications. Producing all male population fingerlings are regarded as contributing to analogous growth which in return results into better yields and therefore better return on investment.
Low tech Spirulina Demonstration	A low technology, cost effective, high yield spirulina cultivation system, consisting of a simple bucket system, to be deployed and tested in an existing aquaponics operating environment (TRL 7/8) to produce fish (animal) feeds.
Nano Bubble Technology and its application in the aquaculture and agriculture industry	The development of a unique, innovative Ultra Fine Bubbler generator which creates nano-bubbles with an average diameter of 75nm and creating 220 million bubbles in 1 ml of water.
In-pipe Mini Hydro Powered Energy Recovery System at Aquaculture Plants	Development and modification of existing hydro-powered turbine technology to generate electricity by designing mini-kinetic turbines that can be placed in the waterpiping network of the aquaculture farm.
The application of an oxidant rich olive pomace for use in aquatic animal feed	The use agricultural waste product which contains valuable bioactive compounds to increase the shelf life as well as the nutritional value of aquaculture feeds with minimal processing and relatively low cost

4.2.4 Soybean food and nutrition development programme

Founded during 2016/2017, through a joint partnership involving the Oil Protein Seeds Development Trust, the Oilseeds Advisory Committee and the DSI, this programme aims to enhance soybean cultivation productivity in communities and ensure food and nutritional security. Subsequently, the project's stewardship was assumed by the TIA in 2017/2018 as part of the ABIPP. The objectives are –

a) optimisation of appropriate technologies including processing technologies;
b) increased focus on the development of soybean palatability;
c) establishment of soybean crop as an alternative protein source;

d) development of soybean crop with reduced salt content;
e) development of soybean agro-processed products;
f) SMME and soybean business development;
g) training of communities, subsistence farmers, smallholder farmers, extension officers and students.

Additional highlights of the programme were the following:

a) The development of niche value-added agro-processed products, namely soy milk and soy yoghurt for home consumption.
b) Increased awareness of the soybean crop as high protein source was achieved by developing a soya DVD and translating it into three South African languages: Afrikaans, isiXhosa and isiZulu.
c) The programme also contributed to the Grain SA journal magazine called PULA/iMVULA and a total of 16 482 magazines were distributed.
d) A market study of the soybean crop was conducted with the University of Pretoria and formed a basis for business development and the development of SMMEs.

4.2.5 Ukhanyo farmer development (UFD) programme

The UFD's primary goal is to transform small-scale rural farmers into commercial entities by providing them with technical assistance, mentorship and skills development, while also offering input cost subsidies. Moreover, the project places a particular emphasis on empowering women and youth, recognising their potential to drive agricultural growth and sustainability in the province. In the framework of the ABIPP, this project specifically targets the cultivation of emerging smallholder maize farmers in the Eastern Cape.

Nixtamalisation is a crucial part of the UFD. It involves the preparation of maize by soaking and cooking the corn in an alkaline solution, typically limewater. Afterwards, the maize is washed and hulled. This process is particularly effective in eliminating 97% to 100% of aflatoxins, which are mycotoxins found in contaminated corn. Mycotoxins are naturally occurring toxins produced by certain moulds and fungi, and they can pose health risks when present in food. These moulds tend to thrive in various crops and food products, including grains, cereals, apples, and coffee beans, especially in warm and humid conditions. Maize, being one of the major crops susceptible to aflatoxin contamination, not only poses health risks but also leads to significant economic losses

in South Africa and globally. This project seeks to mitigate these issues by implementing technologies and training programmes aimed at ensuring safer storage and processing of maize. In addition, the nixtamalisation training mentors provided an isiXhosa manual to all trained beneficiaries (the manual also contained numerous baking and cooking recipes). Through this project, 641 farmers have been trained in financial literacy and in nixtamalisation in various study groups in the Eastern Cape. They are in six municipalities, namely Ntabankulu, Mbhashe, Mhlontlo, King Sabata Dalindyebo, Intsika Yethu, and Engcobo. Out of the participants trained, 80% are women (of whom 20% are young women).

4.3. Overall funding allocation

A total of 23 projects have been supported by the ABIPP in Phase 1 and 2. According to Table 9 below, the grain and oilseed partnership programme and the soybean food and nutrition development programme were the only two programmes to have received funds in both phases.

Table 9: Summary of Phase 1 allocated funds

Summary of ABIPP Phase 1 allocated funds				
Sub-programme	**Allocated funds**	**Total disbursements**	**Committed and undisbursed**	**Reprioritised funds**
Grain and Oilseeds Partnership	R27 000 000.00	R27 000 000.00	R0	R0
Soybean Food and Nutrition Development Programme	R4 177 978.00	R3 859 259.00	R0	R318 719
Agro processing	R7 473 930.00	R5 938 923.00	R1 442 922.00	R92 085.00
Aquaculture Bio-Innovation Programme	R6 000 000.00	R5 477 491.00	R271 400.00	R0
Bioeconomy SA Portal	R699 910.00	R699 910.00	R0	R0
National Rice Cultivar Evaluation Programme	R707 090.00	R707 7171.00	R0	R0
Total	**R46 058 908.00 100%**	**R43 683 300.00 95%**	**R1 714 322.00 4%**	**R410 804.00 1%**

Regarding Phase 2, Table 10 details the financial allocations.

Table 10: Funds allocation Phase 2

Funds allocation in Phase 2			
Sub-programme	Allocated funds	Committed funds	Disbursed funds
Grain and Oilseeds Partnership	R13 500 000.00	R13 500 000.00	R13 500 000.00
Cassava Feasibility Study	R700 00.00	R2 139 840.00	R713 280.00
Wet Carcass Syndrome	R700 00.00	R1 009 907.00	R440 220.00
Aquaculture Cluster Establishment	R1 000 000.00	R0	R0
Agro Innovation Hub	R2 000 000.00	R1 999 830.00	R1 999 830.00
Ukhanyo Farmer Development	R800 000.00	R798 000.00	R798 000.00
Digital Agriculture	R1 000 000.00	R995 100.00	R995 100.00
Food Safety Lab	R930 000.00	R0	R0
Total	**R20 630 000.00 100%**	**R19 447 577.00 94%**	**R18 446 430.00 89%**

5. BENCHMARKING STUDY

As part of an initiative to enhance the effectiveness and efficiency of a programme, benchmarking proves valuable. Through benchmarking, a country can examine and incorporate best practices from other nations to enhance its own interventions. As part of this evaluation study, the benchmarking exercise provides a comprehensive comparison, illustrating the factors contributing to the success or challenges in South Africa's agricultural innovation as compared to countries with a similar population. The benchmarking study unpacks the causes of success or failure in other countries from which South Africa can learn.

The benchmarking findings for this evaluation study are generated from secondary data derived from a desktop review. The generated information provides valuable insights for the TIA to compare and review their own performance and develop novel programmes and strategies to improve service delivery. The purpose is to improve efficiency in South Africa by implementing effective frameworks that may increase the country's innovation capacities.

Three countries (regions) were selected based on the availability of comparative data and on the premise that they provided enough information and comparative judgement on the best match with South Africa (see Table 11). The other criteria considered in the selection of the benchmarking regions were the similarities in terms of agricultural innovation

status, population size, economic performance, and quality of governance structures in each country.

The evaluation team has also taken into consideration the fact that no two countries are identical, so the comparison only provides a rough approximation. However, it is also important to recognise that South Africa's unique position as the only African country with an approved, dedicated and comprehensive bioeconomy strategy means that other regions in Africa can draw valuable lessons from its experiences (Malabo Montpellier Panel, 2022, p 6). Additionally, South Africa is widely acknowledged for its leadership role in both continental and global initiatives aimed at establishing thriving bioeconomies (Malabo Montpellier Panel, 2022, p 6).

Table 11: Benchmarking

Benchmarking	
Programme	**Focus area**
European Innovation Partnerships	Five European Innovation Partnerships have been launched in the context of the Innovation Union. European Union (EU) policy defines innovation as the outcome of an interactive and co-evolutionary process engaging multiple types of actors. European Innovation Partnerships (EIPs) are a new approach to research and innovation. EIPs help to pool expertise and resources by bringing together public and private sectors at EU, national and regional levels, combining supply and demand side measures. All EIPs focus on societal benefits and fast modernisation. They support the co-operation between research and innovation partners sothat they can achieve better, and faster results compared to existing approaches
Bioresources Innovations Network for Eastern Africa Development (Bio-Innovate) programme.	Bio-Innovate is a regional, broad-based biosciences research and innovation initiative established in 2010. Bio-Innovate's goal has been to make smallholder farming and bioresource management more productive and profitable through bioscience innovation. It seeks to link smallholder farmers to new market niches characterised by sustainable and resource-efficient value chains. The programme manages a regional competitive biosciences innovation fund, which has brought together key players from the public and private sectors to promote bioscience innovation in Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. The intervention envisages an economy in which the potential of modern biosciences can be realised, using bioscience innovation adapted to local needs and able to harness opportunities in the region
West Africa Agricultural Productivity Programme (WAAPP)	WAAPP is a multi-year effort to transform West African agriculture by boosting productivity and sustainability, reducing hunger, and improving nutrition, creating jobs, and supporting collaboration across borders. The 13 participating countries of WAAPP are Benin, Burkina Faso, Côte d'Ivoire, The Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. The programme aims to achieve 6% agricultural growth and increased food production and availability in West Africa. To achieve this goal, WAAPP works with scientists, researchers, extension workers and farmers to: • Innovate, generate, disseminate, and adopt improved technologies. • Create enabling conditions for regional co-operation. • Build human and institutional capacity across the sub-region; and • Create youth employment, engage women, and adapt to climate change.

The case studies presented here demonstrate that many countries jointly use biotechnology and innovation to boost agricultural production. This thinking is premised on the notion that nations in a particular region have the same types of agroecological conditions and share bio-resources and the same types of agro- and bio-industrial platforms. However, for South Africa and the other Southern Africa Development Community (SADC) member states to succeed in agricultural production, there needs to be regional cooperation and strong leadership from governments with the provision of appropriate policies and incentives. The fundamental lesson from the benchmarking exercise is that collaboration between member states is possible if the following conditions are met:

a) **Harmonisation and alignment of policy and strategies** promoting innovation and trade as policy and institutional coherence as prerequisites for reaching the full potential of the bioeconomy.
b) **Regional coordination** of trade regulations and standards for bio-based products, facilitating trade and economies of scale.
c) **Collaborative capacity-building** in key areas of bioeconomy, through building regional competence platforms and knowledge-sharing mechanisms.

Below are some of the best practices from the above benchmarked regions which are relevant to South Africa:

a) **Strong policy framework** – European countries who have similar programmes have a stronger policy framework to support the development of the bioeconomy, which provides clear and supportive environment for businesses and investors. South Africa can establish similar policy frameworks that provide a supportive and enabling environment for the bioeconomy.
b) **Collaboration and partnership** – European innovation partnerships (EIPs) have a strong tradition of collaboration and partnership between academia, industry and government, which have contributed to the success of EIPs and the bioeconomy at large. South Africa can learn from this and encourage collaboration and partnership between the various stakeholders in the bioeconomy and agriculture innovators such as research institutions and investors.

c) **Public engagement** – EIPs have placed a strong emphasis on public engagement and education to build support and awareness of the bioeconomy.
d) **Value addition** – BioInnovate places a strong emphasis on value addition, which involves transforming raw materials into higher-value products. South Africa can prioritise value addition in the ABIPP to increase revenue and create jobs.
e) **Capacity-building** – BioInnovate invests in capacity-building to equip entrepreneurs and innovators with the skills and knowledge needed to drive innovation and knowledge in the agriculture sector. South Africa, through the ABIPP, should prioritise capacity-building to ensure that beneficiaries have the necessary skills and knowledge to succeed.
f) **Focus on sustainability** – BioInnovate promotes sustainability development in the agriculture sector by focusing on environmentally friendly and socially responsible practices. South Africa can practice sustainability in the ABIPP by promoting environmentally friendly practices and ensuring that social benefits are realised.

6. KEY EVALUATION FINDINGS

This section presents a comprehensive overview of the key discoveries, insights and results of the evaluation. The findings aim to provide a clear understanding of achievements, challenges and potential opportunities in the field of agricultural bio-innovation.

During its engagement with project teams and the beneficiaries, the evaluation team took note of some contextual factors that both facilitate and impede the efficacious implementation of the ABIPP, and that will determine the longer-term sustainability of the overall approach. Many of these factors are discussed in more detail in other sections of the review. The purpose of this approach is that any assessment of the programme needs to take the relevant factors into account to understand the complex sector environment in which this programme is taking place. The assessment of the ABIPPs' effectiveness and efficiency introduces the causal mechanisms envisioned to bring about change and provides an overview of the implementation framework. This overview highlights both the successes and challenges experienced by the programme in the process of implementing TIA interventions. The section concludes with an assessment of the effectiveness of the

interventions and the overall benefit that these interventions produced in light of the desired outcomes.

The findings are based on the qualitative and quantitative evaluation methods conducted with beneficiaries, implementing agents and the TIA staff. These findings were triangulated with the findings from the desk review of project documents and relevant secondary literature, in order to answer the evaluation questions regarding the relevance, effectiveness, efficiency, impact and sustainability of the ABIPP.

In the following subsections, each evaluation question is answered in turn.

6.1. To what extent is the ABIPP design relevant in enhancing the capacity of South African science in research and development and innovation in agriculture?

The evaluation team found evidence of the ABIPP's innovation leading to the development of novel solutions, technologies and practices that address critical challenges faced by the agricultural sector. From discussions with several respondents, the evaluation team also found that the ABIPP has channelled its investments into various projects that significantly contribute to the growth and competitiveness of the agricultural sector.

Several emerging technologies have gained traction in the market, exemplified by achievements in the aquaculture projects. Moreover, there has been a heightened emphasis on constructing innovation value chains, as demonstrated in the marula, honeybush and Cape aloe projects, and communities have been provided with innovative solutions that contribute to food and nutrition security. In general, the ABIPP has played a pivotal role in supporting the creation of knowledge-based products in the local agricultural bioeconomy. As an illustration, it has been documented that as many as 15 prototypes were successfully developed in the ABIPP during the 2021/22 period alone.

Another key highlight of the ABIPP is the support rendered to local SMMEs, including project-related support extended to SMMEs engaged as project-implementing partners. For example, as part of the ABIPP's aquaculture programme, funding was extended to four SMMEs for development of technologies aimed at improving the industry's overall productivity. Some SMMEs were also assisted through the various ABIPP individual

projects. For instance, it was reported that 19 SMMEs (five in the honeybush project and 14 in the Cape aloe project) were assisted during the 2021/22 period, mostly through training offerings.

In addition, the evaluation team found that the ABIPP's explicit focus on agricultural bio-innovation demonstrates its commitment to leveraging scientific research and technological advancements to address challenges and promote innovation in the agricultural sector. One of the ABIPP programme managers explained that the programme design of the ABIPP emphasises collaboration and partnerships between various stakeholders as it brings together researchers, scientists, industry experts, farmers and policymakers to work collectively towards advancing agricultural science and promoting interdisciplinary research and innovation. This is evidenced by the TIA currently working with several government agencies and research institutions such as the Agricultural Research Council (ARC) for example. This collaborative approach fosters knowledge exchange, sharing of best practices, and the co-creation of solutions. By promoting collaboration, the ABIPP enhances the capacity of South African science by leveraging diverse expertise and resources, resulting in more meaningful research and innovation outcomes. In support, one of the implementing partners commented:

"The ABIPP design plays a crucial role in enhancing the capacity of South African science in research and development [R&D] and innovation in agriculture. The programme is specifically designed to address the unique challenges and opportunities within the South African agricultural sector, fostering a conducive environment for scientific advancements and technological innovations."

– Project implementing partner

As reported in the literature, the ABIPP finances, co-finances, coordinates, facilitates and actively manages multidisciplinary multi-institutional research projects which centre on agricultural bio-innovation, product processes and services, enhancing productivity, food security and sustainable rural development. The programme not only promotes collaboration on national objectives and increases the competitiveness of the agriculture sector nationally, but also has a substantial impact on the DSI's Decadal Plan (2022). Overall, the Decadal Plan prioritises bio-innovation as a part of high-tech industries. The Plan implicitly considers the ABIPP's interventions around funding, joint programmes and coordination to be priority enablers necessary to assist innovation in helping to realise

South Africa's socio-economic ambitions.

One of the major achievements of the programme which makes it relevant to innovation is the amount of co-funding it attracted with the initial investment by the DSI. Impressive co-funding from various public and private partners contributed to the programme allowing for a greater economic and societal impact. During Phase 1, it garnered R48 023 708 in 2018/19, R65 078 623 in 2019/20, and R62 003 855 in 2020/21. Remarkably, in Phase 2 (2021/22), the programme outperformed expectations, amassing R73 375 728 in co-funding/increased investments, effectively exceeding the increased target. This consistent upward trajectory underscores the programme's success in attracting external resources to bolster its initiatives and objectives. Partnerships such the marula value chain project between the TIA and the Industrial Development Corporation (IDC), is a good example of successful public collaboration jointly contributing towards national priorities. The marula value chain project with a total value of R15 million was jointly funded by the IDC (R7,5 million), the TIA (RR5 008 690) and the ABIPP (R2 491 310).

Through strategic investments and collaboration, the ABIPP has taken concrete steps towards innovation and the creation of a dynamic and sustainable agricultural landscape. During Phase 2 (2021/22), the ABIPP focused its efforts on product development and successfully brought 15 products to the market, surpassing its initial target by a significant margin. This accomplishment reflects the relevance and effectiveness of the strategies, resources and dedication put into the project during this phase. The ability to develop and launch products is a crucial aspect of any successful initiative as it not only demonstrates innovation capabilities but also contributes to overall goals and objectives.

Furthermore, the 2021/22 Annual Report of the DSI states that the ABIPP funded the development of a digital platform (known as the "biosecurity hub") at the University of Pretoria. This demonstrates the ABIPP's commitment to innovation, modernising agriculture and supporting interventions for diagnostics, surveillance, monitoring and the piloting of tools and technologies such as early warning systems to assist the government and producers. Small-scale and developing producers are trained to use these biosecurity tools to assist with early detection of biosecurity threats in the grain value chain.

