DESIGN AND IMPLEMENTATION EVALUATION OF SECTOR INNOVATION FUND PROGRAMME 2019

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

NACI
NATIONAL ADVISORY COUNCIL ON INNOVATION

innovation
for a better future

This report has been independently prepared by the National Advisory Council on Innovation (NACI). The Evaluation Steering Committee, chaired by NACI Council member, Ms Claire Busetti, comprised the NACI-appointed expert, Dr Mziwandile Madikizela, and the NACI Secretariat (Dr Mlungisi Cele, Dr Petrus Letaba and Ms Rudzani Maila). The Steering Committee oversaw the operation of the evaluation, and commented on and recommended the reports to the Council for approval.

Submitted by:	Submitted to:
Dr Mlungisi Cele	Mr Imraan Patel
Acting Chief Executive Officer	Deputy Director-General: Socio-economic Innovation Partnerships
National Advisory Council on Innovation	Department of Science and Technology
Pretoria	Private Bag X894
0001	Pretoria
South Africa	0001
Tel: +27 12 844 0940	South Africa
Email: Mlungisi.Cele@dst.gov.za	Tel: +27 12 843 6430
	Email: Imraan.Patel@dst.gov.za

A mixed evaluation method was used, comprising the study of documentation (including a literature review), quantitative (the administration of a survey) and qualitative (interviews with key actors) data collection, and international and local benchmarking. In addition, a round table discussion was held to solicit the views of stakeholders.

The following key stakeholders and institutions are acknowledged for their valuable contribution in the evaluation:

- Department of Science and Innovation (DSI)
- Department of Planning, Monitoring and Evaluation (DPME)
- National Research Foundation (NRF)
- The industrial sectors
- Some higher education institutions

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF **ABBREVIATIONS**

ABBREVIATION	DEFINITION
4IR	Fourth Industrial Revolution
AHP	Analytical Hierarchy Process
ARC	Agricultural Research Council
BEE	Black Economic Empowerment
BERD	Business Expenditure on Research and Development
BL-NCE	Business-led Network of Excellence in Canada
BRICS	Brazil, Russia, India, China, South Africa
CoC	Centre of Competence
CONFAP	Science and Technology Secretariats Council
CRI	Citrus Research International
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DPME	Department of Planning, Monitoring and Evaluation
DSI	Department of Science and Innovation
FABI	Forestry and Agricultural Biotechnology Institute
FINEP	Funding Authority for Studies and Projects (Brazil)
FPEF	Fresh Produce Exporters' Forum
FSA	Forestry South Africa
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
HCD	Human Capital Development
ICFR	Institute of Commercial Forestry Research
ICT	Information and Communication Technologies
IDC	Industrial Development Corporation
IIP	Industry Innovation Partnership
IPAP	Industrial Policy Action Plan
IP	Intellectual Property
IPR	Intellectual Property Rights
M&E	Monitoring and Evaluation
MCTI	Ministry of Science, Technology and Innovation
MFFSA	Marine Finfish Farmers of South Africa
MIASA	Marine Industry Association of South Africa

ABBREVIATION	DEFINITION
MINTEK	Council for Mineral Technology
MTEF	Medium-term Expenditure Framework
MTSF	Medium-term Strategic Framework
NACI	National Advisory Council on Innovation
NGP	New Growth Path
NIPMO	National Intellectual Property Management Office
NRF	National Research Foundation
OECD	Organisation for Economic Cooperation and Development
PAMSA	Paper Manufacturers' Association of South Africa
PHI	Post-Harvest Innovation
PMU	Programme Management Unit
R&D	Research and Development
RDI	Research, Development and Innovation
RGP	Regional Growth Plan
SAMMRI	South African Minerals to Metals Research Institute
SASRI	South African Sugarcane Research Institute
SHOK	Strategic Centre for Science, Technology and Innovation
SIF	Sector Innovation Fund
SIG	Symbiosis Institute of Geoinformatics
SMME	Small, Medium and Micro Enterprise
SMRI	Sugar Milling Research Institute
SPII	Support Programme for Industrial Innovation
STI	Science, Technology and Innovation
TEC	Technical Evaluation Committee
The dti	Department of Trade and Industry
THRIP	Technology and Human Resources for Industry Programme
TIA	Technology Innovation Agency
TICP	Technology Innovation Cluster Programme
TRL	Technology Readiness Level
UIC	University-Industry Collaboration
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WEF	World Economic Forum
WINETECH	Wine Industry Network of Expertise and Technology
WRC	Water Research Commission

EXECUTIVE SUMMARY

BACKGROUND

The purpose of this report is to present NACI's evaluation findings of the design and implementation of the Sector Innovation Fund (SIF) programme of the Department of Science and Innovation.

The DSI formed the SIF programme in 2013. It is organised around public-private partnerships. The programme targets specific industrial sectors who are willing to partner with government to support industry-specific research, development and innovation (RDI) needs in a co-funding arrangement.

The main objectives of the SIF programme are to do the following:

- Broadly address the challenges around the economic competitiveness of a particular sector
- Increase the DSI's interaction with the private sector in accordance with the recommendations of the 2012 Ministerial Review Committee's report
- Create an enabling environment for RDI priorities to be driven largely by industry in a co-funding arrangement with government, thus increasing private sector investments in research and development (R&D)
- Use the identified requirements in a sector to stimulate other sectors or create new economic sectors

The main aim of this evaluation study was to undertake a design and implementation assessment of the SIF programme, especially in terms of how well the programme contributed to addressing low business expenditure on research and development (BERD).

Through this initiative, the DSI's intention was to introduce new paradigms and approaches to fostering RDI partnerships with the private sector, as well as building stronger links between industry and the public science system. As stated explicitly in the programme's Concept Note, a vital performance measure for the programme would be the amount of funding the industry sector contributed to the identified RDI programme to match government funding (through the DSI).

Originally, eight industry consortia from various sectors were selected to be part of the SIF programme. These are the Fresh Produce Exporters' Forum (FPEF) in the area of post-harvest innovation, Forestry South Africa (FSA) in the area of forestry research, the South African Minerals to Metals Research Institute (SAMMRI) in the area of minerals to metals, the Marine Industry Association of South Africa (MIASA) in the area of boat building, the Sugar Milling Research Institute (SMRI) in the area of bio-refineries, the Biotechnology Research Initiative of the Paper Manufacturers' Association of South Africa (PAMSA) in the area of paper, Citrus Research International (CRI) in the area of citrus export research, Marine Finfish Farming of South Africa (MFFSA) in the area of aquaculture and the Wine Industry Network of Expertise and Technology (WINETECH) in the area of research in the wine industry.

In this report, for practical reasons, the abbreviated names of these institutions will be used to denote the industry consortia.

About the evaluation

The main aim of this study has been to undertake a design and implementation evaluation of the programme and present findings, lessons learnt and key recommendations.

The evaluation addressed issues related to the programme's theory of change, relevance and evidence of early impact. An international benchmark analysis of the programme with similar programmes was also conducted. This evaluation was conducted through a combination of document analysis, an online quantitative survey and qualitative interviews.

The main findings of the evaluation are summarised below, together with recommendations made. An attempt has been made to structure the summary according to the evaluation questions. The lessons learnt are presented in Section 5 of the main report.

SUMMARY OF THE EVALUATION FINDINGS FOR THE DESIGN OF THE SIF PROGRAMME

The programme's theory of change

A formal theory of change or intervention logic did not exist and was not presented to the evaluation team, but the DSI set up a formal performance monitoring system to monitor progress.

Hence, using the objectives of the SIF programme, DSI's performance indicators and other programme documents, the evaluation team was able to construct a theory of change to reflect the inputs, activities, outputs, outcomes and impact of the programme.

The derived theory of change was then used to determine how well the programme was designed and implemented to achieve its objectives, including improving the competitiveness of the industrial sectors and increasing BERD.

The performance monitoring system lacks indicators for tracking DSI's interaction with industry, and the use of identified requirements in a sector to stimulate other sectors or create new economic sectors. For example, transformation indicators were measured, even though no transformation objective was set out in the SIF programme's concept document. These problems could be attributed to the setting of the upfront objectives, which were broad, not specific and somewhat vague.

Although not originally specified in the programme design, the triple helix model of innovation was adopted to foster interaction between industry, government and academia.

Relevance of the programme

The programme is aligned with government's goals of improving the competitiveness of existing industrial sectors and addressing the decline in private sector financing of R&D. However, it overlaps with existing government innovation funding programmes, such as the instruments of the Technology for Human Resources and Industry Programme (THRIP) and the Technology Innovation Agency (TIA), and does not have a unique value proposition. On the other hand, it can be argued that the programme provides an additional and alternative funding source and complements existing programmes. Its location in the innovation value chain is also unclear compared to existing funding instruments. An important aspect of the programme is its contribution to industry renewal. Industry renewal occurs when traditional sectors that are losing their competitiveness diversify by entering new growth areas and product lines. For example, the sugar industry consortium has embarked on establishing a bio-refinery to produce new chemicals from sugar feedstock. On the other hand, the paper industry consortium's research focuses on new areas such as bio-oil and nanomaterials.