Interviews revealed that the ABIPP focuses on how South Africa can collectively harness the value of science-based innovation and knowledge management in agriculture to

support food security and ensure that the country meets its requirement for international trade. Three of the interviewed steering committee members shared the view that increased investment in agricultural research and development and the use of innovative technologies such as conventional and modern biotechnology have been instrumental in solving smallholder farmers' crop productivity problems. These comments suggest that by focusing on product and prototype development, the ABIPP is not only fostering innovation but also enabling the introduction of cutting-edge solutions that can enhance agricultural productivity and efficiency.

What came out strongly from the interviews was that through innovation, the ABIPP has been instrumental in creating new bio-innovations (products, prototypes and services) and in helping more farmers to become commercialised. Innovation has also increased nutrition security, skills development, efficient new productive value chains, precision agriculture and digital capabilities to modernise and support the industry to effectively bring new innovations to market. Moreover, these outputs help create outcomes and impacts that are desperately required, such as an increase in GDP and trade, new SMMEs, and the creation of jobs and responsive mechanisms to rebuild, restore and maintain sustainability in the agricultural sector.

Another given success story of the contribution of the ABIPP in innovation is the wheat breeding platform, an ABIPP flagship, which aims to provide industry with access to improved genetics and to higher yielding, locally adapted wheat germplasm to increase production and enhance the sustainability of the local wheat industry, as well as to reduce the balance of payments for wheat imports. On average, 200 genotypes are identified per year for distribution (200 in 2021/22) and sent to the collaborating programmes of private companies such as Syngenta and Corteva, and the Agriculture Research Council’s (ARC's) Small Grain Institute. This germplasm supports the ongoing breeding (pipeline) by the breeding institutions. In 2021/22, two cultivars were selected by industry for commercialisation, one of which has been submitted for registration with the Plant Breeders' Rights Act.

The ABIPP has recorded the completion of 16 prototypes in its aquaculture and agro-processing programmes. These include 10 prototypes for aquaculture, namely two low-tech spirulina prototypes, a field trial demonstration for one diagnostic kit for infectious spleen and kidney necrosis virus and tilapia lake virus (technology readiness level 6), and the demonstration and launch of seven value-added (canned) products by Karoo Catch

(technology readiness level 7).

Extant literature postulates that the ABIPP aims to bridge the gap between research outcomes and practical implementation by facilitating the transfer of technologies, knowledge and best practices from the lab to the field. It was evident from the interviews and site visits that this exchange of knowledge helps to accelerate the adoption of innovative solutions, promotes learning, and enhances the capacity of South African agriculture to leverage scientific advancements effectively. As mentioned above, through supporting capacity-building initiatives, the ABIPP helps smallholder farmers to improve their productivity, income and livelihoods, and contributes to poverty alleviation and rural development. Accordingly, both interviews and document analysis confirm that the ABIPP has been supporting human capacity, development, research excellence, access to next-generation technologies, providing incentives and adequate funding, access to global intellectual property through in-bound technology transfer, alignment with national priorities and regulatory support.

A number of respondents reported positive experiences of the ABIPP's relevance in enhancing the capacity of South African science in research and development and promoting innovation in agriculture. The evaluation team visited the UFD programme which aims to assist smallholder maize farmers in the Eastern Cape by providing mentorship, training and support for increased yields, and sustainable farming practices. The programme addresses the challenges of safe storage of maize through a developed post-harvest technology transfer programme, and the process of nixtamalisation. The nixtamalisation training initiative has had good uptake in the Eastern Cape, with a group of women trained under the Women in Agriculture and Rural Development structure in Qumbu. The group received baking equipment from the Eastern Cape Department of Rural Development and Agrarian Reform to establish an enterprise and use nixtamalisation as a source of income, as well as for food and nutrition security. Every single beneficiary of this programme noted satisfaction with the agro-processing skills they were receiving from the UFD programme. In addition, the nixtamalisation process has ushered in a host of benefits including social cohesion and using the readily available products as an income source. One of the farmers at UFD reported:

"We like this technique of nixtamalisation as it enhances the texture and taste of our corn-based foods. The process improves the dough's workability, making it easier to shape and cook

scones, and other corn products. It also contributes to the characteristic flavour, aroma, and colour associated with the nixtamalised corn."

– Focus group respondent (beneficiary)

Besides the UFD programme, other notable projects include those led by Grain SA, in which a large number of beneficiaries were trained in various provinces across South Africa, further highlighting the relevance of the ABIPP. With reference to support for agro-processing in rural communities and farmer development, as of the 2021/22 financial year, 845 black emerging farmers had benefitted from the ABIPP technology and innovation support programmes. This included 701 farmers in the UFD support programme who received training in financial literacy and nixtamalisation through various study groups in the Eastern Cape, grouped according to municipalities. Of the beneficiaries, 80% were women and, of the women trained, 20% were young women. Of the total of 845 farmers who received support in the form of training, 22 received training in the processing of aloe, 16 received support under the honeybush programme, and 99 farmers received training in, among other areas, agro-processing, plant health surveys, diagnostic surveys, and seed business development under the strategic innovation partnership for grains and oilseeds. In addition, seven farmers were trained under the Cosmeceuticals Platform.

6.2. How does the ABIPP contribute to the mandate of the DSI and the TIA to support the theory of change on how innovation can drive the growth of agriculture?

The mandate of the DSI is defined in the White Paper on Science and Technology (2019), which introduced, among other things, the concept of the national system of innovation, of which the DSI is understood to be custodian. Notably, the DSI is mandated to ensure a well-coordinated and efficient national system of innovation in South Africa. Some of the interview respondents commented that the ABIPP contributes towards this vision by fostering collaboration and partnerships between a national system of innovation players active in the agricultural space.

The TIA's mandate, as earlier highlighted, is premised on stimulating and intensifying innovation in South Africa, while its main investment focus is on technology development.

This begins with proof of concept and extends to technology development stage, in other words, from technology readiness level 3 to level 7 (TIA, 2015). The ABIPP directly contributes to this TIA mandate regarding technology development by investing in technology development projects in the agricultural sector, for example, the programme's investments in the aquaculture space, where it partnered with universities and SMMEs to develop technologies.

When asked how the ABIPP contributes to the mandate of the DSI and the TIA to support the theory of change on how innovation can drive growth of agriculture, more than 50% of the interviewees responded that the ABIPP contributes significantly. One of the respondents explained that the programme aligns with the strategic objectives and priorities of both entities, reinforcing their efforts to promote innovation-led agricultural development. However, the challenge that was cited by many of the respondents as hampering the contribution of the ABIPP to the growth of agriculture was the constraint on resources.

The evaluation team found that the ABIPP contributes to the transformation of South Africa's agricultural sector by promoting diversification, value addition, and market development. The programme encourages the transition from traditional farming practices to more innovative, knowledge-based approaches that leverage the potential of the agricultural bioeconomy. The ABIPP further recognises the importance of smallholder farmers and aims to empower them by providing access to knowledge, technology, and market opportunities.

The small-scale and emerging cotton farmers in Matlerekeng, Limpopo, Nkomazi and Mpumalanga are a good example. They received two baling machines with the potential to lower the farmers' input costs by some 8% to 12%, signalling the end of manual cotton baling. The machines enable farmers to conduct primary agro-processing using a hub-and-spokes model so that they can leverage economies of scale to aggregate their produce into bales, which the gins can accept without additional costs for the small-scale farmers. In addition, the machines gins no longer require a handling fee for the compacted round bales, and the farmers will be able to load more seed cotton on the interlink truck for transportation. As a result, the farmers earn an extra R0,73 per kg for their seed cotton. During a site visit, the evaluation team observed the farmers who were using technology in their farming practices. Figure 8 presents a snapshot of the information gathered from

discussions with the farmers.

The respondents mentioned that the cotton baling machine is offering them numerous advantages over manual baling, including increased efficiency, productivity, consistency, labor savings, space optimization, and improved marketability. This machine plays a vital role in modernizing the cotton industry and improving the overall effectiveness and profitability of cotton processing operations. What makes this approach effective and efficient is that a farmer only pays R100/ bale and instead of baling 4 tons in one and half days, the baling machine has reduced this time to bailing about 4 bales in 5 hours.

The farmers also mentioned that baled cotton takes up less space compared to lose fibres. The cotton baling machine is compressing the cotton fibres tightly, reducing the overall volume required for storage and transportation. This optimizes storage space, lowers storage costs, and facilitates efficient logistics. In addition, the machine is mobile and other communities/cooperatives from another village are benefitting from this machine as well. These cooperatives from other village are paying R200 which in turn get used to buy plastics and diesel.

Figure 8: Cotton baling in Mpumalanga

Comparing the manual baling process to using the machine, one of the farmers commented:

"Manual baling requires substantial human effort and time, particularly when dealing with large quantities of cotton fibres. By automating the baling process, the cotton baling machine that TIA gave us is gigantically saving significant time and reducing labour costs. In addition, it is also minimising physical strain and fatigue on workers, leading to increased safety and well-being."

– Beneficiary

Also, South Africa is part of the global agricultural market and faces competition from other countries. The ABIPP's focus on innovation and value addition helps enhance the competitiveness of the South African agricultural products in domestic and international markets. By encouraging research and development, technology transfer, and market-orientated approaches, the ABIPP supports the growth of agribusiness and strengthens South Africa's position in the global bioeconomy. This thinking supports the views of one of the implementing partners during the group interviews, who observed:

"Supporting farmers involves providing access to information, training, and resources and it is crucial for food security, rural economies, environmental sustainability, cultural preservation, global trade, and fostering innovation. It is an investment that benefits not only farmers but also society. By investing in farmers' education and research, we can foster agricultural innovation,

improve productivity, and address emerging challenges such as climate change and pest management."

- Implementing partner

Another crucial aspect of the ABIPP's design is its ability to emphasise investments in research and development, as well as providing financial support and resources to scientists, research institutions and agricultural organisations. One good example is the national rice cultivator programme, which focuses on evaluating foreign rice germplasm before progressing to a pre-breeding effort to adapt the germplasm to South African conditions. The programme was implemented through a partnership structure with a task team composed of experts from the ARC, the University of the Free State, and the University of KwaZulu-Natal. These investments enable researchers to conduct in-depth studies, explore novel approaches and develop innovative solutions tailored to the specific needs and challenges of South African agriculture. Through bolstering research and development capabilities, the programme enhances the scientific capacity of and expertise in the country.

6.3. How does the programme contribute to a sustainable bioeconomy?

From the literature review, agricultural bioeconomy refers to the sustainable use of renewable resources from agriculture, forestry and marine sectors to produce food, energy and various bio-based products (FAO, 2016). It involves promoting bio-based agricultural practices which emphasise the use of natural inputs, reduced reliance on synthetic chemicals, and the preservation of soil health. This approach supports sustainable farming methods that minimise negative environmental impacts and contribute to long-term agricultural productivity. Furthermore, bio-based agriculture has the potential to contribute to climate change mitigation by reducing greenhouse gas emissions. Practices like organic farming, agroforestry and bioenergy crops can help sequester carbon dioxide and enhance the resilience of agricultural systems to climate variability.

The majority of respondents remarked that farmers are custodians of the land, and their practices greatly affect the environment. The respondents agreed that by providing

support and resources, the ABIPP encourages sustainable farming methods that protect soil health, conserve water resources, promote biodiversity and mitigate climate change. One of the implementing partners stated that supporting farmers in adopting environmentally friendly practices benefits both the local ecosystem and the planet. In addition, farming is deeply intertwined with rural communities and their cultural heritage and initiatives such as the ABIPP can help preserve traditional farming practices, maintain rural populations and prevent the decline of rural areas. This is important for maintaining diversity, vitality, and a sense of identity in societies. Ultimately, the support rendered to farmers in rural areas contributes to the overall competitiveness and sustainability of the nation's agricultural sector.

By providing training and support to farmers, the ABIPP enhances their knowledge and skills in sustainable farming techniques. Evidence gathered from interviews and document analysis suggests that farmers understand the importance of biodiversity and ecosystem services and are encouraged to adopt practices that promote soil health, water conservation and reduced use of chemical inputs. This not only improves the overall environmental sustainability of agriculture but also helps to increase the efficiency of resource use and productivity of the agricultural production system.

Extant literature reports that South Africa faces numerous environmental challenges, including water scarcity, climate change, and soil degradation (DPME, 2022). In response to these challenges, the ABIPP focuses on sustainable agricultural practices that promote resource efficiency, biodiversity conservation, and climate resilience, thereby contributing to a sustainable bioeconomy. When asked how the programme contributes to a sustainable bioeconomy, one of the steering committee members observed that:

"Through research and development initiatives, ABIPP helps farmers adopt sustainable farming methods, reduce environmental impacts, and enhance the long-term viability of the agricultural sector. This programme contributes to sustainable development by promoting environmentally friendly practices, resource efficiency, and renewable energy use within the agricultural bioeconomy."

– Implementing partner

The findings were generally very positive with respect to the ABIPP's role in helping to address pressing sustainability challenges such as climate change, water scarcity and

land degradation while fostering the long-term viability of the sector. According to Nhamo et al. (2022) the agricultural bioeconomy, which encompasses areas such as agro-processing, renewable energy and biotechnology, presents significant opportunities for economic diversification, growth and job creation. In responding to the question of the ABIPP contributing to a sustainable bioeconomy, the evaluators found that the programme emphasises sustainable resource management, including the use of renewable energy, water-efficient practices and environmentally friendly technologies. In addition, by supporting research and development in these areas together with relevant collaborations and partnerships, the ABIPP helps to ensure the long-term sustainability of agriculture in the country.

6.4. What were the geographical markets for goods and services from the ABIPP?

Agriculture plays a significant role in South Africa's economy. It contributes to job creation, food security, and export earnings. The ABIPP aims to enhance the competitiveness and sustainability of the agricultural sector by promoting innovation and value addition. By supporting research and development activities in the bioeconomy, the ABIPP contributes to economic growth, increased agricultural productivity and the development of new market opportunities.

Interviews with the various project proponents and information from secondary data revealed that the ABIPP is currently focused on local South African markets. The following list provides examples of various products from ABIPP-supported projects which are all placed locally.

- No market placements have taken place from the Cape aloe project since the developed prototype samples are not yet fully commercialised. Nonetheless, information from the reviewed reports shows a huge market potential for product placements in the local market. As part of Phase 1 of the Cape aloe project, the CSIR conducted a local market scan of *Aloe ferox*-based ingredients and products and established that very few products were available in the local formal market, including the cosmetic product market.
- As part of activities related to technology readiness level 6, the Karoo Catch project

verified the legislative compliance and safety for human consumption of its production processes for three shelf-stable, fish-based ready-to-eat products (chakalaka fish and bean stew, fish biryani, and fish bobotie and cutlets in chili sauce). Following that, an exercise involving interaction with retailers and consumers was conducted to verify product quality and assess pricing acceptability in the local South African market.

- The ARC is reported to have commercialised two cassava varieties (one for starch and the other for food) in Tzaneen and Limpopo, as part of a supported cassava project. This is particularly significant in view of reports that fresh cassava and derived products (dried cassava leaves, cassava flour) that are consumed in some parts of South Africa, especially Gauteng, are predominantly imported.
- Although the seeds, seedlings and biomass from the honeybush project are reported as not having been placed on the market yet, they will be ready for sale during the 2023/24 financial year.
- Through the Ukhanyo nixtamalisation project, local rural farmers have been trained in making products from locally available grains such as maize. The farmers reported that they are already placing their beneficiated products such as cakes and scones onto the local markets. The evaluation team learned that the farmers had made a breakthrough in selling some of their produce at government and community functions as well as to local shops.
- Orange-fleshed sweet potatoes – not yet commercialised and still in feasibility and market research stages.
- Outcomes from the upland rice development project have not yet been finalised; therefore, the project is not yet commercialised.
- There was no reported market placement of marula-related products as part of the marula value chain project. The reviewed project progress reports indicated that the agro-processing component of the project was to commence only at a later stage, i.e., in the 2021/22 financial year. No further information was provided to indicate whether the planned agro-processing activities had taken place, and in which geographical markets, if any, these products would be placed.

6.5. Is the ABIPP being implemented according to design?

The bioeconomy strategy aims to drive South Africa's bioeconomy by using the country's

diverse natural resources such as animals, plant biodiversity, micro-organisms and minerals to improve human health, address food security and contribute to economic growth. The strategy seeks to use South Africa's bio-based resources to create and grow biotechnology-based industries. This is crucial for job creation and for contributing to the GDP and exports, building industries and addressing market failures by harnessing human capital, financial resources, infrastructure and knowledge. In this context, the evaluation team noted from the document review and several interviews that the current vision of the agricultural sector of the bioeconomy strategy is still vibrant and economically sustainable through bio-innovative technologies, products and services contributing to increased productivity, food security and rural economic development.

More than 50% of the respondents remarked that the ABIPP was robust in its conception and intent as it was launched as a collaborative initiative between many stakeholders, including government entities, research institutions, industry associations and the private sector. The idea for the ABIPP emerged as a response to the need for innovation and sustainable development in South Africa's agricultural sector. Recognising the potential of the agricultural bioeconomy to drive economic growth and address societal challenges, stakeholders came together to establish the ABIPP. Notably, innovation partnerships in the context of agriculture and bioeconomy (including ABIPP) refer to collaborations between different stakeholders such as governments, research institutions, private companies and non-profit organisations. These partnerships are aimed at fostering innovation, driving research and development, and facilitating the commercialisation and adoption of new technologies and practices in the agricultural and bioeconomy sectors. The ABIPP aimed to create a vibrant innovation ecosystem, promoting knowledge-sharing, cross-sectoral collaborations and the pooling of resources to drive agricultural innovation. This is still the case hence the ABIPP is still implemented as designed.

With this background and taking into consideration the initial design of the ABIPP as outlined in the reconstructed ToC, it is evident that the implementation of the ABIPP during the period under review was done according to design. The different programme activities highlighted in the ToC, including research and development, market development and capacity-building, as well as collaborations and partnerships, were undertaken through ABIPP-supported projects and established strategic relations, particularly with industry (see Table 12). It can be concluded that the programme was to a large extent implemented as designed, although some programme-related components outlined in the reconstructed ToC, such as the development of international partnerships,

appear to have been neglected. In relation to this, one of the ABIPP steering committee members made the following comment:

"We need to attract more co-funding, especially from abroad, to make sure that our programmes may have a greater impact."