From a private-sector perspective, the industry representatives who were interviewed agreed that the programme is relevant. Since the consortia are led by industry and industry sets the research agenda, the research projects are aligned with industry needs. Participating industrial sectors that might lack research infrastructure were able to gain access to expertise and research capabilities that reside in public research organisations. Through the co-funding arrangement with government, industry benefitted from the additional resources.

SUMMARY OF FINDINGS FOR PROGRAMME IMPLEMENTATION

Selection process of participating industries

The industry consortia were selected through an open competitive process that targeted sectors prioritised in the Industrial Policy Action Plan (IPAP) of the Department of Trade and Industry (the dti).The weightings of the various objectives were derived by aligning the selection criteria with the individual objectives as shown below:

Programme objectives

Objective	Weighting
Broadly address the challenges around the economic competitiveness of a particular sector	50%
Increase the DSI's interaction with the private sector in accordance with the recommendations of the 2012 Ministerial Review Committee's report	15%
Create an enabling environment for RDI priorities to be driven largely by industry in a co-funding arrangement with government, thus increasing private sector investments in R&D	15%
Use the identified requirements in a sector to stimulate other sectors or create new economic sectors	20%
Aim to achieve zero meat production waste to landfill by 2023	Produce building aggregates and construction inputs from rubble and glass

However, the weighting of the various objectives is problematic. For example, the weighting that is assigned to the objective for increasing interaction between DSI and the private sector is the same as the one for increasing private sector R&D expenditure. It appears that the objectives were not prioritised.

The selection process resulted in industrial sectors being chosen that were traditionally well organised at sector level, but that were low technology, supplier dominated and scale intensive. None of the funded sectors fell under the high-technology and medium-high-technology categories. Only the marine (boat building) and minerals to metals sectors were classified as low to medium. The rest were classified as low-technology sectors.

Hence, there was a complete absence of high-technology sectors or growth sectors with high R&D expenditure. This hampered the objective of increasing the private sector's financing of R&D and the stimulation of emerging and new industries.

The criteria used for the selection of participating industries were found to be biased towards the more organised consortia. Mature sectors tend to have well-established sector innovation systems in which there are existing relationships among various actors in the sectoral innovation system. They are more able to articulate sector challenges and needs, as well as the setting of research agendas. Such established consortia will have large firms who are leaders and are already well resourced. In addition, trust and social capital plays an important role in collaborative research consortia.

Implementation challenges

The challenges in implementing the programme include transformation and inclusivity. For example, researchers who are involved in the projects are still mainly white and the participation of females is low. The participation of previously disadvantaged universities is also very low. Another interesting finding was the limited participation of science councils, which traditionally, unlike universities, focus on industry-relevant applied research.

The research projects are also dominated by incremental innovations. Although incremental innovations are important and can have a cumulative effect, a balance is needed by also attracting more ambitious high-technology and riskier projects, which could end up having greater impact when commercialised if successful.

Evidence of early impact

The DSI developed the following set of deliverables and performance indicators to monitor the outputs, outcomes and impact of the SIF programme.

Deliverables	Performance indicators
Human capital and knowledge generation	• Number of high-level research graduates, fully funded or co-funded (master's degree, PhD or other) • Number of interns (research), fully funded or co-funded in R&D for design, manufacturing and product development • Number of students, funded or co-funded, employed within the sector or industry • Number of unemployed graduates (interns) who are now employed as a result of the intervention • Number of publications in accredited journals as a result of the intervention
Contribution to the intellectual property portfolio (patents, prototypes, technology demonstrators, technology packages, etc.)	• Number of knowledge or innovation products developed or co-developed • Number of knowledge or innovation products transferred
Transformation (opportunities for emerging new players)	• Number of technologies transferred to small, medium and micro enterprises (SMMEs), suppliers or emerging players, previously disadvantaged individuals and black economic empowerment (BEE) companies • Number of jobs created (direct and indirect) • Number of jobs supported or saved • Number of beneficiaries who are women and young people
Increase the general level of RDI within the sector	• Increased levels of R&D within the sector (all public R&D institutions, in-house R&D activities) • Number of start-ups and spin-offs generated from RDI projects
Improve the general competitiveness of the sector	• Increase in revenue generated through R&D-based solutions (SMMEs and emerging players, as well as established players –local turnover and foreign export value turnover) • Savings arising from RDI interventions with respect to labour, material or time • Percentage penetration of new markets or new customers (diffusion of RDI intervention) • Percentage of sales revenue from new products or services (RDI intervention)
Evidence of increased private sector investment in RDI	• Percentage of new R&D leveraged from the private sector • Percentage increase in private sector external R&D funding at public research institutions

In general, the beneficiaries of the SIF programme provided very little feedback on their performance against the metrics included under the objectives relating to transformation and improving the general competitiveness of the sector, citing as reasons that it was too early to measure the impact.

The DSI did not specifically measure indicators for the objectives relating to increased private sector investment on R&D, despite it being one of the programme's stated objectives with a 15% weighting.

The third stated objective, increasing DSI's interaction with the private sector, was not measured or monitored.

The DSI's performance indicators did not include any way to measure the fourth objective of stimulating emerging and creating new industries, which was given a hefty 20% weighting.

The programme has a comprehensive set of performance indicators that were integrated during the design stage. Nevertheless, when this evaluation was undertaken, it became apparent that the SIF programme was still at an early stage for measuring impact since most of the research projects were still in progress. Hence, NACI's formative evaluation generally focuses on design, implementation issues and short-term results (outputs). In terms of "outputs", there was evidence of publications and human capital development (HCD) that have been achieved.

As the impact logic model suggests, impacts such as improved competitiveness, stimulating emerging and new industries and increasing private sector R&D expenditure can take years to be realised. A summative evaluation would provide an opportunity to explore longer-term outcomes and impacts.

SUMMARY OF FINDINGS FOR INTERNATIONAL BENCHMARKING

International benchmarking of the SIF with similar programmes

The overall design features and rationale of the SIF are very similar to internationally benchmarked cases from Brazil, Canada, Finland and Sweden. The main goal of these programmes is improving competitiveness through RDI. Despite context-specific differences, judging from their performance indicators, they have a similar intervention logic. They have all adopted the triple helix model of innovation to encourage collaboration and interaction. Human capital development is a common element. Performance management systems are an essential component of programme design.

In implementing their programmes, industrial actors are selected through an open bidding process. However, unlike the SIF programme, they have managed to attract a mix of traditional low-technology, medium-technology and high-technology industries. Although their funding periods differ considerably (between four and 10 years), they all have longer funding cycles compared to the SIF programme's three-year period.

CONCLUSIONS AND RECOMMENDATIONS

The SIF programme seeks to address ambitious and parallel goals, such as improving the competitiveness of key industries in the South African economy and reversing the decline in the financing of R&D by the private sector. These are relevant and valid, especially given the serious current economic situation in the country and the continued decline in competitiveness. However, this evaluation has revealed that, in its current design, it is not realistic for the programme to make a significant contribution in achieving these goals without major changes.

The following are key recommendations that result from this evaluation, which DSI could consider:

SIF programme design

- **Improve the framing of programme objectives and fully align the performance metrics:** The objectives for meeting the programme's overall goals are too broad, vague and non-specific, and did not include any transformation and inclusivity objectives. For example, one of the objectives is to "use the identified requirements in a sector to stimulate other sectors or create new economic sectors". The meaning of this objective is unclear. The DSI should revisit and sharpen the objectives of the programme. A well thought out and more coherent theory of change will be a good starting point.

- **Determine and set a target BERD in South Africa:** One of the goals of the programme is to contribute towards increasing BERD and reverse the recent decline. However, the appropriate level of BERD in South Africa has not been determined.The DSI should commission a study to determine the desired level of BERD that is required in South Africa for the industry to be competitive.

- **The SIF programme should consider setting a minimum contribution amount by the industrial sectors:** The programme should continue to fund consortia that have performed well and are willing to contribute at least 50% to the project costs for mature and well-established industries. For emerging industries or consortia that consist mainly of SMMEs, the contribution should be much lower. Such contribution needs to be audited as the actual contribution can be much lower than the amount pledged by the industry.

- **Set minimum funds for targeted sector innovation projects:** To create a critical mass of funds, the programme should set a minimum amount of funding for a sector, e.g. R20 million per sector.

- **Set efficiency targets:** Benchmarking administrative efficiency and setting targets would be useful to ensure that administrative costs do not consume the bulk of the programme budget. However, other efficiency measures should be included, such as time to grant, as the longer it takes for a product or service idea to be developed and to be ready for market, the greater the chances are of the proposal ideas being overtaken by events or by the competition.

- **Explore a levy-funded Sector Innovation Fund:** As shown in this evaluation, the overall SIF is very small at about R134 million. For example, the Strategic Centre for Science, Technology and Innovation (SHOK) programme in Finland invested €343 (about R4.8 billion) between 2008 and 2012. To increase the private sector financing of R&D, a more radical approach is necessary. The creation of sector funds, such as is in Brazil, is worth considering. Sector funds are instruments that have been successful in supporting R&D through levies and specific taxes (extra-budgetary sectoral funds). The approach has the added benefit of neutralising the effect of other government priorities competing with investments in R&D. In Brazil, sector funds have been credited with contributing towards improving BERD and protecting R&D expenditure from budgetary variations.