– Steering committee member

Table 12: Implementation of the ABIPP's planned key activities

Table 12: Implementation of the ABIPP's planned key activities as outlined in the reconstructed ToC		
Envisaged Programme Activities		**Status**
1	**Research and Development**	Various R&D related projects targeted at the agriculture sector were supported.
a	Promoting research and innovation in the bioeconomy, with a focus on sustainable agriculture and value chains.	Research and innovation related projects in the bioeconomy spearheaded by various local universities, research councils, and industry were supported during the period under review. Research and product development related work targeted at agricultural value chains, for example within the Marula space, were also undertaken and continues to be supported to date.
b	Providing financial support for research and development projects.	Both direct funding support from ABIPP and co-funding support from industry partners was extended to different projects during Phases 1 and 2 of ABIPP implementation.
c	Supporting research and development initiatives that focus on developing new technologies, products, and practices that promote sustainable agriculture and the bioeconomy.	Research and development related financial support towards the development of new technologies, for example within the local aquaculture space, was provided to different projects as part of ABIPP, including those implemented by SMMEs.
2	**Market development**	New markets, mostly within South Africa are being developed.
a	Creating new value chains and markets related to the bioeconomy, with a focus on rural areas.	The creation of new value chains was supported through the ABIPP, for example through the Marula project. Also, as earlier alluded, new local markets for products developed through ABIPP interventions (e.g., fish products, aloe gels, cassava products, etc.) are already being created.
3	**Capacity development**	Transformation was and remains a major component of the ABIPP.
a	Providing training, skills development, and technical assistance to stakeholders in the agricultural sector, with a focus on empowering rural communities and small-scale farmers to adopt sustainable agriculture practices (including established farmers).	Most of the supported ABIPP projects included some training, skills development, and information dissemination and transformation components.
b	Providing support to black/coloured students (High-end skills, MSc, PhD, technicians).	
c	Dissemination of knowledge and information through various channels, including online platforms publications, and workshops	
d	Providing and facilitating access to financial support.	The financial support was mostly provided through the ABIPP and its industry partners. There was not much evidence revealing the other ways in which the programme facilitated access to financial support.
4	**Collaborations and partnerships**	These formed the key art of the ABIPP.
a	Facilitating collaborations and partnerships across stakeholders to foster innovation and development in the agricultural sector.	The programme facilitated research collaborations amongst key stakeholders including research councils, universities, and the community. The programme also resulted in some strategic partnerships between the government and key industry bodies.
b	Building partnerships with other organisations, both locally and internationally, to leverage expertise funding, and resources.	Local partnerships were quite evident, but there was not much evidence to support the formations or facilitations of international partnerships. Based on the reviewed information and gathered feedback from the stakeholders engaged, the focus of the ABIPP has so far been largely local with no significant international programme related highlights.

6.6. To what extent has the ABIPP been efficient in implementing its projects?

The ABIPP has provided funding and support for research and development activities in the agricultural bioeconomy. This has led to the development of innovative technologies, practices and products that have improved agricultural productivity and sustainability. Research and development practitioners have been able to explore new areas of study and develop solutions to address challenges faced by the sector, and through the ABIPP, technology and knowledge from research institutions to farmers and agricultural enterprises has been facilitated. One of the programme beneficiaries stated that farmers have gained access to new technologies, practices and improved crop varieties through training programmes, workshops and extension services. This has resulted in increased efficiency, improved yields and enhanced agricultural practices across various subsectors. The ABIPP has encouraged value addition and diversification in the agricultural bioeconomy, for example, through nixtamalisation. By supporting research and development in areas such as agro-processing, biotechnology and renewable energy, the programme has enabled the creation of new products and markets. This has expanded the range of opportunities for farmers, agribusinesses and entrepreneurs, contributing to economic growth and job creation.

To enhance its overall efficiency, the ABIPP has developed and adopted Steering Committee terms of reference that clearly outline the role, responsibilities, structure and processes of the programme. These are further complemented by the programme's standard operating procedures (SOPs), which also define key programme elements, including both programme and grant management issues. Notably, both the ABIPP Steering Committee terms of reference and SOPs address the key issues relating to the programme that have a direct bearing on the overall efficiency and performance of the ABIPP, including the potential conflict of interest in the programme's key governance structures, such as the Steering Committee. Through such mechanisms, it can be noted that the ABIPP has developed robust governance structures that are efficient in proactively mitigating some programme-related ills, including financial mismanagement. For instance, the availability of effective governance structures as part of the ABIPP led to some projects not being supported due to project management issues that the ABIPP steering committee identified.

Regardless of the programme's efforts to have in place certain guiding SOPs and terms of reference, there is evidence that the ABIPP at some stage encountered some inefficiencies. However, some of these could be attributed to the Covid-19 pandemic while others were mostly programme teething problems. The reviewed reports and feedback from stakeholders revealed ABIPP initial setup and Covid-19-related problems that resulted in delays in the disbursement of funding and commencement of ABIPP projects. According to one of the ABIPP steering committee members, the ABIPP project managers stationed in the TIA "were too slow, and they were not doing things on time, so we actually had one or two years where we did very badly with spending and with disbursement." This was confirmed by the project managers and another ABIPP steering committee member, who went further to indicate that some delays experienced as part of the programme emanated from the shortage of skills of project partners – something earlier highlighted in the individual project performance reviews.

"So, we had money that was left over which was more than what we should have had. That compromised the next years` allocation and the budget was cut."

– **Respondent 18**

"In some incidents, we are unable to spend all the money we are given by the government because we lack educated personnel to run the projects therefore, we ended up being penalised and the money reduced by finance ministry."

– **Steering committee member**

At some point, such inefficiencies had serious financial implications where the programme's funding had to be cut, consequently affecting the continued support and onboarding of new projects.

There is also evidence of inefficiencies relating to the onboarding of new projects as part of ABIPP. According to ABIPP officials responsible for project onboarding and management, the programme issues a six-week application call for ABIPP funding support. Following the receipt of applications, the ABIPP SOPs require programme managers to screen and provide applicants with responses within seven days. However, it was reported that sometimes the application volumes are large, and the PMU does not have enough capacity to screen the applications within the stipulated timelines. For example, the PMU reported that on previous occasions they took up to 14 days to screen

and respond to the applicants instead of the stipulated seven days.

In the subsequent phase, applicants are granted a timeframe of 21 days to draft complete applications for submission to a technical review committee. The committee comprises a group of experts from the agriculture space and from government, academia and industry who do not have any conflicts of interest arising from the project. However, these experts are reportedly not remunerated; consequently it was reported that the programme team had previously struggled to secure the availability or commitment from the experts. This arrangement could also be understood as a risk in that such lack of commitment could delay the finalisation of the adjudication process. According to ABIPP officials, the technical review committee recommends that the applications to be considered and endorsed by the ABIPP steering committee. The steering committee assesses whether the application falls within the ABIPP mandate, and whether there are sufficient funds to support the application. Overall, it is reported that the full adjudication of the applications requires a turnaround time of 6 to 12 weeks. According to some reports, it is understood that there are key ABIPP stakeholders who believe that such turnaround times can be improved, while others maintain that "if we move any faster, we will miss things".

There are also inefficiencies in reporting, in that not all project managers are providing the required progress reports, nor are they carrying out frequent site visits to validate the progress-related information presented in reports and to build relationships with the partners.

"We do site visits, but we do not do them as often as we would like because of the operational budget and the capacity and time."

– **Respondent 18**

Regarding the issue of potential conflicts of interest, both the ABIPP SOPs and the steering committee terms of reference are clear and explicit regarding how conflicts of interest can be resolved or even mitigated. According to the reviewed SOPs, members in key ABIPP governance structures such as the steering committee or the TIA's executive committee who might have conflicts of interest in supported projects should declare their interest and should not be involved in key decision-making relating to such projects. The steering committee terms of reference also make it clear that the notion of transparency in the ABIPP's decision-making processes is vital. Therefore, the chair and

members should have no conflicts of interest. Where there is a potential conflict of interest, the terms of reference are clear that the conflicted members should recuse themselves from the steering committee meeting. Two notable instances identified by the stakeholders regarding potential conflicts of interest in ABIPP structures are listed below.

- It was reported that the capacity constraints in the PMU, in some cases, resulted in the chair of the steering committee having to assist project managers in compiling the programme performance report, which the chair (and the committee) is supposed to approve. The chair's increased involvement in the programme's project management resulted in the chair having to abstain from voting in certain programme-related matters.
- The inclusion of Grain SA in the steering committee is perceived as a potential conflict of interest, with some stakeholders raising concerns that Grain SA is the only industry representative sitting on the ABIPP steering committee, and their priority crops do not include all crops that could be supported through the ABIPP. However, the inclusion of Grain SA in the ABIPP steering committee is provided for in the programme's terms of reference, where co-funders can be extended some membership in the Steering Committee should they meet the set co-funding threshold. Therefore, the primary concern moving forward should be centred on attracting additional co-funders, including those representing various grains, to ensure that the steering committee maintains a balanced composition.

While giving priority to the recruitment of more co-funders to uphold a balanced ABIPP steering committee composition, it is equally important to promptly resolve a seemingly misperceived conflict of interest. The perception that a steering committee member enjoys a distinct advantage in advocating for their proposals during committee evaluations, potentially granting them privileges not extended to their competitors, does not portray a good image for the programme. It is therefore imperative to address the misperceptions and ensure a fair and equitable playing field for various agricultural initiatives. This concern is substantiated by feedback from the following respondents, as detailed in Table 13.

Table 13: Conflict of interest quotation table

Conflict of interest quotation table	
Respondent	**Remarks**
4	All applicants on proposals should be treated equally which we don't feel is the case with Grain South Africa because they also sit in the steering committee and also apply for project funding against other players outside the committee. Obviously, the Grain SA will influence their projects to be prioritised in person which is an unfair advantage. Therefore, proper governance structures should be put in place to allow a level playing field so that diverse projects are approved including projects outside the grain industry as well. There is a lot of value that can be realised from other industry value chains which qualify for ABIPP funding.
7	We believe there issue of Grain SA is not managed properly by TIA on proposals because any competition for this industry is thwarted in terms of priority areas for funding. Often, it happens that Grain SA have an advantage of defending their proposals in the committee, which is an advantage and privilege other competitors do not have. This uneven platform in should be corrected to allow for ABIPP to expand its funding to wide spectrum of agricultural projects that can support other critical value chains in the sector.
13	We only have one industry for the grain sitting in the ABIPP steering committee which often results in conflict of interest if proposals emanate from other agricultural related industries that could also benefit from the programme. So when Grain SA feels a certain project outside their scope will work, they wouldn't support it in the steering committee and the diversity on programmes funded is lost.
4	The participation of Grain South Africa in the steering committee is a conflict that needs to be redressed.

The network diagram (Figure 9) below further supports this narrative.

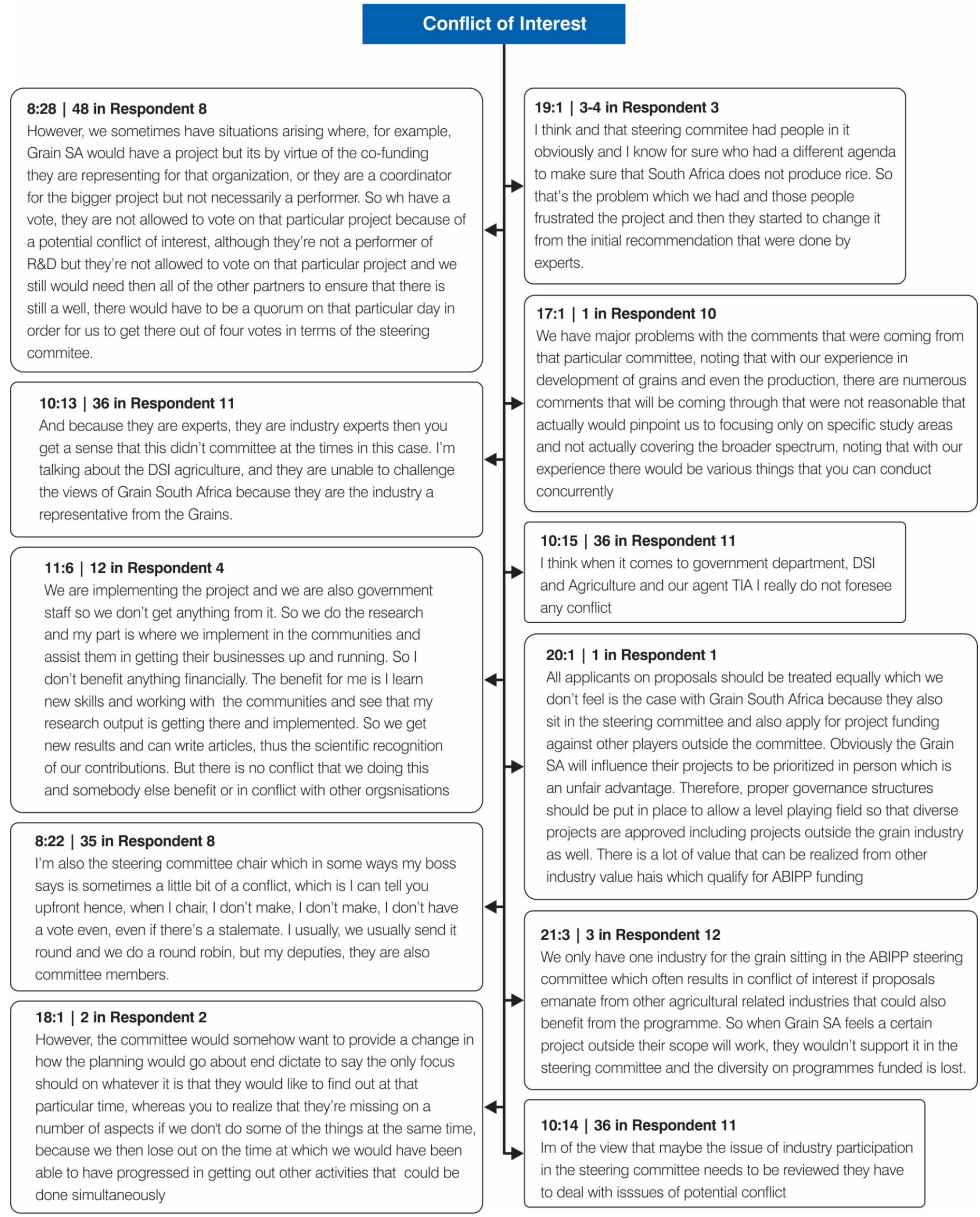

Figure 9: Conflict of interest

As shown above, the quotations from interviews highlight potential conflicts of interest in the ABIPP. Respondents expressed concerns about Grain SA's influence in the steering committee, where the company is both a participant in and applicant for project funding. This dual role may lead to favouritism towards Grain SA's projects and potential prioritisation issues, hindering the approval of proposals from other agricultural sectors. The respondents suggest the need for better management of Grain SA's involvement to ensure fairness and equal consideration for diverse projects. Additionally, conflicts of interest arise when steering committee members have close relationships with specific project partners, leading to abstaining from voting on certain projects to maintain objectivity as stipulated in the terms of reference. The comments from respondents as presented in Table 13 and Figure 9 shed light on the importance of addressing and managing potential conflicts of interest to maintain transparency and equity in the ABIPP's funding decisions.

The efficiency of the ABIPP governance protocols has, however, largely ensured that the conflict-of-interest mitigations stipulated in the SOPs are adhered to. For instance, owing to potential conflict of interest concerns, respondents reported that Grain SA is not allowed to vote on certain projects in the steering committee. It was also reported that on particular occasions the chair recused themself from certain decision-making and voting exercises due to the perceived conflict of interest.

6.7. Which factors promoted the ABIPP's support of innovation?

Various factors have contributed to the ABIPP's support of innovation in the South African agricultural sector. These include the following:

- Access to finance: the ABIPP receives about R20 million annually from the DSI to support innovation in the bioeconomy. Other co-funders complement the available government funding, including those from industry. For instance, Grain SA is reported to contribute more than R50 million in co-funding per annum.
- Access to partnerships: the ABIPP partnerships are evident in different forms. For instance, a programme implementation partnership exists between the DSI and the TIA. These establishments have a contract that stipulates the TIA as the implementing agency of the programme. This also implies that the programme can

access in-house TIA support (both monetary and in-kind) and that the DSI and TIA can collaborate on projects. For instance, when the ABIPP began, the two establishments had to use the strategic partnerships they had with other relevant entities active in the agricultural space. Accordingly, strategic partnerships between the ABIPP and industry bodies and associations remain a key factor contributing towards the success of the ABIPP. Other critical forms of partnership include the ABIPP's implementing partnerships with research councils such as the CSIR and ARC, universities (for example, University of Stellenbosch and Nelson Mandela University), SMMEs, industry bodies such as Cotton South Africa, and farmer organisations. The ABIPP is a programme that relies on partnerships for success, particularly partnership with industry. This ensures that priorities are linked to real-world challenges in agricultural value chains and outcomes are linked to active role players in the industry. It further ensures projects undergo a dual evaluation process from project conception to outcomes and impact.

- Access to community support: buy-in from the actual programme beneficiaries in the form of local communities is also critical. Any research and development projects needs the people on the ground to adopt the resultant technologies. Such technologies require community stakeholders, such as local farmers, to carry out trials and offer feedback on their efficacy.

The available data and information related to factors that promoted the ABIPP in support of innovation were thoroughly canvassed. There is strong evidence that the ABIPP fosters collaboration and knowledge-sharing among stakeholders in the agricultural sector. By bringing together researchers, industry experts, policymakers and farmers, the programme facilitates the exchange of ideas, expertise and best practices. This collaborative approach strengthens the agricultural innovation ecosystem and accelerates the pace of progress.

Enhancing food security is a critical objective for South Africa, and the ABIPP plays a role in achieving this goal. Through its focus on innovation, the ABIPP supports the development and adoption of technologies and practices that improve agricultural productivity, enhance crop diversification, and strengthen post-harvest handling and storage systems. Overall, the ABIPP has played a crucial role in driving innovation, research, and development in the agricultural bioeconomy in South Africa.