- **DSI should consider merging the SIF programme with other relevant programmes:** Since the programme is similar in design to THRIP (both use triple helix approaches), the two programmes could be merged to create a critical mass of funds and avoid duplication of effort and fragmentation. There is an opportunity for such a dialogue by the two departments, DSI and the dti, since THRIP is currently undergoing changes. Alternatively, the programme could be merged with the TIA's technology development funding instruments.

- **Benchmark government's financial support for BERD and innovation against that of the BRICS countries (Brazil, Russia, India, China and South Africa):** The DSI should commission a study to benchmark the level of government funding required to incentivise and support private sector innovation and BERD against BRICS and other emerging economies in order for the South African industry to be competitive.

SIF programme implementation

- **The DSI should consider its selection process and try to attract both traditional and high-technology industrial sectors:** The current selection criteria and weightings according to the objectives need to be revisited. The SIF programme criteria needs to be revised so that the participation of high-technology sectors in the programme is actively encouraged. The causes of the lack of participation of the medium- to high-technology sectors should be investigated.

- **The use of sectoral foresight exercise and technology roadmaps:** Industrial sectors, especially traditional mature sectors that are not research intensive can be locked into existing and outdated technology regimes. As a result, they do not need to renew and adopt new technology trajectories or enter new growth areas. The DSI should consider the introduction of foresight studies and technology roadmaps at national or sectoral level to identify and assist sectors that could benefit from smart solutions of the Fourth Industrial Revolution (4IR).

- **Increase the SIF funding period from three to five years:** A short funding period lends itself to incremental innovation. In order to facilitate disruptive innovation, the quantum of funding may need to be larger, combined with a longer funding term. As the findings of this evaluation show, the majority of the current research projects are incremental in nature.

- **Allocate a percentage of the budget to address inclusivity:** To address inclusivity, a percentage of the budget should be allocated to peripheral or rural regions and universities. The approach to include peripheral regions was adopted in Brazil. The participation of science councils as key actors in the innovation system should be increased to enhance commercialisation.

- **The monitoring and evaluation of early-stage technology development:** The current reporting of progress on research projects provides very little information regarding the maturity of the technology development effort. This makes it difficult to monitor meaningful progress towards reaching technical success. The consortia should consider using the Technology Readiness Level (TRL) tool, which provides more granular and quantitative progress between the scales of 1 to 9. The TRL should be combined with the Market/Commercial Readiness Level to assess the commercial readiness of the development of projects.

- **The introduction of annual reports by the DSI's Programme Management Unit (PMU):** Although the PMU receives quarterly reports, there is no evidence of how this information is used as a monitoring tool. As a result, some of the reports are incomplete and the information is inconsistent. The PMU should produce annual reports based on its quarterly reports by analysing the data in real time to identify problems that are experienced in implementing the programme. The reports should be used to track trends and include what the programme has achieved against certain metrics.
- **Continuous international benchmarking:** The DSI should continuously benchmark the SIF programme with international programmes to revitalise and renew its approach. For example,countries such as Finland and Sweden are experimenting with new models for public-private partnerships in innovation where their existing approaches have not met the desired expectations. Other instruments that are receiving increased attention are smart specialisation methods, which are replacing traditional clusters for improving industrial competitiveness.

1. INTRODUCTION

1.1 EVALUATION CONTEXT

This report presents the findings of the evaluation of the SIF programme of the DSI. The DSI launched SIF programme in 2013, building from the successes of the Post-harvest Innovation (PHI) programme.

The PHI programme was established in October 2007 as a public-private partnership. The private partners were DSI and the Agricultural Research Council (ARC), while the FPEF was the private partner. The ARC managed this programme, but eventually withdrew from the partnership. As a result, the programme management function was transferred to the FPEF.

The initial government contribution to the programme (PHI-1) was R15 million over a three-year period. This programme was renewed in 2011 (PHI-2) and again in 2014 (PHI-3) as part of the SIF programme.

In this programme, priority industrial sectors collaborate with government through a public-private partnership arrangement. The overall aim of the programme is to improve the competitiveness of industry, and to strengthen linkages between the private and academic sectors so that they are positioned to deliver on the R&D challenges that face specific sectors.

The SIF programme was also created to counterbalance a sharp drop in R&D spending by the private sector in recent years. It is envisaged that the SIF will not only result in increased private sector financing of R&D, but will contribute towards enabling South Africa to reach its target of spending at least 1.5% of GDP on R&D from the current level of 0.82%.

The evaluation results and findings are intended to inform the potential renewal process for the programme. An important element of this evaluation is developing a set of forward-looking ideas and making recommendations to the DSI, as well as industrial sectors and innovation policy stakeholders. It has to be mentioned beforehand that the evaluation framework focuses on the level of the SIF initiative as a whole.

It is therefore not intended to evaluate the individual industrial sectors that are supported. Moreover, since it is a formative evaluation, it focuses on programme design and implementation. The evaluation followed the results-oriented method recommended by the DPME. One of the requirements of government's programmes, policies and projects is to improve decision making, accountability and learning.

1.2 BACKGROUND OF THE SECTOR INNOVATION FUND PROGRAMME

In the global economy, competitiveness is important, as firms, industries and nations strive to enhance their competitive positions. If companies want to survive, they should be able to compete well in both the domestic and international markets. Highly competitive nations are able to gain and sustain a higher global market share. Competitive industries can increase incomes to their stakeholders and also contribute to national economic growth. Nations that are competitive are also favourable destinations for skilled personnel and foreign investment.

The World Economic Forum (WEF), which measures the competitiveness of nations, has revealed that South Africa's competitiveness is declining. As indicated in Figure 1.1, the country's ranking on the Global Competitiveness Index (GCI) was 67th out of 140 countries in 2018.

The South African government views industrial innovation as a key driver of international competitiveness, economic growth and improving the quality of life of its citizens. Science, technology and innovation (STI) policies support business innovation, thus enabling economies to improve their long-term productivity and international competitiveness.

Given the crucial and strategic role of R&D in improving competitiveness, South African industry should invest in research and innovation. However, since the economic crisis of 2008, there has been a decline in BERD, as indicated in Figure 2. In order to reverse this trend, government and the private sector have to join hands in partnership to increase investment in RDI.

Against this background and to address these challenges, DSI established the Industry Innovation Partnership (IIP) Fund to enhance industrial competitiveness through RDI. The fund was established under a six-year, R25 billion economic competitiveness support package announced by the Minister of Finance in 2011. The budget allocated for the 2012/13 Medium-term Expenditure Framework (MTEF) period was R9.5 billion, and most of this budget was allocated for manufacturing competitiveness and the enhancement programme (R5.8 billion). The second-largest portion, R2.3 billion, was to be deployed in support of the then proposed new special economic zones. The DSI was allocated R500 million over the 2013/14 MTEF to develop and implement the IIP programme, of which R135 million was budgeted for the SIF programme.