6.8. What were the barriers to the ABIPP?

A number of barriers to the efficacy and efficiency of the ABIPP were identified in this evaluation. According to the stakeholders, the ABIPP faces challenges which include limited funding, Covid-19-related delays, loadshedding disruptions, poor interdepartmental collaboration and an over-reliance on the TIA, capacity overload in the PMU and climate change impacts. Some of these challenges are depicted in Figure 10 below.

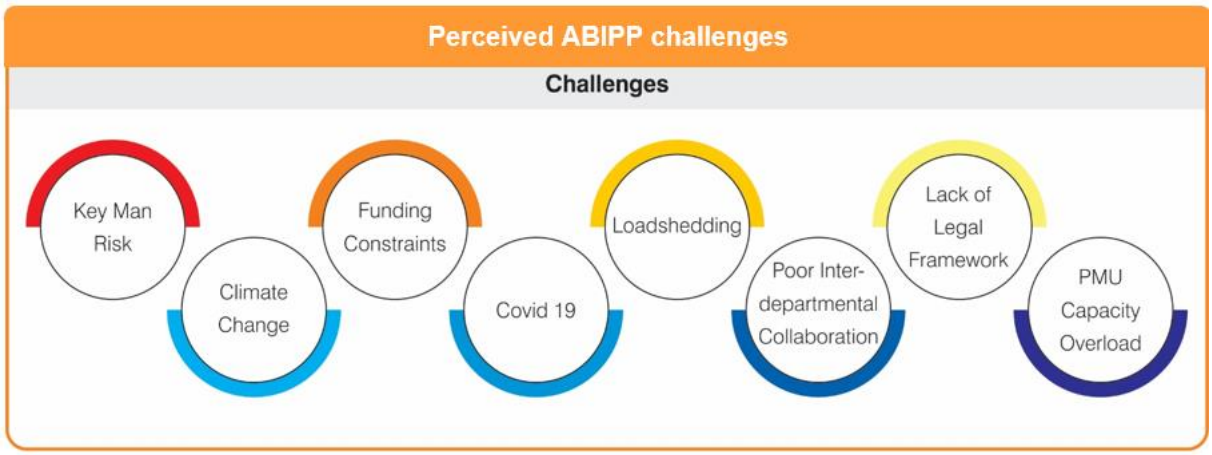

Figure 10: Perceived ABIPP challenges

Table 14 provides quoted comments from respondents relating to the challenges highlighted in the figure.

Table 14: ABIPP challenges sample quotes

ABIPP challenges sample quotes		
Respondent	**Theme**	**Theme**
5	Funding Constraints	So that's currently you know ABIPP receives about 20 million a year, that's very little to support, you know to make you know greater impact in that culture sector in terms of innovation, so hence at times we say for R1 we put then you also put R1 as an applicant.
2	Covid-19	Like we had the Covid in between which delayed, like we were on lockdown obviously we couldn't get to the labs and certain things couldn't happen, so we had to revise the project
4	Load shedding	… with the load shedding they can't pump water to irrigate in these fields. So, its things that are out of our control
11	Poor Interdepartmental Collaboration	For ABIPP to succeed, they must address their reliance on TIA. TIA's performance impacts how people perceive the organisation, even if ABIPP performs well. Establishing their own product management unit and direct engagement through a dedicated office and website could enhance their effectiveness and efficiency.
8	PMU Capacity Overload	They seem overburdened without proper technical committees. Taking on multiple roles, like being an M&E reporter and technical manager simultaneously, may not be feasible or effective. Separate responsibilities for content and management can help improve their efficiency.

While the table above details some challenges as perceived by various stakeholders, it should be noted that not all of these are valid. The more valid and more pressing challenges linked to the ABIPP are discussed in detail in the ensuing paragraphs.

6.8.1 **Access to finance**

According to ABIPP proponents, the funding available for the programme is not sufficient. The R20 million per annum funding made available for the programme was reported to be almost 10% of the budget that the proponents required. According to the ABIPP officials, a budget of R200 to 300 million was required to support the proper implementation of the programme.

"*We can only create 10% of our potential value.*"

– Steering committee member

"There is still a lot that needs to come in so currently ABIPP receives about R20 million a year. Really that is very little to make greater impact in the agriculture sector and innovation."

– Steering committee member

The limited funding has, in some instances, resulted in the programme not being able to fund new calls or support certain important components of supported projects. The information gathered from most of the partners was that the programme could not support all the components of their projects, including important milestones such as commercialisation. Some partners indicated that they were only supported during one phase and did not continue to receive support in the next phase even though they had not previously generated the expected return on investment. In other cases, some funding was made available for certain projects whose outcomes were never utilised as intended, for example the Omos YY project based in Brits. A lack of project continuity caused by limited funding is therefore evident, and it is something that calls for urgent attention.

6.8.2 Lack of information and communication technology systems

The PMU stationed in the TIA does not have a project management system, in spite of the ABIPP SOPs mandating the TIA to provide the PMU with support and infrastructure, including information technology-related systems and services. Consequently, the unit relies on manual systems.

"We send emails and prepare spreadsheets the old way because we do not have a system that caters for what exactly we wanted because TIA has their own system that is according to how they do things."

– Respondent 9

6.8.3 Human resources capacity constraints

The PMU is heavily constrained in terms of human resources. There are only two project managers left in the unit; the third project manager having resigned. Accordingly, the Managers are reliant on the support they receive from interns as well as the other assistance and guidance from the steering committee chair based at the DSI.

The project managers have a portfolio of 14 projects which they have to manage on their own. They have to do both the monitoring and evaluation in addition to technical management-related work since the subcommittees that should be assisting them are not always available considering that they are not remunerated. The portfolio managers from the TIA are also not always available as they have other TIA-specific assignments and commitments. The project managers have to carry out work, even when it does not fall within their scope.

"Initially when I was appointed, I was basically the programme manager and not the project manager, but because of capacity issues and resignations within the unit, I ended up being a project manager and a programme manager."

– Respondent 18

6.8.4 Institutional factors

Some stakeholders highlighted that the TIA has bureaucratic processes which could inhibit the programme's efficiency. Furthermore, the dynamics pertaining to the positioning of the PMU in the TIA are worth unpacking.

The ABIPP managers are employed on a contract basis and their unit (i.e., the PMU) operates under the TIA's agriculture unit. According to the ABIPP SOPs, the PMU is supported by TIA portfolio managers. However, during the period under review, technical support was missing. It was reported that although the TIA is supposed to provide this support, it does not always do so. Ideally, the TIA portfolio manager is meant to be involved at the beginning of the project onboarding process. The manager can conduct due diligence based on technical expertise and conduct meetings with the technical experts, refer the applications to the steering committee, defend and get them approved. It is specified in the ABIPP SOPs that "the ABIPP Programme Manager together with the Portfolio Managers will convene an advisory committee comprising 4–8 peer reviewers

and any other experts that may be deemed appropriate or necessary".

With this in mind, it would be ideal for the portfolio manager to hand over the approved projects to the project managers for contract management, monitoring and evaluation.

"We haven't always had strong technical support from TIA, simply because there is only one or two portfolio managers were historically with us and the others are new; they don't understand the model, or they're not directly involved."

– Implementing partner

Besides the lack of technical support from TIA, the PMU also reported that they were overburdened as a result of taking projects beyond their scope in order to get good performance appraisals from the TIA performance appraisal system. The PMU also reported sometimes being bottlenecked by their line managers in the TIA structures.

"Because of that as a PMU we kind of over burden ourselves with projects because we want to ensure that we meet our targets at the end of the year."

– Respondent 9

"We get appraised as project managers if we reach our targets. So, because we share some of the projects with portfolio managers, there is kind of a battle of who is going to report what because we cannot report things twice; so, what about the effort that I put in."

– Respondent 9

6.8.5 Lack of programme awareness

The ABIPP does not have a website, and the stakeholders felt that the programme was not properly marketed to all the relevant stakeholders. Although a broader bioeconomy SA portal (www.bioeconomy.co.za) can be used by various bio-innovation stakeholders, it does not promote particular programmes.

6.9. To what extent has the DSI funding enabled the ABIPP to leverage additional funding?

Significant strides have been made in advancing the objectives of the ABIPP, making meaningful contributions to the bioeconomy strategy. Among the programme's achievements is its remarkable success in securing co-funding beyond the initial investment provided by the DSI.

As shown in Figure 11 below, the programme maintained a consistent co-funding/increased investment target of R10 million throughout Phase 1 (2017/18 to 2020/21) and the target for Phase 2 (2021/22) was elevated to R20 million. Although the programme fell short of its target in 2017/18 with only R1 071 372 secured, subsequent years witnessed remarkable achievement. During Phase 1, it garnered R48 023 708 in 2018/19, R65 078 623 in 2019/20, and R62 003 855 in 2020/21. In Phase 2 (2021/22), the programme outperformed expectations, amassing R73 375 728 in co-funding and increased investments, effectively exceeding the increased target. This consistent upward trajectory underscores the programme's adeptness in attracting external resources to bolster its initiatives and objectives.

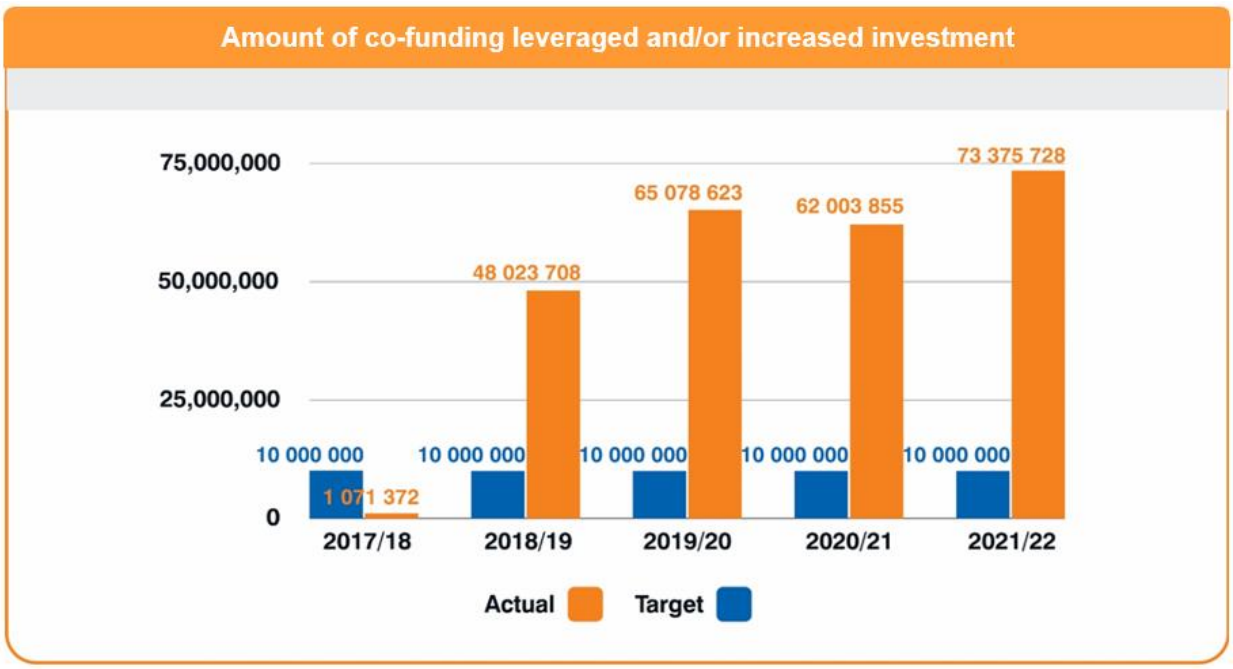

Figure 11: Amount of co-funding leveraged and/or increased investment

In addition, partnerships such as the collaboration between the TIA and the IDC for the marula value chain project, stand out as exemplary instances of successful collaboration. These collaborations have played a pivotal role in collectively advancing national priorities. With a total value of R15 million, the marula value chain project received joint funding from the IDC (R7.5 million), TIA (R5 008 690), and the ABIPP (R2 491 310). This project is designed to establish the marula crop value chain across South Africa, with a specific focus on fostering the production, processing and marketing of this valuable crop resource.

Sustainable funding is crucial for the continuity and effectiveness of the ABIPP. Adequate financial support from government entities, private sector partners and international organisations is necessary to sustain the programme's activities. One of the implementing partners observed that continued funding ensures the availability of resources for research and development, technology transfer and capacity-building initiatives.

"*It is important that there is adequate and consistent funding as it is essential for the sustainability of ABIPP. The programme requires financial support to carry out research and development activities, provide training and extension services, and facilitate technology transfer. It is crucial for the government and other stakeholders to continue investing in ABIPP to ensure its long-term sustainability.*"

- **Respondent 7**

In summary, regarding co-funding, the ABIPP surpassed the set co-funding target of R20 million. The programme was able to attract substantial co-funding with strategic partners such as Grains SA – reported to have leveraged co-funding of more than R50 million per annum. Accordingly, it can be concluded that R20 million of the DSI funding for the ABIPP did, to a large extent, leverage additional funding.

6.10. Are stakeholders aware of the ABIPP's support for innovation in the agriculture sector?

The marketing and awareness campaigns aimed at conscientising the market about the ABIPP can be improved. According to some of the programme stakeholders, the

communities who benefitted from ABIPP funding were not previously familiar with it, while other institutions which could benefit from the ABIPP, including previously disadvantaged institutions, did not know about it.

"I would like to believe that not a lot of people know it, so we really need to create some awareness so that stakeholders are aware that there is this instrument ABIPP and how, and when to apply as well as the requirements."

– Respondent 11

"The project manager is a middleman between us and the steering committee. It's a broken telephone challenge."

– Implementing Partner

6.11. Has the ABIPP achieved the intended outcomes of its objectives?

ABIPP has a set of key performance indicators agreed upon by the steering committee. The responses to this question demonstrate how the ABIPP has performed against the targets set to date. the ABIPP has four main strategic outcomes, and the performance of the key indicators is categorised per outcome as shown in Figure 12.

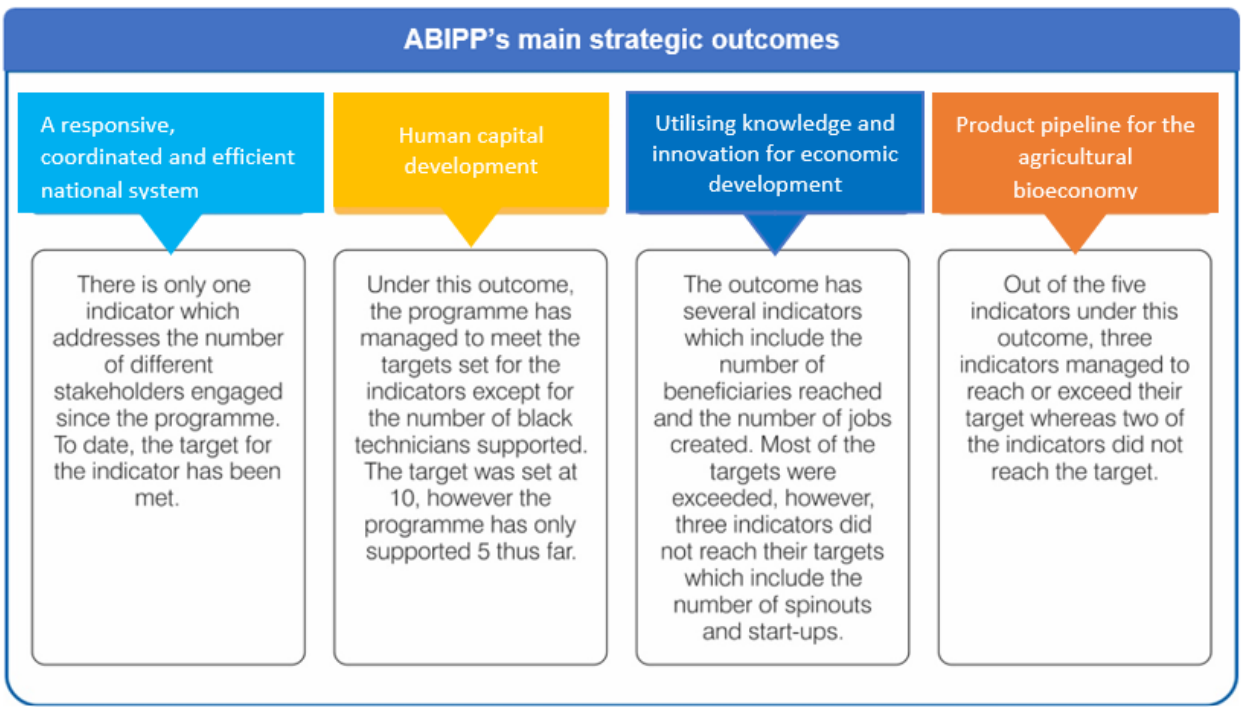

Figure 12: ABIPP's main strategic outcomes

6.11.1 Outcome 1: A responsive, coordinated, and efficient national system

The "responsive national system" outcome has exhibited a steady upward trend from Phase 1 to Phase 2. While it fell short of the 2020/21 target, the trajectory remained positive as depicted in the following figure (Figure 13).

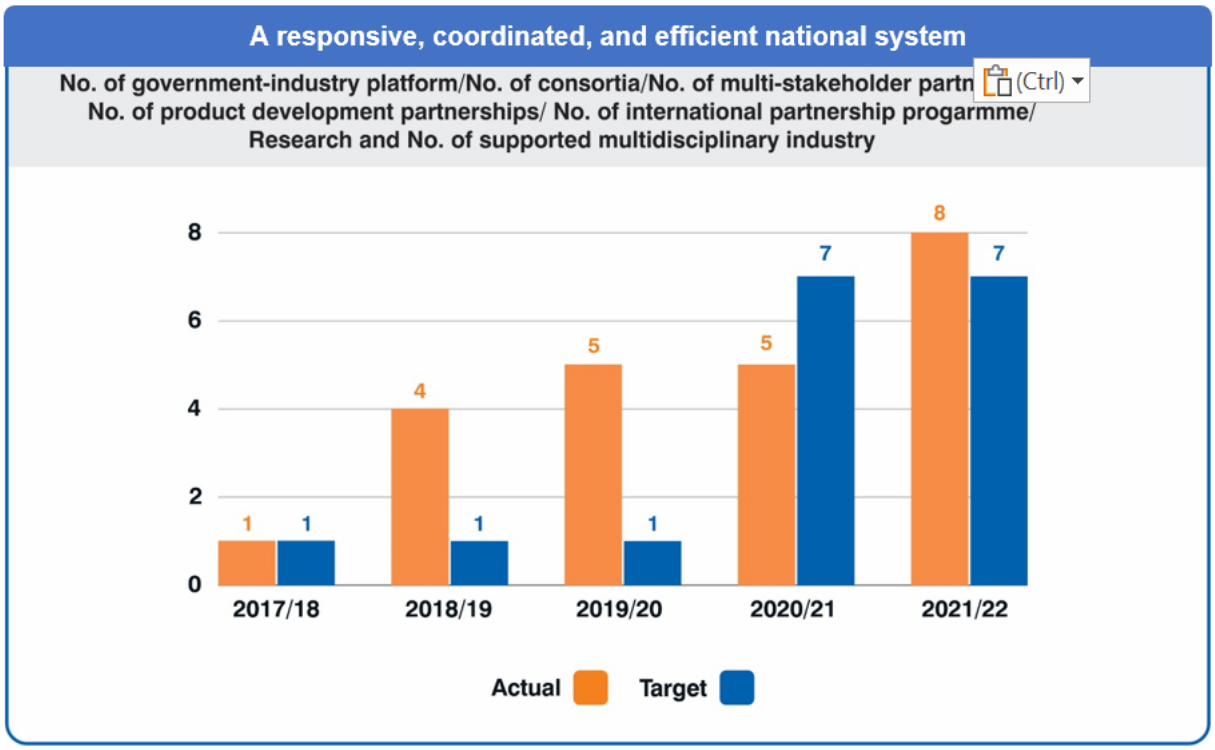

Figure 13: A responsive, coordinated and efficient national system

6.11.2 Outcome 2: Human capital development

Black MSc/PhD students supported

In the first year of Phase 1, 2017/18, the programme successfully supported three black MSc/PhD students, meeting the target. Subsequently in 2018/19, the programme exceeded the target by supporting six students, marking a 100% increase from the previous year. This performance was maintained in 2019/20, with another six students being supported. In 2020/21, the programme significantly surpassed the target by supporting 18 students, reflecting an impressive 200% growth from the previous year. Moving into Phase 2, specifically in 2021/22, the programme set an ambitious target of supporting 20 black MSc/PhD students. Remarkably, it managed to achieve this target,

showcasing its commitment to facilitating the academic and professional growth of black MSc/PhD students as shown in the Figure 14.

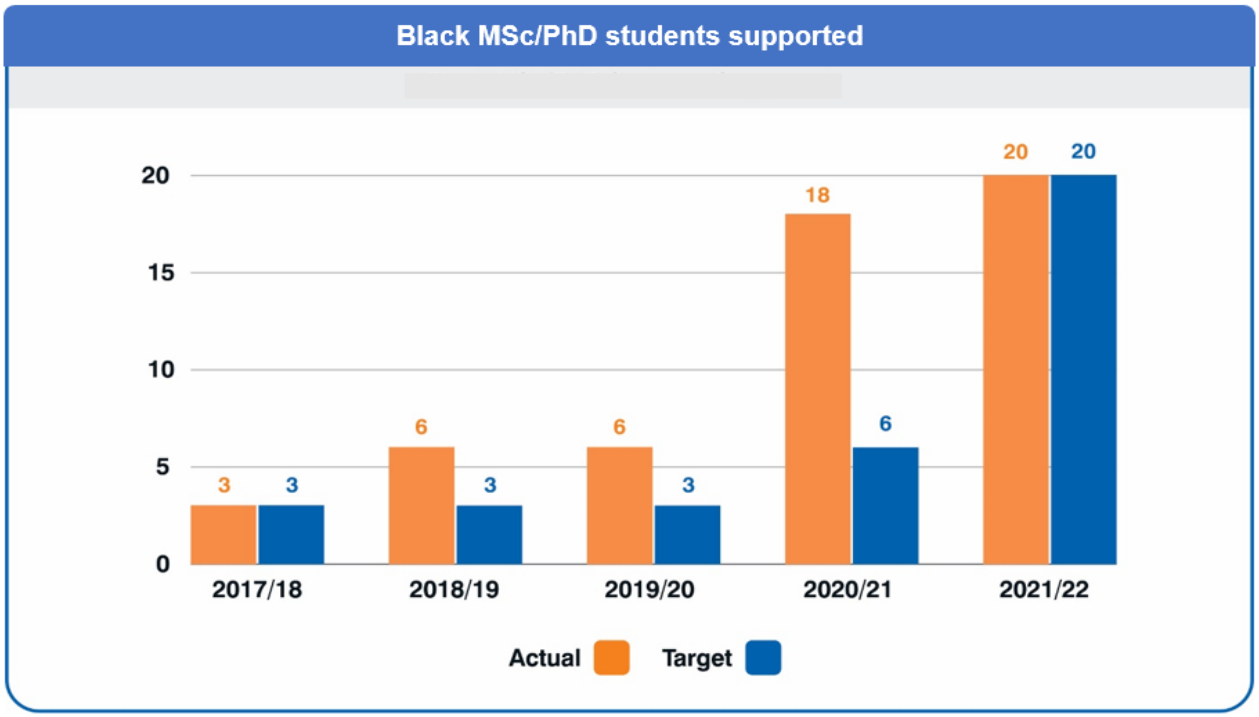

Figure 14: Black MSc/PhD students supported

Black post-doctoral candidates supported

The programme's commitment to supporting black post-doctoral candidates and its consistent progress over the years is commendable. This focus demonstrates a dedication to promoting diversity, equity and inclusion in the academic and research community. By providing targeted support to black post-doctoral candidates, the programme acknowledges the need to address underrepresentation and create opportunities for individuals from historically marginalised groups. Consistent progress in this area suggests that the programme's initiatives have been effective in fostering an environment where black post-doctoral candidates can thrive.

In Phase 1 (2017/18 to 2019/20), the programme consistently met its annual target of supporting one black post-doctoral candidate, highlighting its dedication to this specific academic group. During 2020/21, the programme exceeded its target by assisting two candidates, marking a 100% growth compared to previous years. As Phase 2 (2021/22) commenced, the programme set a higher target of supporting two candidates, a goal it surpassed impressively by supporting 10 candidates. This shift reflects a substantial and

commendable expansion in the programme's impact, underscoring its commitment to advanced research and academic development among black post-doctoral candidates (see Figure 15).

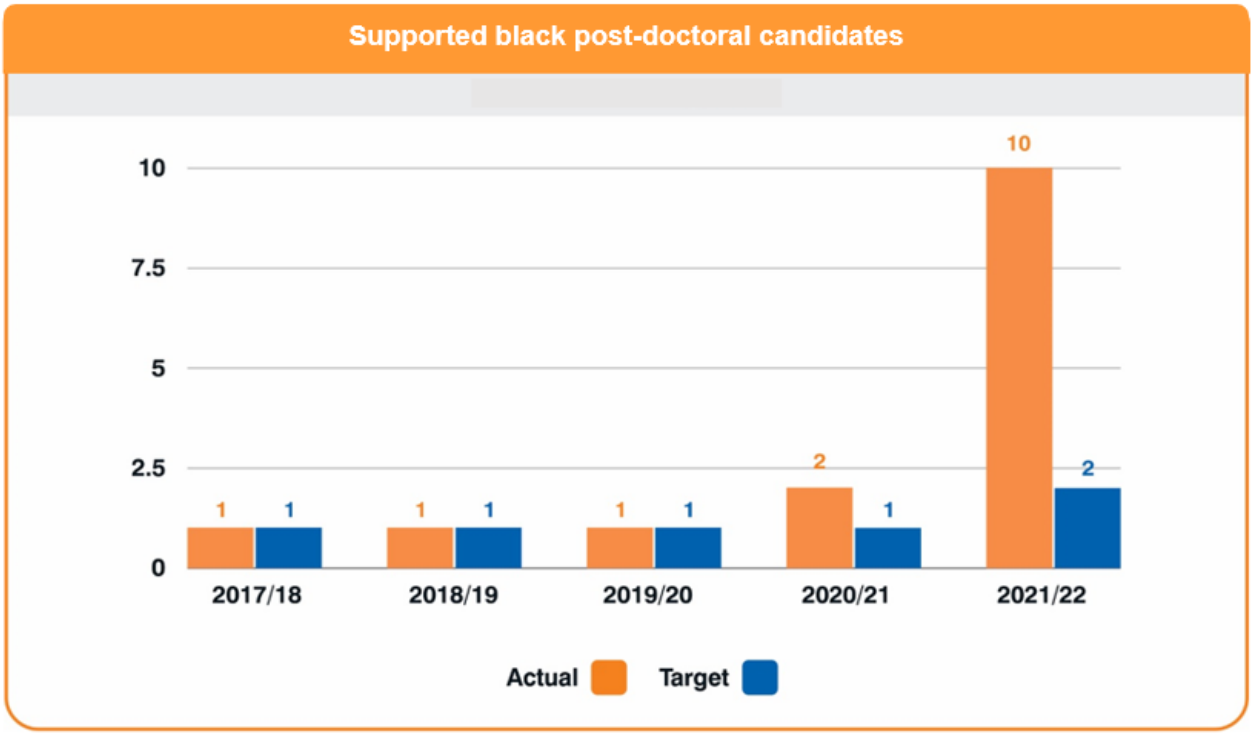

Figure 15: Supported black post-doctoral candidates

Black technicians supported.

As depicted in Figure 16, in Phase 1 (2017/18 to 2019/20), the programme encountered difficulties in meeting its targets to support black technicians, with no actual support provided in the initial years. However, progress was made in 2019/20, as the programme supported one candidate. In the single-year Phase 2 (2021/22), the programme aimed to support 10 black technicians but managed to assist five, indicating a partial achievement of the target. This suggests a mixed trajectory of progress and challenges in the programme's efforts to support black technicians.

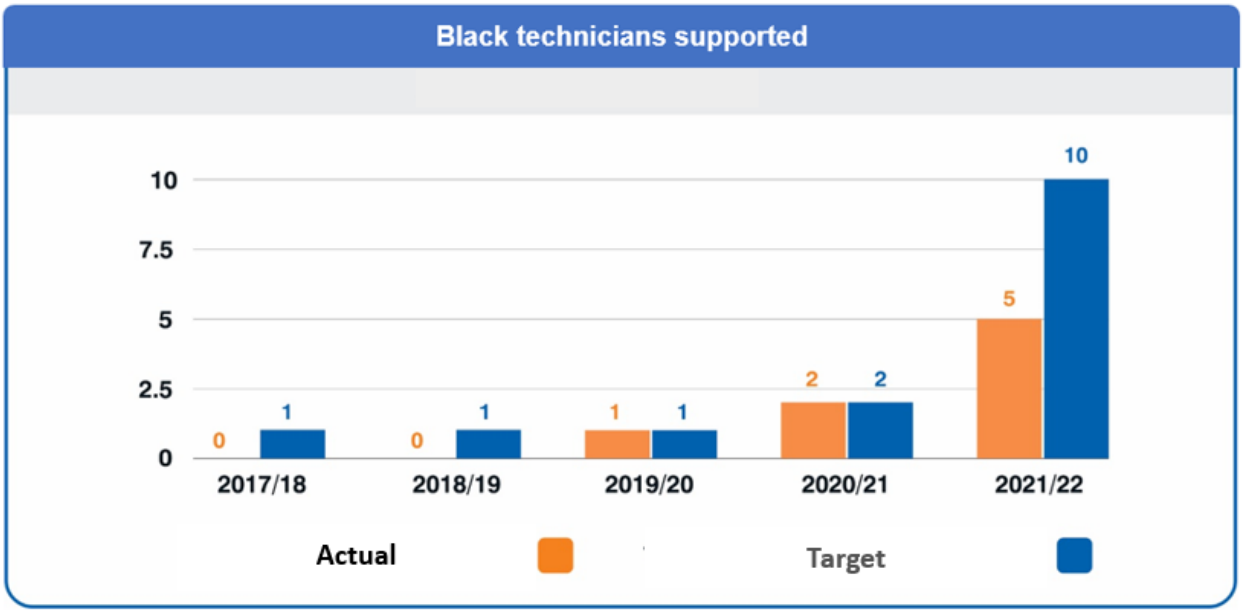

Figure 16: Black technicians supported.

6.11.3 Outcome 3: Utilising knowledge and innovation for economic development

Black farmers supported

The programme's performance in supporting black farmers exhibited variability over the years. It consistently surpassed its targets in Phase 1, notably exceeding the goals in 2017/18 and 2018/19. The programme achieved a remarkable spike in impact during 2019/20, significantly surpassing its target. However, the performance dipped in 2020/21. Phase 2 commenced with the programme setting a higher target, which it achieved in 2021/22. See Figure 17 which follows.

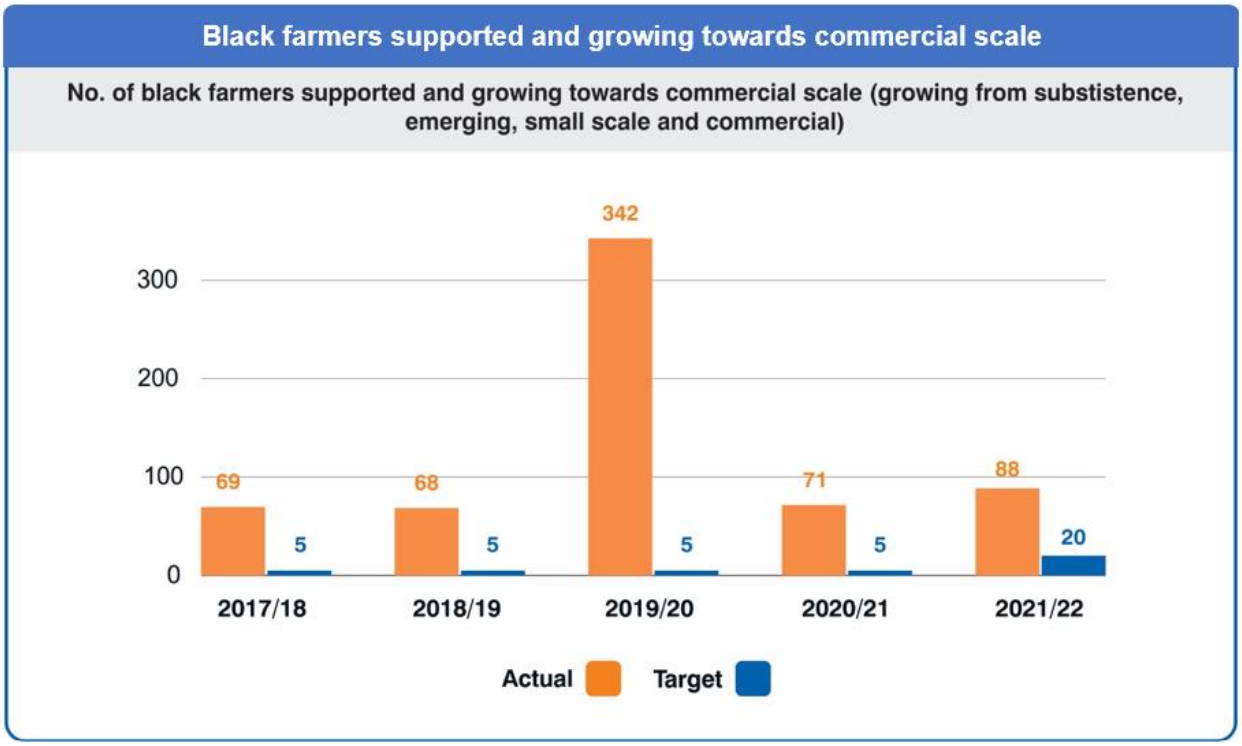

Figure 17: Black farmers supported and growing towards commercial scale

Beneficiaries (communities, women and youth)

The outreach to beneficiaries, including communities, women and youth, displayed dynamic fluctuations over the evaluated periods, as illustrated in Figure 18. In Phase 1, the programme consistently surpassed its targets, with a remarkable surge in 2018/19, reaching 12 068 beneficiaries against the set target of 20. However, Phase 2 (2020/21) experienced a major drop in numbers, with only 142 beneficiaries against the target of 200. In the final year of Phase 2 (2021/22), the programme rebounded significantly, attaining 2 686 beneficiaries against a set target of 50. While the results demonstrate an overall impactful reach, the fluctuations in Phase 2 indicate potential challenges or shifts in implementation strategies affecting beneficiary engagement.