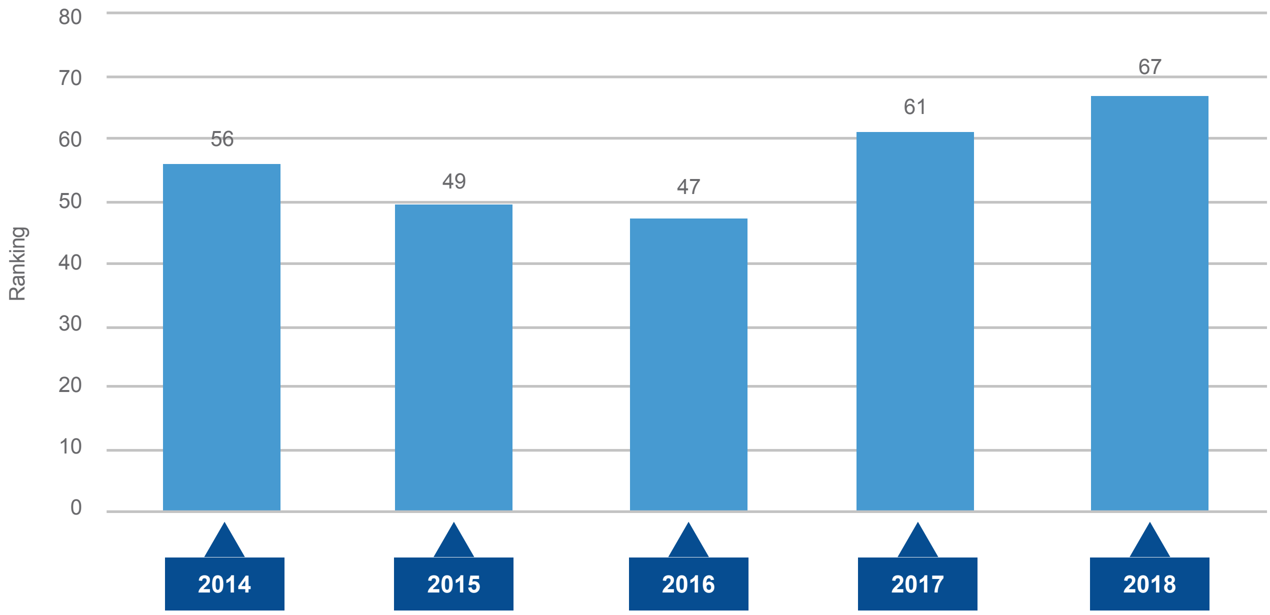

Figure 1.1: Trend in Global Competitiveness Index of South Africa

Source: WEF Reports

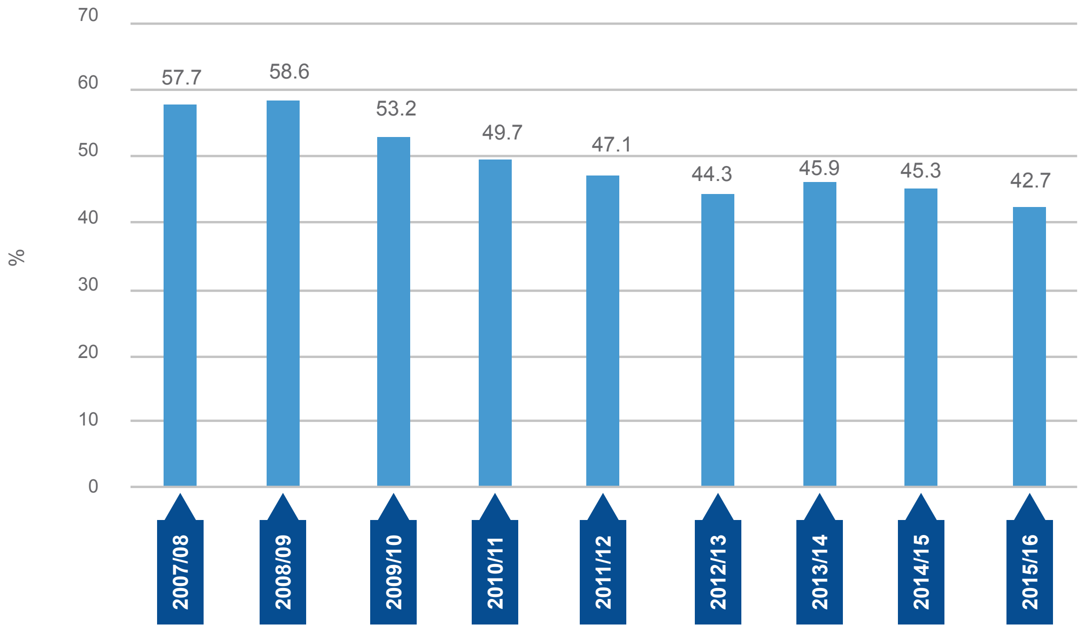

Figure 1.2: Trends in BERD in South Africa

The key goals of the IIP programme are to leverage industry investment in RDI by stimulating increased RDI through public-private partnership arrangements. Participation by industry will mitigate the current under-investment in technology and innovation within identified niche and strategic sectors of the South African economy. It is expected that the key long-term outcomes will be improved economic competitiveness through RDI and increased industrial sector contribution to the gross domestic product (GDP) through stronger RDI-based industrial development.

The sub-programmes that are supported under the IIP programme are the Titanium Centre of Competence (CoC), Satellite Development and Manufacturing, Bio-manufacturing, Nano-upscaling, Bio-refinery and Photonics at the Council for Scientific and Industrial Research (CSIR), ICT Industry Partnerships (CSIR Meraka), the Nanotechnology Innovation Centre and the SIF programme.

The SIF programme has emerged as one of DSI's key programmes. According to a SIF Concept Note, the objectives of the SIF programme are to do the following:

- Broadly address the challenges around the economic competitiveness of a particular sector
- Increase the DSI's interaction with the private sector in accordance with the recommendations of the 2012 Ministerial Review Committee's report
- Create an enabling environment for RDI priorities to be driven largely by industry in a co-funding arrangement with government, thus increasing private sector investments in R&D
- Use the identified requirements in a sector to stimulate other sectors or create new economic sectors

This brief historical context is important to understand the rationale of the SIF programme and its anticipated outcomes and expectations.

1.3 OVERVIEW OF FUNDED SECTORS

During the 2014/15 financial year, eight industry consortia from various sectors were selected for funding through a competitive bidding process. Table 1.1 lists the successful consortia,s ome of which were led by research institutions.

The successful consortia include FPEF, which manages the PHI programme, FSA, SAMMRI, MIASA, MAFFISA, SMRI, PAMSA, CRI and WINETECH.

Table 1.1: List of funded industry associations

Industry association	Abbreviated name	Initiative/programme
South African Minerals to Metals Research Institute	SAMMRI	Mineral processing and beneficiation of minerals
Citrus Research International	CRI	Research on citrus crops
Marine Finfish Farmers Association of South Africa	MAFFSA	Marine aquaculture research for finfish farming
Paper Manufacturing Association of South Africa	PAMSA	Paper manufacturing
Forestry South Africa	FSA	Future plantation forests for the South African bio-economy
Sugar Milling Research Institute	SAMRI	Sugarcane bio-refinery research programme
Fresh Produce Exporters' Forum	FPEP	PHI programme
Marine Industry Association of South Africa	MIASA	Marine manufacturing innovation – boat building
Wine Industry Network of Expertise and Technology	WINETECH	Wine industry innovation

An overview of some basic information on the selected sectors is displayed in Table 1.2.

The industry consortia are very diverse in terms of industrial structure, size, contribution to GDP, employment, stage of maturity and export orientation. The contribution of the industries to the economy differs considerably from large contributors, such as the mining, forestry, paper, sugar, citrus, wine and forestry associations, to associations that represent the emerging and niche sectors, such as the marine aquaculture (finfishing) and marine (boat building) associations. The majority of the sectors are in primary or resource-based industries, such as agriculture, fishing, forestry and mining.

Although the information is incomplete, the funding sources for innovation also differ considerably. Some sectors rely on levies that are collected from exporting companies and industry contributions. The levy is used to fund industry-driven R&D activities and human capital development. Other funding sources are government innovation programmes such as THRIP, and government departments and agencies such as the Department of Agriculture, Forestry and Fisheries (DAFF), the Water Research Commission (WRC) and TIA.

Based on their business plans, the most common challenges of these institutions to competitiveness are cost pressures, limited local demand, shortage of skills and environmental concerns such as climate change. However, the sectors have a wide range of needs, which reflect differences across industries.

The organisation of research, institutional arrangements and interaction with public research organisations differ from sector to sector. For example, the sugar industry has a dedicated research institute that is located at a university.

The citrus and paper industries have their own industry R&D facilities, but these are not located at universities. All the sectors have some collaboration and linkages with universities and science councils.

The participation of two selected consortia in the programme, MIASA and MAFFSA, was discontinued. The participation of MIASA was terminated after the consortium could not meet its co-funding financial obligation. There was also a lack of commitment from the industry. For example, attempts to hold a final third workshop with industry was unsuccessful due to the non-availability of members.

Additional reasons that were advanced by MIASA when terminating the agreement with DSI were as follows:

- The industry has cash flow challenges, which are driven by the order book nature of the business
- Members should take ownership of their own R&D, but they need to internalise enough of their own profits to allocate money to innovation
- Industry challenges are lower down the "hierarchy of needs" than innovation
- Volume is needed to support collaborative efforts, such as the Marine Manufacturing Industry Innovation Fund
- Maturity and sustainability are needed in the sector

The evaluation team could not establish the exact reasons for terminating the participation of the MAFFSA consortium as an interview could not be secured with its representative.

1.4 REPORT STRUCTURE

The remaining sections of this report are structured as follows. Chapter 2 presents the evaluation methodology of the SIF programme. Chapter 3 provides the analysis of findings, and covers design, relevance and implementation issues. Chapter 4 presents the findings of the benchmarking of the SIF with similar international programmes. The lessons learnt are presented in Chapter 5, including the lessons from international benchmarking. Chapter 6 summarises the main conclusion and presents a set of recommendations.