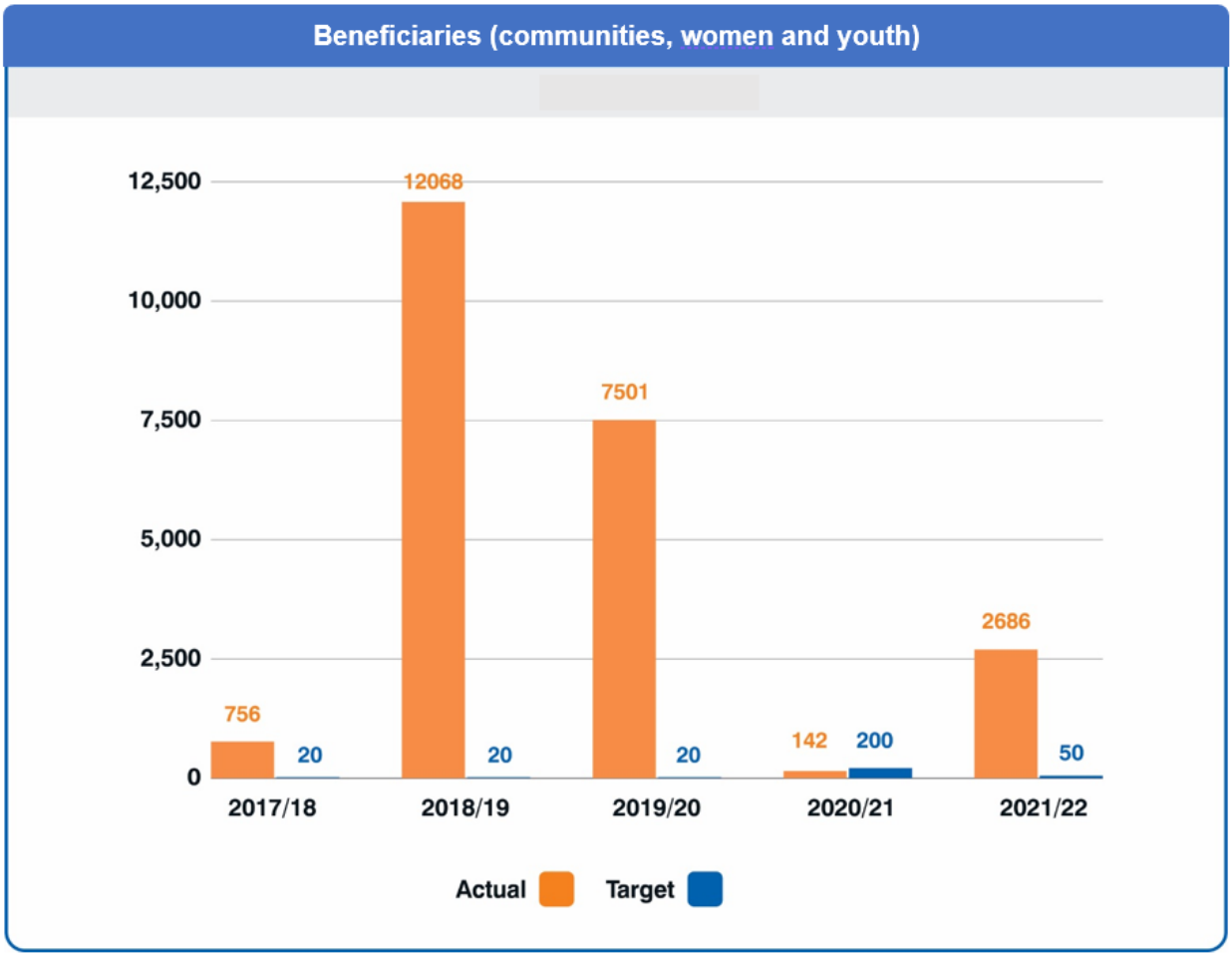

Figure 18: Beneficiaries (communities, women and youth)

Job creation

The job creation target was consistently set at 10 jobs per year during Phase 1 (2017/18 to 2020/21) (see Figure 19). However, actual job creation fell significantly short of the target in the earlier years, with no jobs created in 2017/18 and 2018/19. The programme showed improvement in job creation during the latter years of Phase 1, with nine jobs created in 2019/20 and two jobs in 2020/21. In Phase 2 (2021/22), the programme achieved four of the targeted 10 jobs, reflecting a 40% achievement rate. While there was progress in job creation, sustained efforts are needed to consistently meet and exceed the set targets.

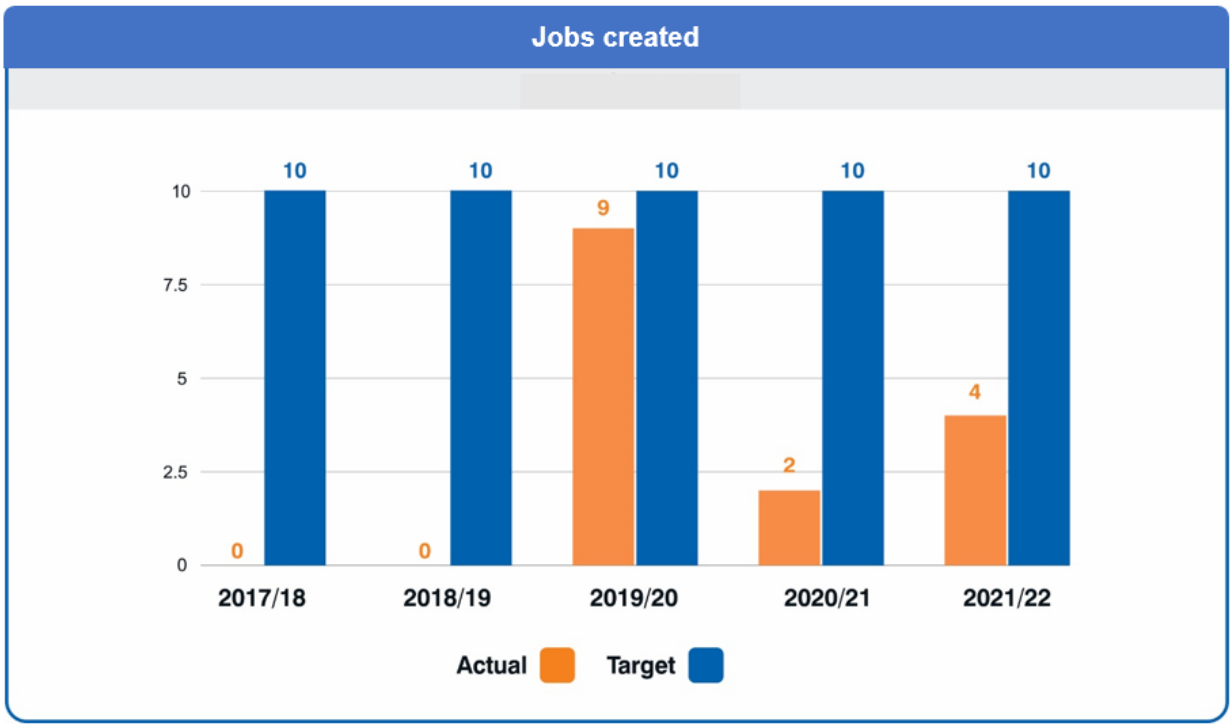

Figure 19: Jobs created

Co-funding

As previously reported, the programme maintained a consistent co-funding/increased investment target of R10 million throughout Phase 1 (2017/18 to 2020/21). Notably, the target for Phase 2 (2021/22) was elevated to R20 million. Although the programme fell short of its target in 2017/18 with only R1 071 372 secured, subsequent years witnessed remarkable improvement. During Phase 1, it garnered R48 023 708 in 2018/19, R65 078 623 in 2019/20, and R62 003 855 in 2020/21 (refer to Figure 20). Remarkably, in Phase 2 (2021/22), the programme outperformed expectations, amassing R73 375 728 in co-funding/increased investments, effectively exceeding the increased target. This consistent upward trajectory underscores the programme's ability to attract external resources to bolster its initiatives and objectives.

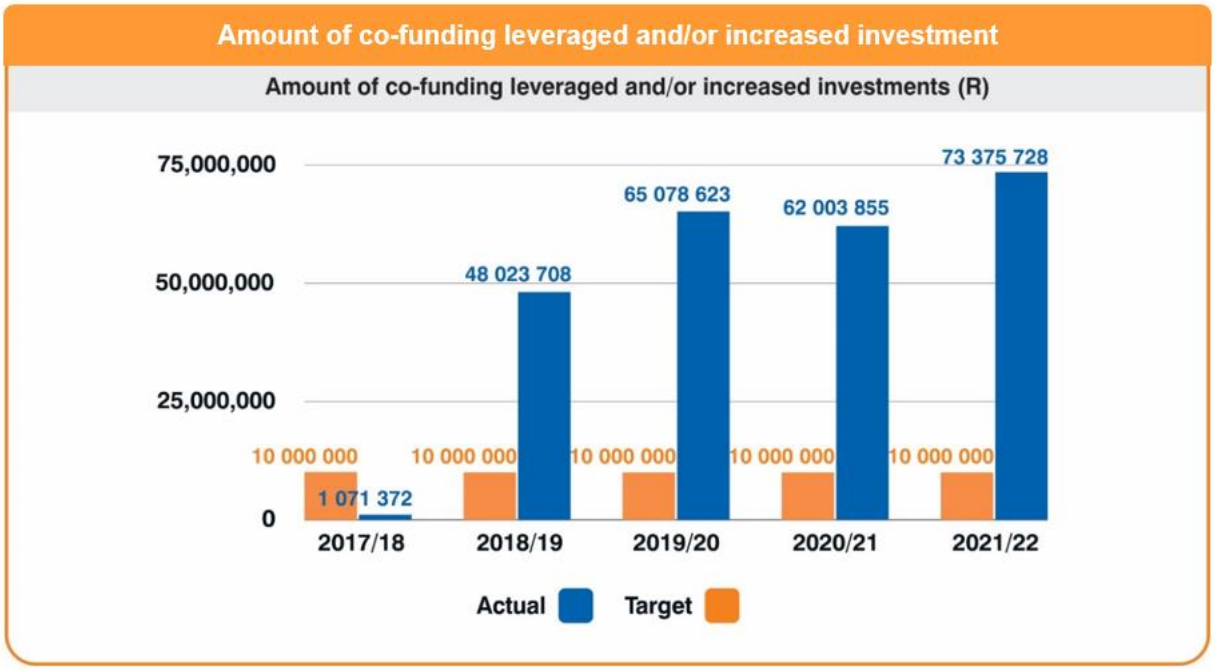

Figure 20: Amount of co-funding leveraged and/or increased investment (R)

However, over Phases 1 and 2 there were no black farmers supported for regulatory, phytosanitary, food safety, quality, and accreditation initiatives to enable their access to formal domestic and international markets. Additionally, no spin-outs or start-ups were initiated during the assessed period. The programme did not exhibit any activity or progress in these particular aspects.

6.11.4 Outcome 4: Product pipeline for the agricultural bioeconomy

Assessments in the mapping of value chains for indigenous niche underutilised crops and animals

The programme's aim to conduct assessments in the mapping of value chains for indigenous, niche underutilised crops and animals was met with varied success. In Phase 1 (2017/18 to 2020/21), the programme experienced challenges, failing to meet its assessment targets for each year. While targets were set at one assessment for each of the first three years, no assessments were accomplished during this period. However, in Phase 2 (2021/22), the programme showed improvement. With targets set at two assessments, the programme successfully conducted two assessments, meeting the set objectives for this particular year. This indicates that the programme encountered difficulties in its initial stages but managed to make progress towards its goals in the later phase. Refer to Figure 21 which follows.

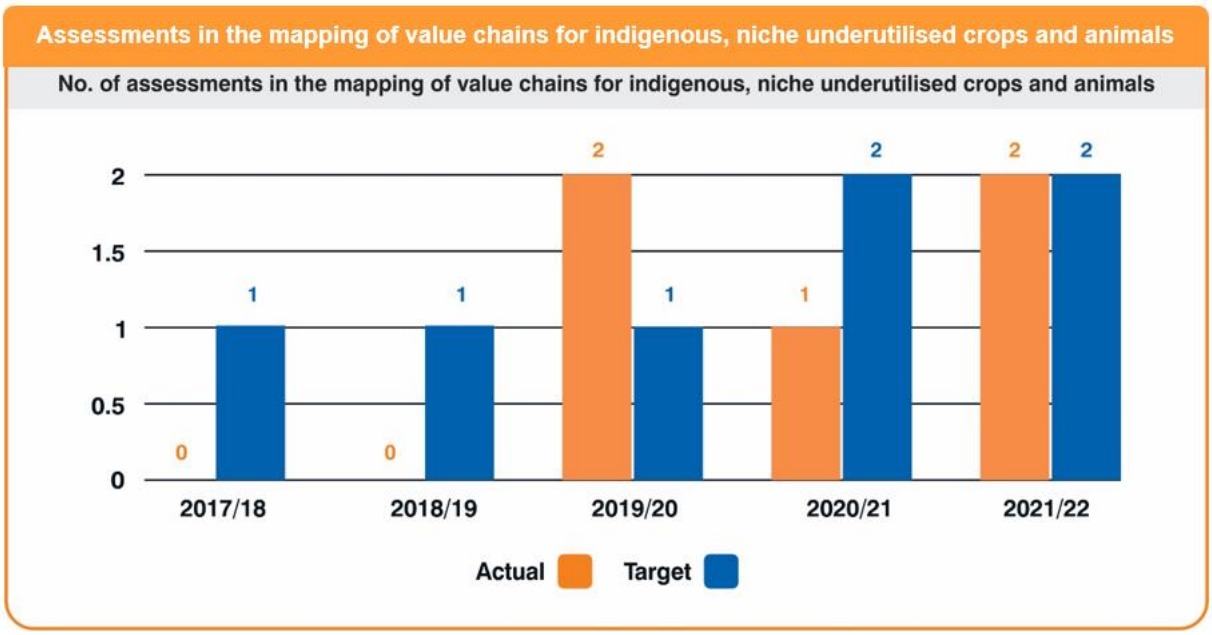

Figure 21: Assessments in the mapping of value chains for indigenous, niche underutilised crops and animals

New plant or animal lines developed.

The programme's focus on developing new plant or animal lines resulted in varying outcomes over the evaluation period. In Phase 1 (2017/18 to 2020/21), the programme faced challenges in meeting its targets, falling short of the set goals in the first year and not achieving any development. However, in subsequent years, the programme significantly surpassed its targets, with 270 new lines developed in both 2018/19 and 2019/20. Phase 2 (2021/22) continued this positive trend, achieving the set target of 300 new lines. This analysis indicates a shift from initial difficulties to a more successful implementation of new plant or animal line development in later phases, resulting in substantial progress towards programme objectives. The results are displayed in Figure 22.

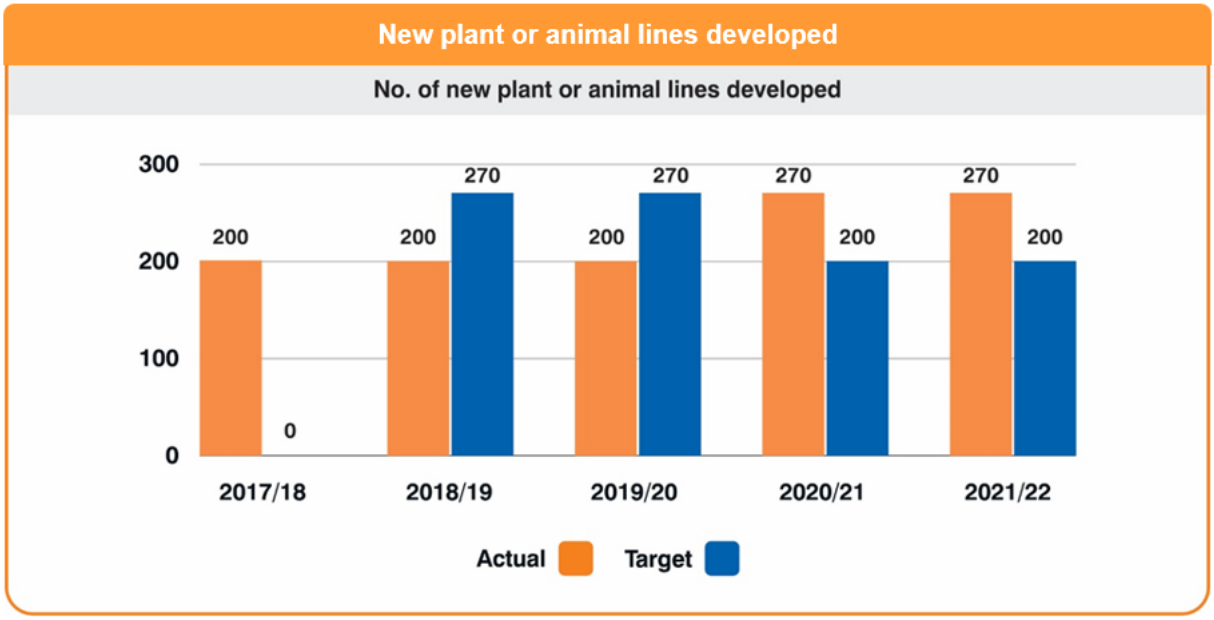

Figure 22: New plant or animal lines developed

Proactive intervention for diagnosis, surveillance, monitoring and early warning systems

The programme's efforts to implement proactive interventions for diagnostics, surveillance, monitoring and early warning systems were inconsistent over the evaluation period, as illustrated in Figure 23. In Phase 1 (2017/18 to 2020/21), the programme struggled to meet its targets, failing to accomplish the set goals for three of the four years. With an annual target of one proactive intervention, no interventions were achieved during these years except for 2019/20, when one intervention was successfully executed. Phase 2 (2021/22) demonstrated some improvement, with the programme achieving one of the set target of two interventions. This analysis suggests that while there were challenges in consistently meeting targets, the programme managed to make limited progress in the latter phase.