Table 1.2: Summary of supported industrial sectors

	SMRI	MFFSA	SAMMRI	MIASA	PAMSA	CRI	WINETECH	FSA
Industry association structure	30 members	1 SMME 2 corporations 2 multi-national corporations	1 SMME 5 corporations 6 multi-national corporations	76 SMMEs 6 corporations 5 multi-national corporations	2 corporations 4 multi-national corporations	5 companies	693 companies that contribute to R&D levy	21 300 SMMEs 7 corporations 4 multi-national corporations
Turnover of industry	R12 billion	No information	R135 billion	R700 million	No information	R8.5 billion	R26.3 billion	R35.4 billion
Exports	R2 billion	No information	No information	No information	No information	R7.95 billion	No information	No information
Contribution to GDP	0.35%	0.026%	8.8%	No information	0.6%	0.16%	2.2%	1.2%
Employment (direct)	79 000	200	500 000	2 600	150 000	60 000	275 600 direct and indirect	146 300
Employment (indirect)	350 000	No information	No information	3 000	No information	80 000 to 100 000	No information	No information
Industry life cycle	Mature	Emerging in South Africa	Mature	Niche in South Africa	Mature	Mature	Mature	Mature
R&D expenditure	R39 million (South African Sugarcane Research Institute (SASRI))	R6.5 million over a three-year period	No information	R1.2 million	No information	R36 million (2015)	No information	R13 million (FSA) R4 million(DAFF) R6 million private sector contract R&D
Cooperation with public research organisation	University of KwaZulu-Natal, Stellenbosch University	CSIR	Council for Mineral Technology (MINTEK)	Cape Peninsula University of Technology, University of the Western Cape	University of Pretoria, Stellenbosch University, Durban University of Technology, University of KwaZulu-Natal	University of KwaZulu-Natal, ARC, University of Pretoria, WRC, Stellenbosch University, Rhodes University, Nelson Mandela Metropolitan University	ARC, Stellenbosch University	University of KwaZulu-Natal-Institute of Commercial Forestry Research (ICFR) University of Pretoria-Forestry and Agricultural Biotechnology Institute (FABI), pharmaceuticals and personal care products and fast-moving goods, University of the Witwatersrand, Nelson Mandela Metropolitan University, University of Cape Town, CSIR
Funding sources	Industry, TIA	THRIP, DAFF	Industry	No information	THRIP, industry	Levy, THRIP, PHI programme, WRC	Levy, National Agricultural Marketing Council, ARC, THRIP	THRIP, FSA, private sector, DAFF

Source: DSI's SIF Programme Concept Document, 2013

2. EVALUATION METHODOLOGY

This is the first evaluation of the SIF programme since its implementation. The overall evaluation objectives of the programme are the following:

- Identify the SIF programme's theory of change (logic model) or to derive one if it does not exist
- Determine the relevance and overlap of the SIF programme with other private sector innovation grants of government
- Benchmark the SIF programme with other similar local and international programmes in terms of its administration efficiency
- Measure early evidence of the impact of the programme
- Recommend improvements to the programme in terms of its design, implementation or impact

2.1 EVALUATION QUESTIONS AND ISSUES

Based on these evaluation objectives, the evaluation team derived the following guiding questions for evaluation:

Programme design

- What is the programme's logic model or theory of change?
- What are the performance indicators that are used to measure changes?
- Are indicators aligned with programme objectives and are they relevant?
- Which indicators are lacking from the current set of indicators?

Programme relevance

- What is the relevance of the programme in the South African innovation ecosystem?
- How does this funding instrument differ from existing funding programmes? Does it agree overall with them?
- If it differs from existing programmes, how does it complement them?
- Where is it located in the innovation value chain?
- How will the programme improve the R&D financing of the participating industry consortia?
- Do intermediaries play a role in the programme?

Programme implementation

- How are industrial consortia selected?
- What are the characteristics of the programme's funded industries?
- What are the challenges in implementation?
- If there are challenges, what are the causes?
- What does it cost to implement the programme and is it cost effective?
- Are transformation and inclusivity issues taken into account in the implementation of the programme?
- Is there evidence of early impact?

Benchmarking with similar international programmes

- When benchmarked against similar international programmes, how does the programme compare in terms of design and implementation?
- What lessons and best practices can be learnt from the international programmes?

Recommendations

- What are the design and implementation strengths and weaknesses of the programme?
- What are key areas of improvement?
- What are the key recommendations for improving the design and implementation?

2.2 EVALUATION DESIGN

To address these questions, the evaluation methodology (Figure 2.1) comprised the following steps:

Document review

As a starting point, South Africa's competitiveness and innovation performance were examined. This was followed by a document review of reports such as the SIF programme's Concept Note, individual sector documents, such as business plans and quarterly and annual reports, and general literature on clusters, the triple helix model of innovation and industry R&D agenda setting. Documents were reviewed and assessed in terms of their relevance to specific evaluation issues and questions.

Quantitative survey

A web-based survey to all the funded research consortia and researchers, using a census approach, was administered as part of the evaluation. The researchers were defined as individuals involved in projects funded by the consortia either as a lead researcher or as a member of the project research team.

A list of programme managers, stakeholders and researchers of SIF-funded partnerships was compiled from databases that were provided by the SIF's Programme Management Unit (see Table A1 in Appendix A).

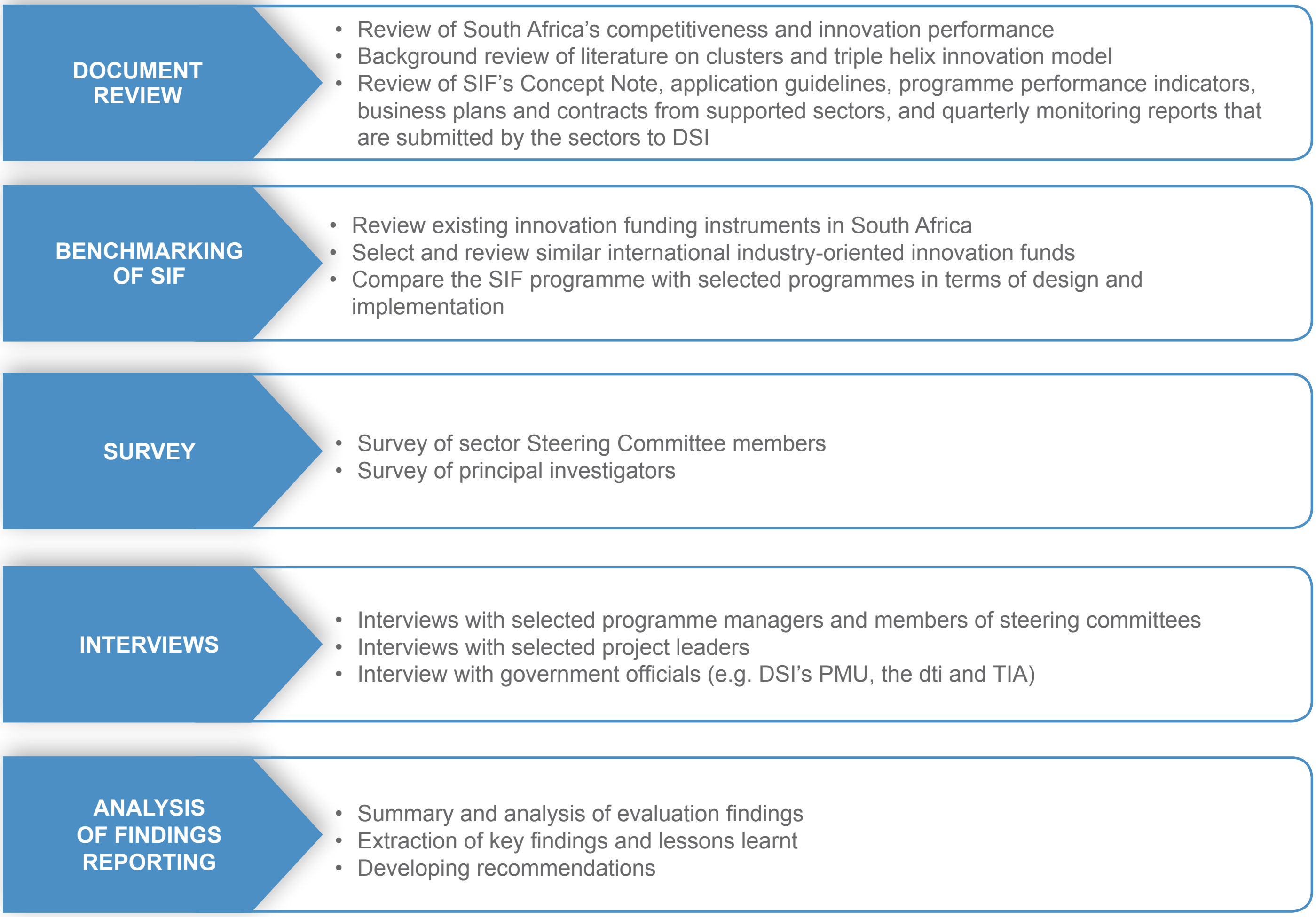

Figure 2.1: SIF programme's evaluation methodology

Response rates of 48.8% and 42.5% were achieved for steering/technical committee members and principal researchers, respectively.

Interviews

A total of 16 individuals from 11 organisations (see Table B1 in Appendix B) were interviewed in person or telephonically. These included programme managers and stakeholders, and project leaders at universities. Interviews were also held with DSI's management,and staff of the SIF's Management Unit.

Benchmarking with similar programmes

A benchmark assessment was undertaken against selected local and international programmes. The benchmark analysis provides information on the rationale and objectives of the programmes, their governance structures, funding cycles and intellectual property regimes.

The international cases that were selected are industry-driven programmes and are sufficiently comparable to be used as benchmarks.

Local innovation funding programmes against which the SIF prgoramme was compared are THRIP and the Support Programme for Industrial Innovation (SPII), as well as TIA's technology development funding programmes.

The following international programmes that are similar to the SIF programme were examined:

- The Vinnvaxt Programme in Sweden
- The Networks Centres of Excellence in Canada
- The Strategic Centre for Science, Technology and Innovation in Finland
- The sector funds in Brazil

2.3 LIMITATIONS

It is recognised that the SIF programme is one of many RDI support programmes in South Africa. Some of its limitations might be addressed through other mechanisms. As an example, the R&D infrastructure challenge at the previously disadvantaged universities can be best addressed through the NRF's Infrastructure Fund. Therefore, the limitation is with regard to a lack of comprehensive evaluation of other innovation support programmes in relation to the SIF programme.

It is important to note that the evaluation exercise suffered from data limitations, especially with regard to information that was supplied in the quarterly reports that the consortia submit to DSI.

The list of quarterly reports that was supplied was incomplete for the period under review. Moreover, although a standard template is used for reporting, the quality and content of the data and information differed considerably.

Some of the consortia submitted comprehensive reports, while in several cases the information was limited. There was also a lack of consistency and some data missing.

The DSI does not conduct or produce its own internal monitoring reports, such as annual reports. Such reports are necessary for external evaluators who do not have time to go through quarterly reports.

Because of the quality of the data and missing information, some of the evaluation objectives, such as measuring the efficiency of the programme, could not be met. The calculation of the contribution of private sector funding to the programme was compromised due to inadequate and incomplete financial information.

Because most of the projects are still in progress, there was also no information or case studies to show evidence of early impact of the SIF intervention. However, the evaluation results show early programme outputs, such as HCD and publications.

Although an attempt was made to include a suitable international benchmark from another developing country, relevant information and reports were not available.

3. EVALUATION RESULTS AND AN ANALYSIS OF THE FINDINGS OF THE SIF PROGRAMME

This section presents the evaluation results and an analysis of the findings. It combines the document review, quantitative survey and qualitative interviews to perform a critical analysis of the design, implementation and relevance of the SIF programme.

The analysis only focuses on key emerging issues, hence a large portion of the reference information (e.g. the literature review) is not included in this section.

The full quantitative survey and qualitative interview results are included in the appendices of this report. The evaluation findings are structured according to the evaluation questions.

3.1 ASSESSMENT OF THE SIF PROGRAMME DESIGN

The section addresses the evaluation of the programme's theory of change, the indicators that are used to measure change and their alignment with the programme's objectives. It also includes some insights that were uncovered by the analysis, such as the innovation model that emerged. The section includes an examination of the relevance of the programme.

3.1.1 Theory of change

One of the objectives of this evaluation is to identify the programme's theory of change or logic model, or to derive one if it does not exist. A theory of change behind a programme describes how and why change will be achieved, and depends on theories and assumptions about how impacts come about.

No explicit, documented programme logic model could be identified, although the SIF programme is clearly being implemented through a certain well-defined intervention logic. The overall logic model for the programme is presented in Figure 3.1 and was derived from the SIF Concept Note, the programme's performance indicators are from the survey and interview information that was collected.

As shown in Figure 3.1, the first component of the derived logic model is the inputs (R&D funding from DSI

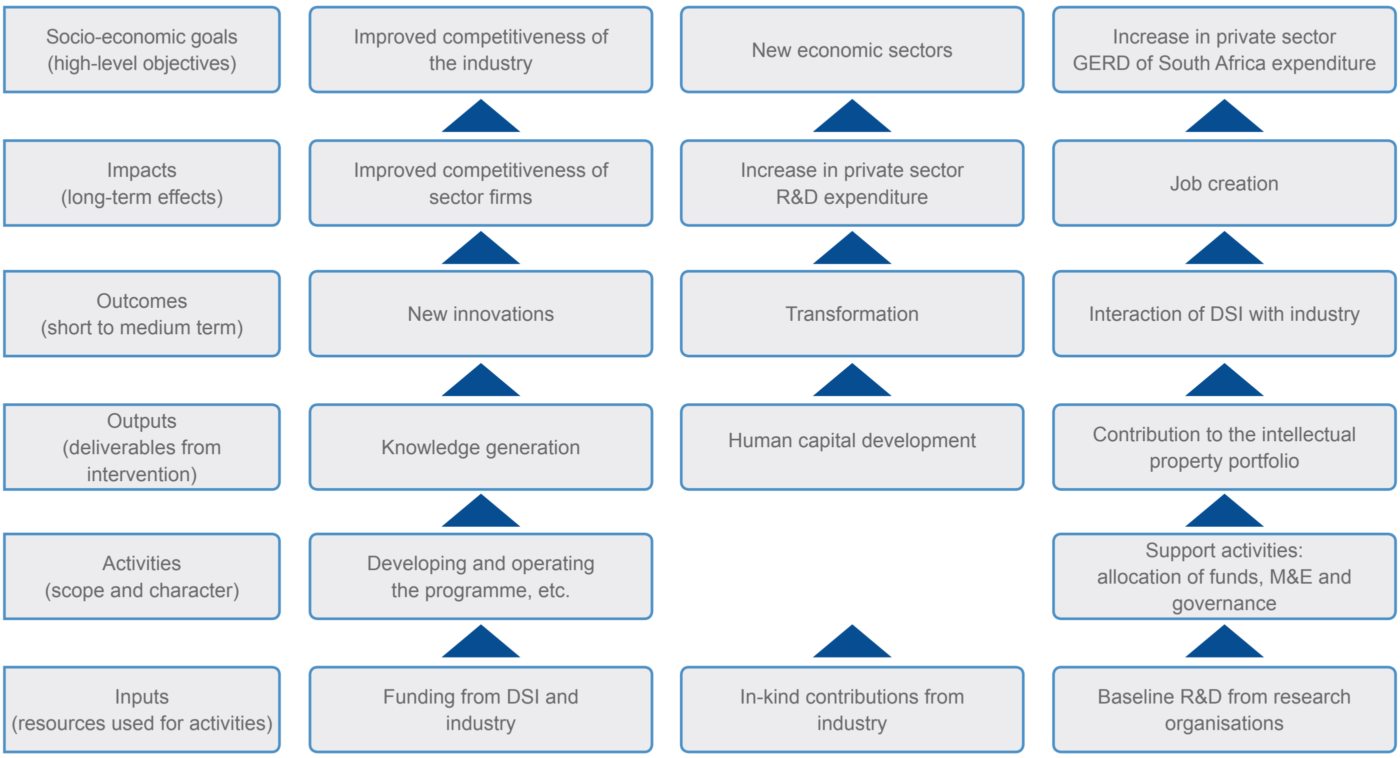

Figure 3.1: Logic model of the SIF programme

and industry associations, in-kind contributions from industry (e.g. R&D and technology infrastructure and human resources) and baseline R&D from universities and science councils).

The programme's activities take place in three spheres: the DSI, industry associations and research-performing organisations. The support activities performed by the DSI and industry associations include the allocation of funds, monitoring and evaluation, as well as governance.

The tangible outputs (deliverables) of the SIF programme are knowledge generation, HCD and increased R&D collaboration (universities, science councils and industry). The outcomes of these outputs are new innovations, as well as increased R&D within the sector. The long-term impact is the improved competitiveness of the sectors and an increase in private sector R&D expenditure.

Through this intervention logic model, the DSI is able to increase the private sector's investment in R&D, and the industrial sectors are able to improve their competitiveness.

The intervention logic was further elaborated on and supported by findings from the survey. In a survey of sector programme managers and Steering Committee members, 57.7% of the respondents indicated that the challenges addressed by the SIF programme relate to a lack of human capital (Figure 3.2), which has a great influence on the competitiveness of the industrial sectors. This is followed by a lack of cooperation among government, business and the research institutions (53.8%), a low business RDI investment (50.0%) and a lack of long-term innovation planning within the sector (42.3%).

Human capital development on the DSI's quarterly reporting template includes targets such as a number of high-level (master's degree or PhD) research graduates, fully funded or co-funded, and number of interns, fully funded or co-funded, in R&D design, manufacturing and product development.

This information was supported through the qualitative interviews, although one respondent from industry warned that human capital development does not necessarily mean students alone. It can also refer to skills development that can lead to industrial competitiveness. An official from DSI indicated that there was a strong need for cooperation between government and industry as, in some instances, some industries were approaching DSI for cooperation opportunities.