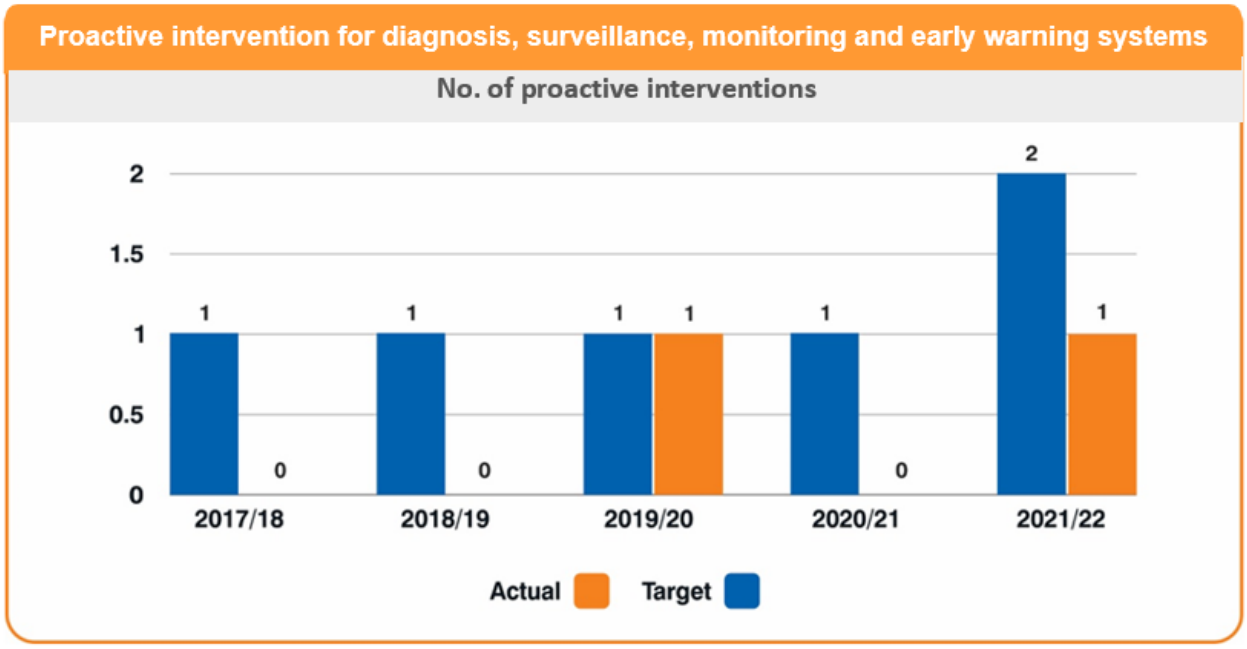

Figure 23: Proactive interventions

Product/cultivator registrations

The programme's efforts to register products or cultivars showed varying levels of success across the evaluation period. In Phase 1 (2017/18 to 2020/21), the programme encountered challenges, failing to meet its registration targets in both 2017/18 and 2020/21 (see Figure 24). However, in the subsequent years, the programme demonstrated a remarkable improvement, significantly exceeding its targets by registering seven products or cultivars in both 2018/19 and 2019/20. Phase 2 (2021/22) continued this positive trajectory, successfully registering one product or cultivar, meeting the set target. This analysis highlights the programme's shift from initial setbacks to a successful registration trend, contributing to the achievement of its objectives.

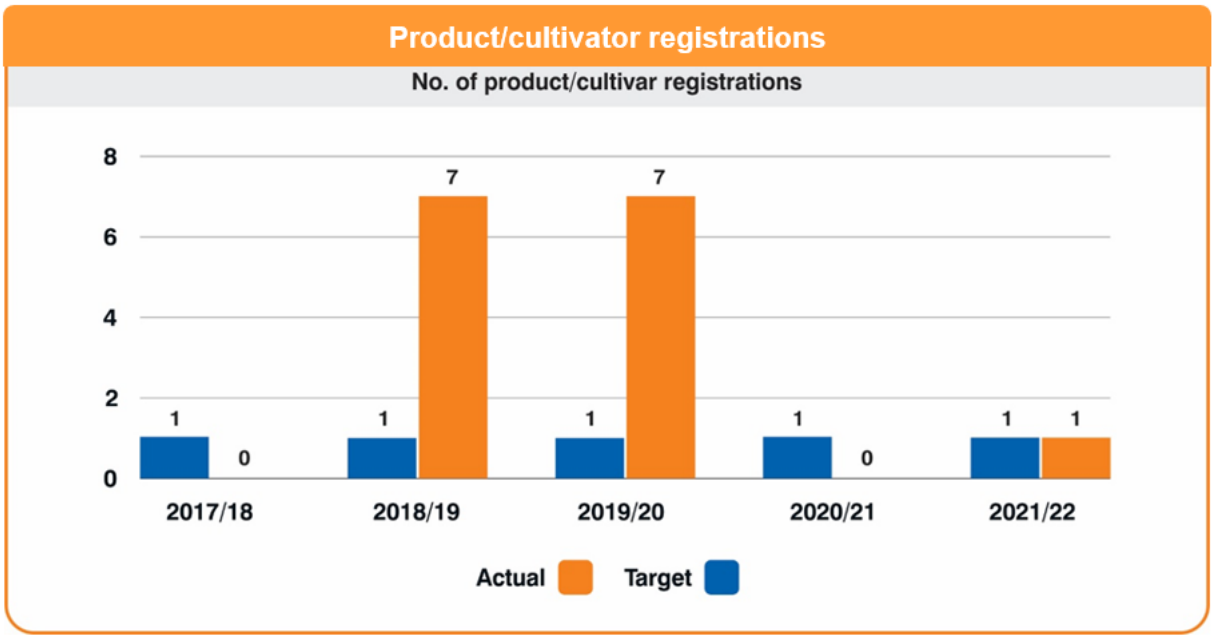

Figure 24: Product/cultivator registrations

Develop and launch products

The evaluation period showcases the programme's concentrated efforts in Phase 2 (2021/22) to develop and launch products. While Phase 1 did not witness any products being developed or launched, Phase 2 exhibited a substantial achievement. The programme surpassed its target by a significant margin, successfully developing and launching 15 products in the specified year. This outcome underscores the programme's focused approach and accelerated progress in Phase 2, resulting in multiple products being created and introduced to the intended beneficiaries.

Based on analysis of the progress made in achieving the ABIPP implementation goals, it is evident that, to date, the ABIPP has met or surpassed the targets for more than half of the key performance indicators, considering that these indicators were only defined in 2019/20. In addition, the bulk of the funding earmarked for programmes was disbursed. In Phase 1, six programmes were funded, while 17 programmes were funded in Phase 2. Only two programmes (the grains and oilseed partnership programme and the soybean food and nutrition development programme) continued from Phase 1 to Phase 2. During Phase 1, most programmes encountered delays in implementation due to Covid-19, culminating in funding being disbursed late. However, some Phase 2 programmes such as the Food Safety Lab could not be deployed owing to concerns about the programme feedback from the steering committee not being addressed.

7. CONCLUSIONS

In line with the DAC evaluation criteria from the Organisation for Economic Cooperation and Development (OECD), this evaluation assessed the findings in terms of relevance, effectiveness, efficiency, impact and sustainability.

7.1. Relevance

In general, there is strong evidence that supports the conclusion that the ABIPP is relevant to development priorities at regional, country and global levels. To begin with, the ABIPP is strongly aligned with the development aspirations and priorities presented in the National Development Plan (2030): "South Africa's competitiveness will rely on national systems of innovation permeating the culture of business and society. Innovation and learning must become part of our culture." Furthermore, the objectives and goals of the ABIPP align with the Development Plan's recognition of the agricultural sector as a key driver of food security and rural economic development in South Africa. The need to address specific agricultural challenges, including the issue of low technological innovation, is at the core of both the DSI's Decadal Plan (2022) and the ABIPP's aims. In prioritising bio-innovation as a part of high-tech industries, the Decadal Plan also cements the significance and relevance of the ABIPP by acknowledging the fierce nature of global agricultural competition and its ultimate need for substantial support, even in the form of subsidies. The Plan implicitly considers the ABIPP's interventions around funding joint programmes and coordination to be key priority enablers necessary to assist innovation in contributing towards the realisation of South Africa's socio-economic ambitions.

The vision of South Africa's Agriculture and Agro-processing Masterplan (AAMP) 2022 regarding improving the global competitiveness of the local agricultural and agro-processing sectors, as well as developing rural economies and ensuring food security in South Africa, also directly aligns with what the ABIPP aims to achieve. The AAMP's focus on the agricultural and agro-processing subsectors relates to the ABIPP's programme intervention areas in Phase 1 and Phase 2. Notably, the ABIPP's strong orientation towards high-tech agricultural interventions in the form of increased bio-innovation aligns with one of the AAMP pillars pertaining the provision of research and development support to the agricultural and agro-processing subsectors. The AAMP focus on the

creation of an enabling infrastructure is something that can also be realised through ABIPP contributions. Furthermore, the ABIPP can play a pivotal role in realising the AAMP's various objectives, including that of strengthened partnerships with the private sector "to boost comprehensive farmer support programmes, biosecurity control measures and protocols, agricultural research and development, technology adoption, and access to markets".

The ABIPP's focus on improving food security in South Africa speaks directly to the National Food and Nutrition Security Plan for South Africa (NFNSP) 2018–2023 vision of "optimal food security and enhanced nutritional status for all South Africans". Moreover, the ABIPP`s interventions which target the development of local agricultural value chains directly align with or contribute towards the realisation of the NFNSP's second strategic objective, namely the establishment of inclusive local food value chains to support access to nutritious and affordable food. In this way, the ABIPP could be considered a valuable programme tool that has been supporting not only the actioning but also the achievement of the NFNSP for the 2018/23 period.

The relevance of the ABIPP also lies in addressing several critical challenges in the agricultural sector and promoting sustainable practices. It is highly relevant owing to its focus on sustainable agriculture, environmental conservation, climate change mitigation, food safety, rural development and international commitments. It addresses critical challenges in the agricultural sector and provides a framework for promoting bio-based practices that contribute to a more sustainable and resilient food system.

Notwithstanding the above, when a deeper analysis of the relevance was made in view of the ABIPP's implementation progress to date, the review revealed that the ABIPP is too ambitious, has too many interventions, and is generally not in line with the limited resources (financial and non-financial) that are available for the programme. Some beneficiaries, such as the UFD, are receiving training, but they lack resources and the means to grow their businesses.

To conclude, the ToC encompasses a clear hypothesis of change, presenting causal pathways linked to and supported by inputs and outcomes. It is deemed capable of enabling agriculture to reach its developmental results, and it could engender a better understanding of how interventions are intimately linked to the outcomes and, ultimately,

to the goals sought under the ABIPP.

7.2. Effectiveness

The ABIPP has demonstrated effectiveness in achieving its intended objectives, as indicated by the analysis of key performance indicators. With more than half of the indicators surpassing their targets, the ABIPP has showcased notable success in fostering a responsive and coordinated national system, promoting human capital development, utilising knowledge and innovation for economic development, and advancing the product pipeline for the agricultural bioeconomy. While there are areas for improvement, such as supporting black technicians and developing new plant or animal lines, the overall performance of the programme is commendable. Continued monitoring and adjustment of strategies will be crucial to further enhance the ABIPP's impact and ensure the sustained growth of the agricultural bioeconomy. The dashboards in the figures below demonstrate the achievements that denote the effectiveness of the ABIPP in the following four key focus areas:

a) Human capital development

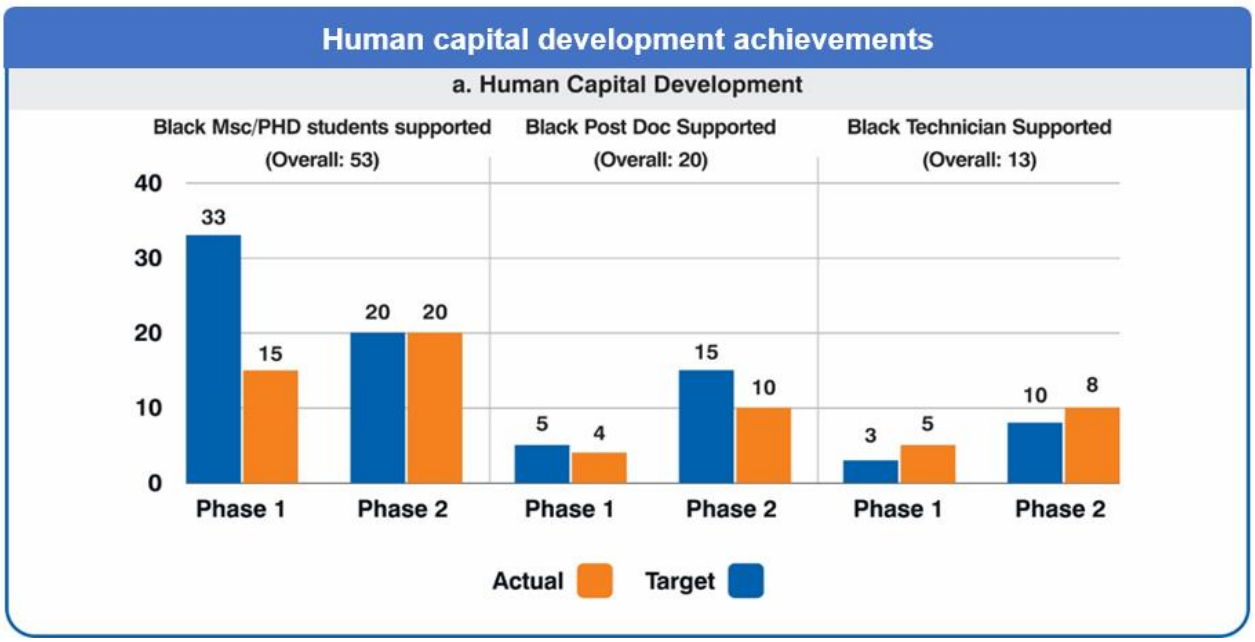

Figure 25: Human capital development achievements

b) Utilising knowledge and innovation for economic development

Utilising knowledge and innovation for economic development

b. Utilising knowledge and innovation for economic development

INITIAL TARGET	PHASE 1		PHASE 2		OVERALL
No. of black farmers supported and growing towards commercial scale (growing from subsistence, emerging, small scale and commercial)	20	550	20	88	638
No. of black emerging farmers (subsistence, small scale and potential commercial farmers) benefitting from technology/ innovation support programmes	0	0	200	3 194	3 194
No. of beneficiaries (communities, women and youth)	260	20 467	0	2 686	23 153
No. of black farmers supported for regulatory, phytosanitary, food safety and quality and accreditation to be able to access formal domestic and international markets	12	0	5	0	0
No. of jobs created	40	11	10	4	15
No. of spin-outs or start ups	4	0	1	0	0
Amount of co-funding leveraged and/ or increased	R10m	R176m	R20m	R73m	R249m

Figure 26: Utilising knowledge and innovation for economic development

c) A responsive, coordinated, and efficient national system

A responsive, coordinated and efficient national system achievements

c. A responsive, coordinated, and efficient national system

No. of government-industry platform
No. of Consortia
No. of multi-stakeholder partnerships
No. of product development partnerships
No. of international partnership programmes
Research and no. of supported multidisciplinary industry coordinated programmes
(Overall: 23)

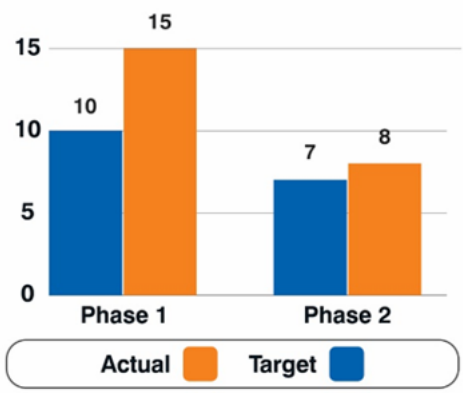

Figure 27: A responsive, coordinated and efficient national system achievements

d) Product pipeline for the agricultural bioeconomy

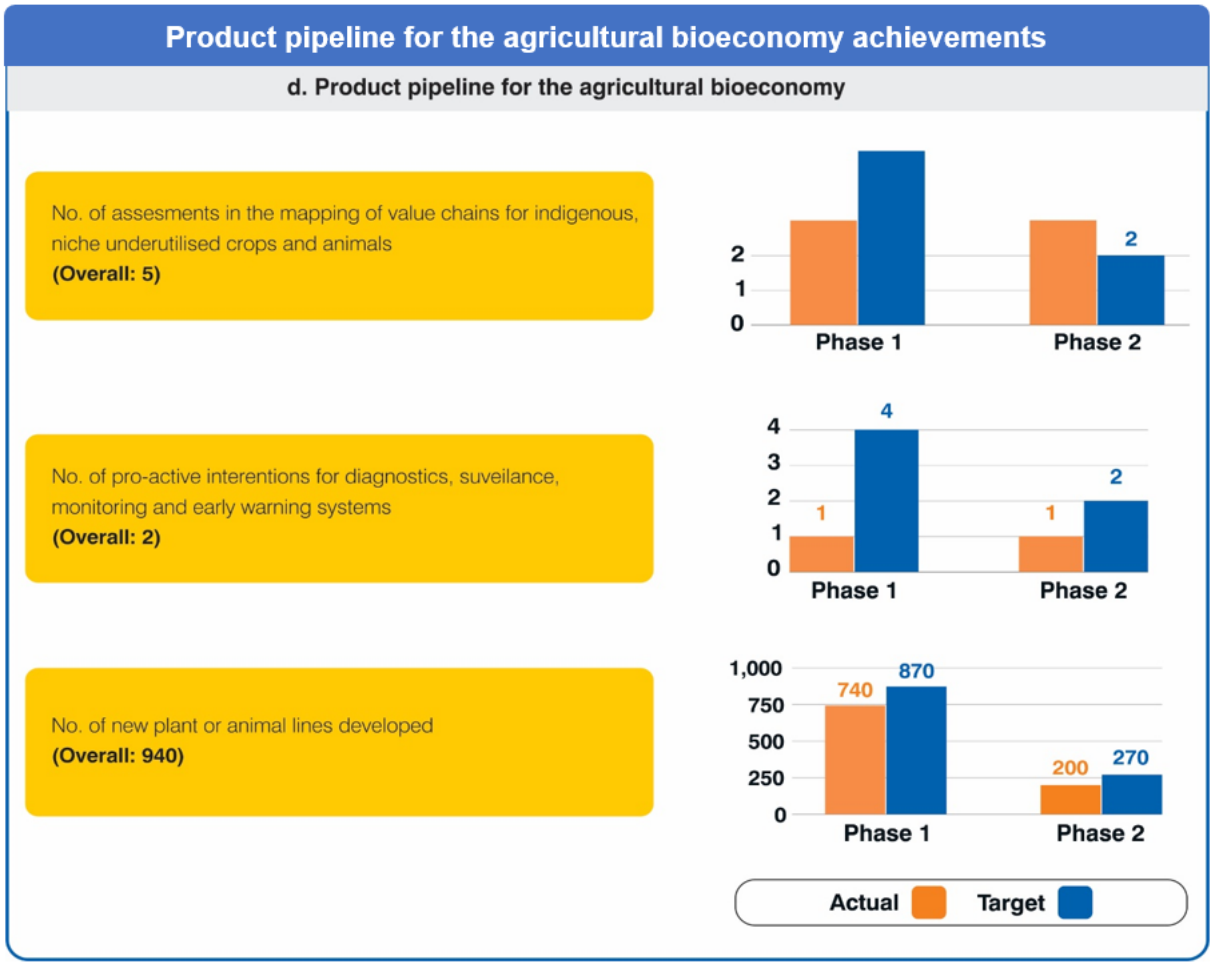

Figure 28: Product pipeline for the agricultural bioeconomy achievements

7.3. Efficiency

ABIPP has demonstrated a significant level of efficiency in implementing its projects. Through funding and support for research and development activities in the agricultural bioeconomy, the programme has facilitated the development of innovative technologies, practices and products that have enhanced agricultural productivity and sustainability. By providing training programmes, workshops and extension services, the programme has ensured that farmers gain access to new technologies, practices and improved crop varieties, resulting in increased efficiency and improved yields. The programme has also encouraged value addition and diversification in the agricultural bioeconomy, leading to the creation of new products and markets and contributing to economic growth and job creation. The allocation of funds in Phase 1 and Phase 2 demonstrates a balanced distribution among various programmes, with most of the allocated funds being

disbursed, indicating effective utilisation of resources. However, some inefficiencies, challenges and delays have been encountered as part of the programme, resulting in unused funds and also funding cuts. It is essential that the various programme-related inefficiencies noted as part of this evaluation are dealt with.