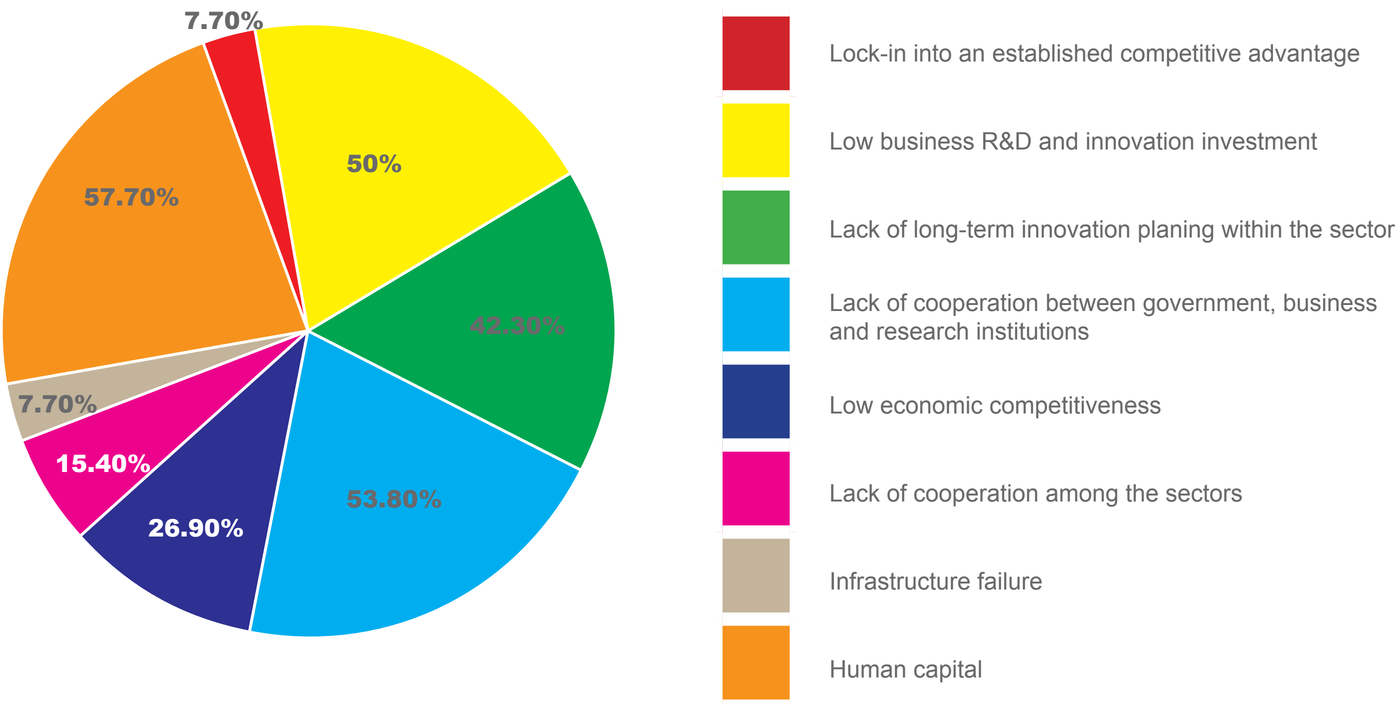

Figure 3.2: Industry challenges addressed by the SIF programme

3.1.2 Performance indicators

The theory of change that is depicted and described in the previous section should be used to construct appropriate indicators to measure intended changes in the form of outputs, outcomes and the impact of the programme. Relevant and appropriate indicators during and after the programme's life cycle should provide sufficient data to identify and assess immediate and short-term impacts. It should also provide some evidence of future long-term impacts. In this section, the assessment of the indicators that are used to measure progress is discussed.

The DSI developed a set of indicators to monitor progress regarding the implementation of the SIF-funded projects through the SIF portal https://www.dstsifportal.co.za/.

As indicated in Table 3.1, the overall deliverables are categorised as HCD and knowledge generation, contribution to the intellectual property portfolio, transformation, increasing the general level of RDI within the sector, an improvement of the general competitiveness of the sector, and evidence of increased private sector investment on RDI.

The specific performance indicators are listed in Table 3.1. These indicators broadly cover inputs (R&D spending), activities (sector-operated SIF operations), outputs (knowledge generation, new innovations, HCD and R&D collaboration), outcomes (increase of sector R&D and innovation, as well as knowledge and technology transfer to the designated groups) and impacts (improved competitiveness of the industries, employment creation, as well as transformation and inclusivity).

Some of the respondents of the industry association interviews indicated their frustration with the choice of the SIF programme's success indicators. These include a concern that SIF indicators are more relevant to the dti, e.g. transformation,technology transfer, jobs created, the number of the start-ups created, etc. One of the respondents alluded to the fact that a short funding period of three years makes it difficult to quantify the impact.

"It is difficult to quantify the impact from the short-term funding."

Table 3.1: Deliverables and performance indicators for the SIF programme

Deliverables	Performance indicators
Human capital and knowledge generation	• Number of high-level research graduates, fully funded or co-funded (master's degree, PhD or other) • Number of interns (research), fully funded or co-funded, in R&D for design, manufacturing and product development • Number of students, funded or co-funded, employed within the sector or industry • Number of unemployed graduates (interns) who are now employed as a result of the intervention • Number of publications in accredited journals as a result of the intervention
Contribution to the intellectual property portfolio (patents, prototypes, technology demonstrators, technology packages, etc.)	• Number of knowledge or innovation products developed or co-developed • Number of knowledge or innovation products transferred
Transformation (opportunities for emerging new players)	• Number of technologies transferred to SMMEs, suppliers or emerging players, previously disadvantaged individuals and BEE companies • Number of jobs created (direct and indirect) • Number of jobs supported or saved • Number of beneficiaries who are women and young people
Increasing the general level of RDI within the sector	• Increased levels of R&D within the sector (all public R&D institutions, in-house R&D activities) • Number of start-ups or spin-offs generated from RDI projects
Improving the general competitiveness of the sector	• Increase in revenue generated through R&D-based solutions (SMMEs and emerging players, as well as established players – local turnover and foreign export value turnover) • Savings arising from RDI interventions, with respect to labour, material or time • Percentage penetration of new markets or new customers (diffusion of RDI intervention) • Percentage of sales revenue from new products or services (RDI intervention)
Evidence of increased private sector investment in RDI	• Percentage of new R&D leveraged from the private sector • Percentage increase in private sector external R&D funding at public research institutions

A short funding period makes it difficult for the industry to make long-term commitments (e.g. commitment to new R&D capacity) and it skews SIF programme investments to more incremental innovations, as opposed to radical innovations. Indeed, as reflected by one of the respondents:

"Showing the improved competitiveness within a quarter is normally impossible."

3.1.3 Assessment of indicators against programme objectives

To evaluate the alignment of the indicators against the programme objectives, the existing indicators were categorised according to the programme's objectives (see Table 3.2). The aim of this exercise was also to reveal if there are any missing performance indicators.

Table 3.2: Assessment of alignment of SIF's performance metrics with its objectives

Objective	Deliverable	Metrics
Broadly address the challenges around the economic competitiveness of a particular sector	• Increased general competitiveness in the sector	• Increase in revenue generated through R&D-based solutions (SMMEs and emerging players, as well as established layers – local turnover and foreign export value turnover) • Savings arising from RDI interventions with respect to labour, material or time • Percentage penetration of new markets or new customers (diffusion of RDI intervention) • Percentage of sales revenue from new products or services (RDI intervention)
	• Contribution to the intellectual property portfolio (patents, prototypes, technology demonstrators, technology packages, etc.)	• Number of knowledge or innovation products developed or co-developed • Number of knowledge or innovation products transferred
Increase the DSI's interaction with the private sector		
Create an enabling environment for R&D and innovation priorities to be driven largely by industry in a co-funding arrangement with the government, thus increasing private sector investments in R&D	• Increased general level of RDI within the sector	• Percentage of new R&D funding leveraged from the private sector • Percentage increase in private sector external R&D funding at public sector research institutions • Percentage increase in in-house R&D budgets within private sector companies
Use the identified requirements in a sector to stimulate other sectors or create new economic sectors		

The table shows that the objective of broadly addressing the challenges around the economic competitiveness of a particular sector has performance indicators for monitoring change. Furthermore, the overall objective of increasing private sector investments in R&D has appropriate metrics to measure progress. On the other hand, two objectives lack appropriate indicators. For example, it is not clear how the interaction between DSI and the private sector will be measured. This will make it difficult to measure whether the objectives have been met.

This is an interaction failure and will require indicators such as network analysis. Similarly, there are no indicators for measuring the stimulation of other sectors or the creation of new economic sectors.

Another interesting observation is that, although the programme logic contains indicators for measuring transformation (opportunities for emerging new players), there is no specific objective for this deliverable.

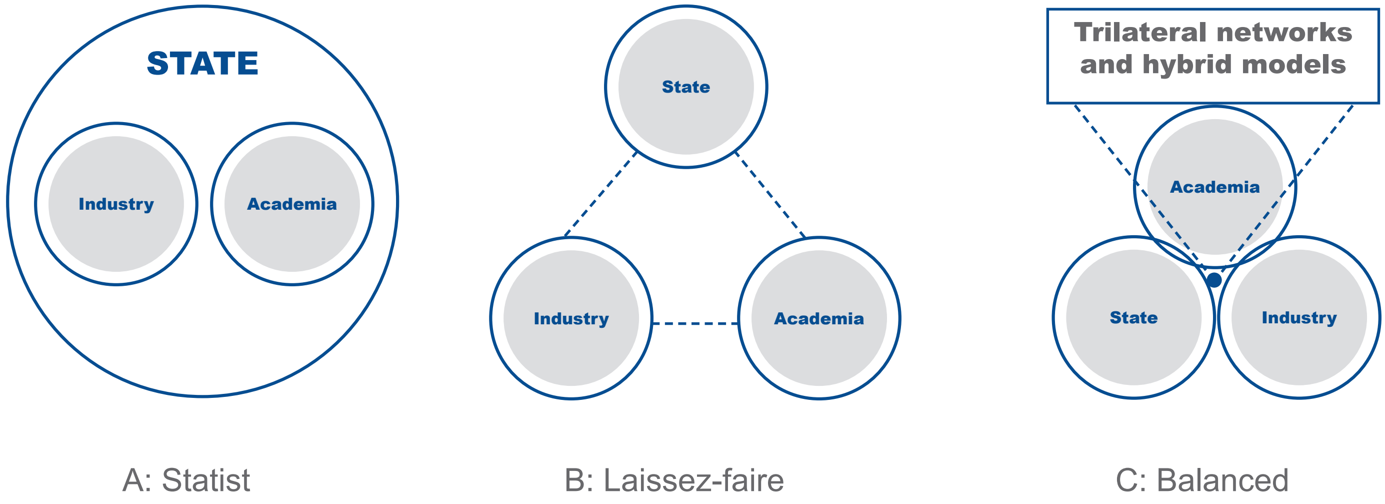

Figure 3.3: Configurations of triple helix models[1]

3.1.4 Emergence of the SIF programme as a triple helix model

A key finding and insight that emerged as a result of the evaluation was the emergence of the SIF programme as a triple helix model of innovation. From interaction with DSI officials and various official programme documents, it is evident that the SIF programme was originally designed as a partnership between the DSI and industry. The SIF Concept Note states that the programme seeks to build stronger links between industries. A standard contract between the DSI and the consortia is not explicit about higher education and public research institutions being active participants in the programme. However, this evaluation has discovered that the SIF programme is being implemented as an industry-led triple helix model, also called a "laissez-faire model" (B in Figure 3.3).