A total of **23** projects have been supported by the ABIPP in Phases 1 and 2. The grain and oilseed partnership programme and soybean food and nutrition development programme were the only two programmes to have received funds in both phases. The grains and oilseed partnership programme received by far the most funding **(54%)** from the ABIPP. The rest of the programmes each received less than **10%** of the funds. Half **(50%)** of the programmes, each received **1%** of the funds while **30%** of the programmes each received **2%** of the funds. Agro-processing was allocated the second-highest of the funds with **8%**, followed by aquaculture and soybean food and nutrition each receiving **7%** of the funds. Based on details obtained from DSI officials, the grains and oilseed partnership programme partnerships have been the most significant contributors of co-funding to the ABIPP.

7.4. Emerging impact

The use of the impact criteria has enabled a comprehensive evaluation of the ABIPP's emerging and potential impacts, providing valuable insights into the effectiveness and outcomes of the programme. Upon analysing the data and indicators associated with the ABIPP's strategic outcomes, it becomes apparent that the programme has made substantial and positive contributions across various domains. These include areas aligned with the findings of the Malabo Montpellier Panel report from 2022, such as enhanced income and job creation (in particular through the expansion of productive agro-processing sectors and the establishment of new value chains and markets), and improved food security and nutrition – objectives which are strongly emphasised in the AAMP (2022) and the NFNSP 2018/23.

The indicators reveal that a considerable number of targets have been met or exceeded, indicating the successful realisation of the ABIPP's intended objectives. The ABIPP has made remarkable progress in terms of human capital development, technology and innovation support for emerging farmers, job creation and the leveraging of co-funding

and investments. These achievements signify the ABIPP's contribution to advancing the agricultural bioeconomy and its potential to foster sustainable economic growth, promote social inclusion and address environmental challenges. The emerging impacts which have been identified demonstrate the tangible benefits that the ABIPP has brought to individuals, communities and the agricultural sector at large. Furthermore, the ABIPP's potential influence is promising, as it continues to build on its successes, expand its reach, and drive transformative change in the bioeconomy. The ABIPP's achievements, together with its emerging and potential impact, underscore its effectiveness in driving positive change in the agricultural sector and positioning itself as a catalyst for sustainable development in the bioeconomy.

7.5. Sustainability

The application of the DAC sustainability criteria has been instrumental in evaluating the sustainability of the ABIPP. This criterion has provided a comprehensive framework for assessing the long-term impact and viability of the ABIPP's development interventions. Through the lens of environmental sustainability, the ABIPP has demonstrated a commitment to minimising negative environmental impacts, promoting sustainable resource management and addressing climate change concerns. Regarding economic sustainability, the ABIPP has focused on generating economic growth, creating employment opportunities, and enhancing livelihoods, thereby contributing to inclusive and sustainable economic development. In terms of sustainability criteria, the ABIPP has positioned itself as a model for sustainable development, ensuring that its interventions contribute to long-term positive outcomes for both beneficiaries and the environment. Nonetheless, other programme-specific sustainability issues around project continuity should be addressed. It is not sustainable for the programme to provide funding to begin research and development activities and fail to support the same activities with funding to upscale or commercialise.

8. RECOMMENDATIONS

Based on the evaluation findings and conclusions drawn, a set of recommendations is proposed, focusing on how to strengthen and enhance the ABIPP, harmonise and integrate it further, and ensure its long-term sustainability and coherence based on

lessons learned. These recommendations are presented at both a strategic level and a more concrete operational level. Whereas neither has priority over the other, both types of recommendation involve a different level of engagement from different actors and therefore differ in their level of involvement and associated timelines. The strategic recommendations focus on more profound changes at the system level, going beyond just the project itself, requiring the involvement of multiple actors from different sectors. Recommendations at the operational level, on the other hand, concentrate on enhancements in the programme. Being more practical and action-orientated, these recommendations largely require involvement from actors directly involved in the implementation. These insights provide a comprehensive roadmap for the ABIPP's future endeavours and growth as it continues to support farmers and communities in South Africa.

Table 15: Recommendations

Recommendations		
Recommendation		**In detail**
Awareness	R1. TIA and DSI to promote Knowledge Sharing and Awareness	TIA and DSI to facilitate networking and knowledge sharing among stakeholders involved in the ABIPP. This can be done through establishing platforms for farmers, researchers, policymakers, and industry representatives to exchange experiences, best practices, and innovations. This can include conferences, workshops, online forums, and collaboration with existing agricultural networks and associations. The knowledge sharing and awareness campaigns should also be utilised to address some of the noted misconceptions that stakeholders have about the ABIPP, its legal status and structures, and co-funders.
	R2. The PMU should consider increasing the visibility of ABIPP on the bioportal or establishing own ABIPP website.	ABIPP should consider increasing its visibility on the local bioeconomy website or establishing its own independent and standalone website. Traffic to the website following either of the above proposed options should be promoted through the use of various social media platforms, such as Twitter, Facebook, Youtube, etc.
Governance	R3. The ABIPP PMU to increase the frequency of its project site visits.	The PMU should be provided with the sufficient financial and human resources support by both the DSI and TIA to ensure that project site visits are conducted regularly.
	R4. ABIPP Steering Committee members to prioritise transparency in decision making as stipulated in the ToRs	While acknowledging the merit of ABIPP Steering Committee members adhering to the ToR requirement to recuse themselves in case of potential conflicts of interest, it is additionally suggested that the committee fully complies with another ToR requirement, which prohibits members from having any conflicts of interest within the programme. Considering the complexities between completely doing away with conflict of interest and the implications on the co-funding element, it is recommended that the DSI should explore other mechanisms that balance the two. This could be done in a separate study or through a comprehensive evaluation study for the ABIPP.

Recommendation		In detail
Governance	R5. The DSI to consider effecting institutional changes to the structuring of the ABIPP	The DSI should consider the following changes to the ABIPP governance structures: ✪ A PMU with own dedicated resources should be prioritised. This should be a standalone unit within the TIA working independently, but in collaboration with the TIA agricultural unit. Clear distinctions of the roles of PMU personnel as presented in the SOPs and the ABIPP PMU Structure report produced in 2021 should be complied with. Furthermore, the PMU should be well resourced, particularly in terms of having sufficient and appropriate human resources and ITC solutions. ✪ The operations of the sub-committees stipulated in the ABIPP concept document should be formalised and pursued as articulated. The remuneration (and contracts) of the experts forming part of those sub committees should be well defined and agreed upon. The requirement for the sub-committees to be chaired by members who are part of the ABIPP steering committee should be complied with.
Funding	R6. The ABIPP to lobby for increased funding from both public and private sector funders	Given the noted successes and impact of the ABIPP programme, the programme proponents (DSI and TIA) should promote the ABIPP more, publicise its impact, and communicate the need for increased funding support towards the programme.
	R7. The government should diversify funding sources where possible and support SMMEs to develop more commercially oriented models, which could lead to a more diversified funding mix, reducing dependencies on public funds	TIA should facilitate and promote the development of more commercially viable activities among the SMMEs who support farmers in order to create more sustainable business models and reduce the dependence on public funding e.g., Ukhanyo Farmer Development Programme, Food Safety Lab etc.
Further Study	R8. DSI and TIA should undertake a full scale economic and impact evaluation of the ABIPP.	The DSI and TIA to commission a thorough and full-scale evaluation study. This study should encompass various focus areas, including but not limited to the development of theories of change for each focus area, as well as a comprehensive investigation into the precise and overall impact of the ABIPP.

9. REVISED THEORY OF CHANGE

The figure below represents a systematic theory of change that aligns with the assessment of the ABIPP and serves as a framework for future use by the TIA. These changes have been shaped in a considered response to document reviews and engagements with various ABIPP stakeholders.

Assumptions

- Collaboration and partnerships across stakeholders can lead to improved innovation and development in the agricultural sector.
- Fostering innovation in the bioeconomy can lead to increased value economic growth in rural areas
- The adoption of sustainable agriculture practices can lead to enhanced productivity and resilience in the agricultural sector.
- Improved productivity and access to markets can lead to increased economic opportunities for small-scale farmers and rural communities
- Improved food security and nutrition outcomes can lead to improved health outcomes and reduced poverty in rural areas.

Programme Activities

Research and Development

- Promoting research and innovation in the bioeconomy, with a focus on sustainable agriculture and value chains
- Providing financial support for research and devlopment projects
- Supporting research and development initiatives that focus on developing new technologies, products, and practices that promote sustainable agriculture and the bioeconomy.

Market Development

- Creating new value chains and markets related to the bioeconomy, with a focus on rural areas

Capacity building

- Providing training, skills development, and technical assistance to stakeholders in the agricultural sector, with a focus on empowering rural communities and small-scale famers to adopt sustainable agriculture practices (including established farmers).
- Providing support to black/ coloured students (high-end skills, Msc, PhD, Technicians)
- Dissemination of knowledge and information through various channels, including online platforms, publications, and workshops.
- Providing and facilitating access to financial support

Collaborations and Partnerships

- Facilitating collaborations and partnerships across stakeholders to foster innovation and development in the agricultural sector
- Building partnerships with other organizations, both locally and internationally, to leverage expertise, funding, and resources.

OUTPUTS | **OUTCOMES** | **IMPACT**

- Research and innovation promoted
- Research and development initiatives supported
- New value chains and markets related to the bioeconomy created
- Capacity building initiative and technical assistance provided
- Students supported
- Knowledge and information disseminated
- Collaborations and partnerships across stakeholders in the agricultural sector facilited
- Partnerships established

Short term

- More innovations including new technologies, products and practices
- Efficient and/ or new productive value chains
- Enhanced capacity and skills development among stakeholders in the agricultural, particularly small-scale farmers and rural communities
- Human capital/ skills development
- Increased awareness, adoption and understanding of sustainable agriculture practices and the bioeconomy among stakeholders in agricultural including rural communities
- Enhanced participation and opportunities for communities, women, and youth beneficiaries within the agricultural sector
- Increased access to and/ or awareness of funding opportunities
- Enhanced stakeholder engagement and communication

Medium term

- Diverse product pipeline established within the agricultural bioeconomy
- Effective harnessing knowledge and innovation within the bioeconomy as catalysts for sustainable economic development
- New entrepreneurs/ SMMEs
- Increased job creation
- Improved agricultural risk management and resilience
- More black farmers in low-income communities becoming commercialised
- Improved access to markets and value chains for small scale farmers, leading to increased income generation and livelihoods
- Responsive, coordinated and efficient national system

Improved social outcomes for communities leading to sustainable rural economic growth and development

10. REFERENCES

Bamberger, M. (2010). Reconstructing baseline data for impact evaluation and results measurement.

CBD (Convention on Biological Diversity). (1992). Article 2. Use of Terms. In: Convention on Biological Diversity [online]. Retrieved on 14 February 2023, from https://www.cbd.int/convention/articles/?a=cbd-02.

Creswell, J. W., & Tashakkori, A. (2003). Differing perspectives on mixed methods research. *Journal of mixed methods research*, *1*(4), 303–308.

Department: Agriculture, Forestry and Fisheries. (2015). Agricultural Policy Action Plan (APAP) 2015–2019.

Department for International Development (2012). Results in Fragile and Conflict Affected States and Situations, p. 6. http://www.dfid.gov.uk/documents/Publications1/managing-results-conflict-affected-fragile-states.pdf

Department of Performance Monitoring and Evaluation (DPME) (2011). National evaluation policy framework.

Department of Science and Innovation & Technology Innovation Agency. (2019). DST Contract Reporting. Annual Report 2019/20 for Agriculture Bio-Economy Innovation Partnership Programme

Department of Science and Innovation & Technology Innovation Agency. (2020). Agriculture Bio-Economy Innovation Partnership Programme Business Plan 2020/21-2023/22 – 2022/23

Department of Science and Innovation & Technology Innovation Agency. (2020). Agriculture Bio-Economy Innovation Partnership Programme: Standard Operating Procedures

Department of Science and Innovation & Technology Innovation Agency. (2020). Agriculture Bio-Economy Innovation Partnership Programme: Terms of Reference

Department of Science and Innovation & Technology Innovation Agency. (2020). DST Contract Reporting. Final Report for Agriculture Bio-Economy Innovation

Partnership Programme

Department of Science and Innovation I& Technology Innovation Agency. (2021). 'DST Contract Reporting. Annual Report for Agriculture Bio-Economy Innovation Partnership Programme'.

Department of Science and Innovation & Technology Innovation Agency. (2021). Agriculture Bio-Economy Innovation Partnership Programme: Programme Management Unit Structure

Department of Science and Innovation & Technology Innovation Agency. (2022). DST Contract Reporting. Annual Report for Agriculture Bio-Economy Innovation Partnership Programme

Department of Science and Innovation (2022). Science Technology and Innovation Decadal Plan 2022-2032. Science, technology and innovation enabling inclusive, sustainable South Africa development in a changing world

Department of Science and Technology I& Technology Innovation Agency. (2017). Project Funding Agreement. Number: DST/CON 0250/2017. Management of Agriculture Bio-Economy Partnership Programme

Department of Science and Technology. (2013). The Bio-economy Strategy.

EC (European Commission). (2020). Brief on jobs and growth of the EU bioeconomy 2008-2017. The European Commission's Knowledge Centre for Bioeconomy (KCB). Brief on jobs and growth of the EU bioeconomy 2008-2017 | Knowledge for policy (europa.eu)

EC. (2021). Natural capital accounting. In: EC Nature and biodiversity [online]. Retrieved on 23 November 2023. https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm.

FAO (Food and Agriculture Organisation). (2021a). Sustainable Development Goals Indicators. In: FAO Sustainable Development Goals [online]. [Cited 9 February 2023]. http://www.fao.org/sustainable-development-goals/indicators/1231/en/

FAO. (2021b). Biotechnology. In: FAO Biotechnology [online]. [Cited 14 February 2023]. http://www.fao.org/cgrfa/topics/biotechnology/en/

FAO. (2021c). Aspirational Principles and Criteria for a Sustainable Bioeconomy.

Rome. 16 pp. (Retrieved on 11 October 2023) http://www.fao.org/3/cb3706en/cb3706en.pdf.

FAO (2015). Overview and a proposed way forward. FAO. http://www.fao.org/in-action/sustainable-and-circular-bioeconomy/)

German Bioeconomy Council. (2021). International Bioeconomy Strategies. In: Global Bioeconomy Summit 2020 [online]. [Cited 30 January 2023]. https://gbs2020.net/international-bioeconomy

Giuntoli, J., Robert, N., Ronzon, T., Sanchez Lopez, J., Follador, M., Girardi, I., & Barredo Cano, J. (2020). Building a monitoring system for the EU bioeconomy. https://op.europa.eu/en/publication-detail/-/publication/9be6bf37-3e5e-11ea-ba6e-01aa75ed71a1 F

Gomez San Juan, M., & Bogdanski, A. (2021). *How to mainstream sustainability and circularity into the bioeconomy. A compendium of bioeconomy good practices and policies.* https://doi.org/10.4060/cb5798en

Leeuw, F. L., & Vaessen, J. (2009). *Impact evaluations and development*: NONIE guidance on impact evaluation.

Kusek, J. Z., & Rist, R. C. (2004). *Ten steps to a results-based monitoring and evaluation systems. A handbook for development practitioners*. The World Bank.

Mabhaudhi, T., Hlahla, S., Chimonyo, V. G. P., Henriksson, R., Chibarabada, T. P., Murugani, V. G., Groner, V. P., Tadele, Z., Sobratee, N., Slotow, R., Modi, A. T., & Baudron, F. (2022). Diversity and diversification: ecosystem services derived from underutilized crops and their co-benefits for sustainable agricultural landscapes and resilient food systems in Africa. Papers published in Journals (Open Access), International Water Management Institute, pages 1-4:859223. https://doi: 10.3389/fagro.2022.859223.

Macnab, D. G. C. (2019). *David Hume: His theory of knowledge and morality.* Routledge.

Malabo Montpellier Panel. (2022). *Nature's Solutions: Policy Innovations and Opportunities for Africa's Bioeconomy.* Routledge.

Migiro, S. O., & Magangi, B. A. (2011). Mixed methods: A review of literature and the future of the new research paradigm. African journal of business

management, 5(10), 3757-3764.

Newman, G. F. (1978). Crime and Punishment. Quercus Publishing. DAC. 2010. Quality Standards for Development Evaluation.

Nhamo, L. (2022, 10, 12). Achieving food security demands that we look at new agricultural pathways. *Daily Maverick*. Achieving secure food systems demands new agricultural pathways (dailymaverick.co.za)

Patton, M. Q. (2008). Utilization-focused evaluation. Sage publications.

Tashakkori, A., & Teddie, C. (2003). *Mixed methods research, alternative approaches and unresolved issues in conceptualization and design of mixed methods. Handbook of mixed methods in social and behavioural research.* Sage.

Technology Innovation Agency (2022). DST Contract Reporting: Annual Report for Agriculture Bioeconomy Partnership Programme. Contract Number: DST/CON 0250/2017.

Wagner, C., & Esbensen, K. H. (2012). A critical review of sampling standards for solid biofuels–Missing contributions from the Theory of Sampling (TOS). Renewable and Sustainable Energy Reviews, 16(1), 504-517.

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