In the "laissez-faire"configuration, the three institutional spheres operate separately from one another with minimal interaction. The interactions are more likely contractual or transactional in nature and are modest across strong institutional boundaries. The state does not interfere in the economy, and industry is the driving force behind economic system development.

The advantage of this model is that industry will be able to grow without any undue interventions by government. The other actors play a supporting and ancillary role, with academia focused on basic and applied research, and providing skilled human resources. Government is mainly a regulator of social and economic mechanisms, and is limited to solving the problems of the so-called "market failures".

This is true for the SIF programme, where government is mainly concerned about industrial competitiveness and an increase in R&D expenditure in the private sector. The individual sectors sign separate contracts with the universities and other research entities for access to knowledge, technology and human capital.

To summarise, the SIF programme does not have an explicit theory of change, so the evaluation team derived one. Despite the absence of an explicit theory of change, the PMU formulated a set of performance indicators to monitor programme changes. As discussed in this section, two of the four programme objectives lack performance indicators. Another finding was that, while transformation is one of the key expected deliverables of the programme, there are no specific objectives. A key observation that emerged is that the programme has adopted the triple helix model of innovation, which enhances interaction between government, industry and the academic sector.

3.1.5 Relevance of the SIF programme as part of the innovation ecosystem

Comparison with other STI support programmes in South Africa

To be relevant, innovation programmes should address a problem or weakness in the innovation system that existing programmes do not address or address inadequately. The purpose of this sub-section is to compare the SIF programme with other dedicated government innovation funding programmes in South Africa.

[1] Ranga, M. and Etzkowitz, H. (2013). Triple helix systems: An analytical framework for innovation policy and practice in the knowledge society. *Industry and Higher Education*, August, 27(4), Special Issue.

This comparative analysis is meant to present high-level similarities and differences with the SPII, THRIP and funding instruments such as the Seed, Technology Development and Pre-commercialisation programmes of the TIA. The comparison will also examine if the SIF programme complements these programmes as part of a policy and instrument mix.

Table 3.3 provides a comparative analysis of the selected innovation funding programmes in South Africa. The key dimensions that are considered in this analysis are the location of operations, governance structures, the programme's objectives, operational model, supported sectors, innovation value chain focus, as well as funding decision criteria, models, beneficiaries, amounts and periods.

Overall, the strategic goals of the four instruments are similar in respect of key elements such as industry competitiveness, partnerships between industry and academia, co-funding and HRD. Unlike the administrators of the other funds, the TIA is governed by a Board of Directors that reports to the Minister. The SIF programme is managed by industry consortia with representatives from government and participating universities.

The funding regimes of all the programmes are primarily cost-sharing, non-payable grants. However, TIA occasionally provides loans and expects returns in the form of royalties for successfully commercialised innovations. For THRIP and SPII, the funding ratios are prescriptive, based on predetermined criteria, such as size of the company or BEE status. The funding period for THRIP and the SIF programme is three years,while TIA can support a project for up to five years. As the data in Table 3.3 shows, unlike the other programmes, TIA funds projects from selected sectors, such as information and communication technologies (ICT), natural resources, energy bio-industries, health, agriculture and advanced manufacturing.

To cater for different target beneficiaries, the SPII, THRIP and TIA's programmes have devised different funding schemes (e.g. process product development, seed funding, etc.). On the other hand, the SIF programme does not have such alternatives, and is a one-size-fits all kind of programme.

Table 3.3: Comparative analysis of the SIF, SPII, THRIP and TIA's funding programmes

	SIF	SPII	THRIP	TIA programmes
Managing agency (operations)	Industry consortia	The dti	The dti	TIA
Governance structure	The DSI provides funding and oversight. Steering committees provide strategic direction, decision making, and monitoring and evaluation (M&E)	The dti provides funding, the SPII's programme management and Secretariat, M&E, and reporting	The dti provides funding, the THRIP programme management and Secretariat, and M&E	The DSI provides funding to the TIA Board and the Executive Committee provides policy and strategic direction, approves funding proposals, and performs M&E
Strategic goal/ objectives	Support global competitiveness through technology development and innovation	Promote technology development and the commercialisation of viable innovative products and processes	Support and promote research on technologies to develop the competitiveness of South African industry research that develops skilled human resources for industry	Stimulate and intensify technological innovation in order to improve economic growth and the quality of life of all South Africans by developing and exploiting technological innovations
Operational model	Increase industry, academic and government partnerships	Operations are managed by the dti	Operations are managed by the dti	Operations are managed within the TIA
Supported sectors	Operations are managed by industry consortia on behalf of the DSI, including the day-to-day administration of the programme	Preference on IPAP priority sectors	IPAP priority sectors	Advanced manufacturing, agriculture, energy, health, ICT and natural resources

	SIF	SPII	THRIP	TIA programmes
Project review/ due diligence	The PMU appoints an independent panel of experts based on research project themes. The panel reviews and makes recommendations to the PMU for approval.	External consultants conduct due diligence and make recommendations, which are approved by the SPII's evaluation panel (with representation from the Industrial Development Corporation (IDC), the dti and invited experts).		Initial internal review by the TIA Assessment Committee, chaired by the Group Executive. Detailed review by TIA's assessment team, which makes recommendations to TIA's Executive Committee or Board in the case of large projects.
Funding regime	Co-investment by industry players No prescribed ratios, but the 80/20 principle currently applies.	Grants are provided on a cost-sharing basis, ranging between 50 and 85%.		Funding grants or loans are based on matching ratios, loan funding and royalties
Beneficiaries/ target market	Industry associations	Individual SMMEs and large companies		Individuals, private sector companies, including SMMEs, and large corporations
Funding period and maximum amount	Three years	Pharmaceutical product development: up to R2 million. Matching scheme: up to R3 million.	Up to three years. Up to R8 million per annum.	Can be up to five years. Maximum amount: • Seed funding: R500 000 • Technology development and pre-commercialisation: R15 million
RDI value chain focus	Applied research and development	Proof of concept to pre-production prototype stage		Development and pre-commercialisation

The following main conclusions can be made regarding the alignment of the SIF programme in relation to other STI support programmes:

- The SIF programme differs substantially from the SPII for the following reasons:
  - The SPII does not support industry consortia; it only supports individual companies.
  - The SPII does not support applied research, and only funds projects after proof of concept has been achieved.

- The SIF programme differs from THRIP based on the following:
  - THRIP provides financial support to both individual companies and industry consortia.
  - THRIP has prescriptive funding criteria that are based on the size of the company in order to accommodate SMMEs. On the other hand, the SIF programme does not have separate funding schemes for SMMEs. The SMMEs are expected to be part of industry consortia.

- The SIF programme differs from the TIA's technology funding schemes based on the following:
  - TIA primarily funds individual companies, although recently it has supported consortia with its new programmes that have adopted the cluster approach.
  - As an innovation agency, TIA manages the projects, whereas, in the case of the SIF programme, the industry association plays a key role in project management.

- Similarities between the SIF programme and THRIP:
  - They have both adopted the triple helix model of innovation.
  - Participating sectors are selected from priority sectors based on the IPAP

- Similarities between the SIF programme and TIA's technology programmes:
  - Both TIA's Technology Innovation Cluster Programme (TICP) and the SIF programme aim to catalyse collaborations among the innovation value chain players in a particular industry

Location within the innovation value chain

Figure 3.5 illustrates the positioning of various programmes in the innovation value chain. It must be noted that both THRIP and SPII have undergone substantial changes recently in terms of design, implementation and governance. TIA also continues to undergo changes to improve existing and introduce new funding instruments.

As a result of these continuous changes and evolution, the exact positioning in the innovation value chain and the role of the programmes is debatable.

Nevertheless, Figure 3.5 attempts to locate the programmes in the innovation value chain based on our existing knowledge and interpretation.

As indicated in Figure 3.4, both the SIF programme and THRIP mainly support business-led applied research.

The similarity between these two programmes was discussed extensively by the participants in the evaluation consultative workshop on 30 November 2018. The stakeholders expressed their concern with regard to a lack of value proposition for the SIF programme, which is different to THRIP.

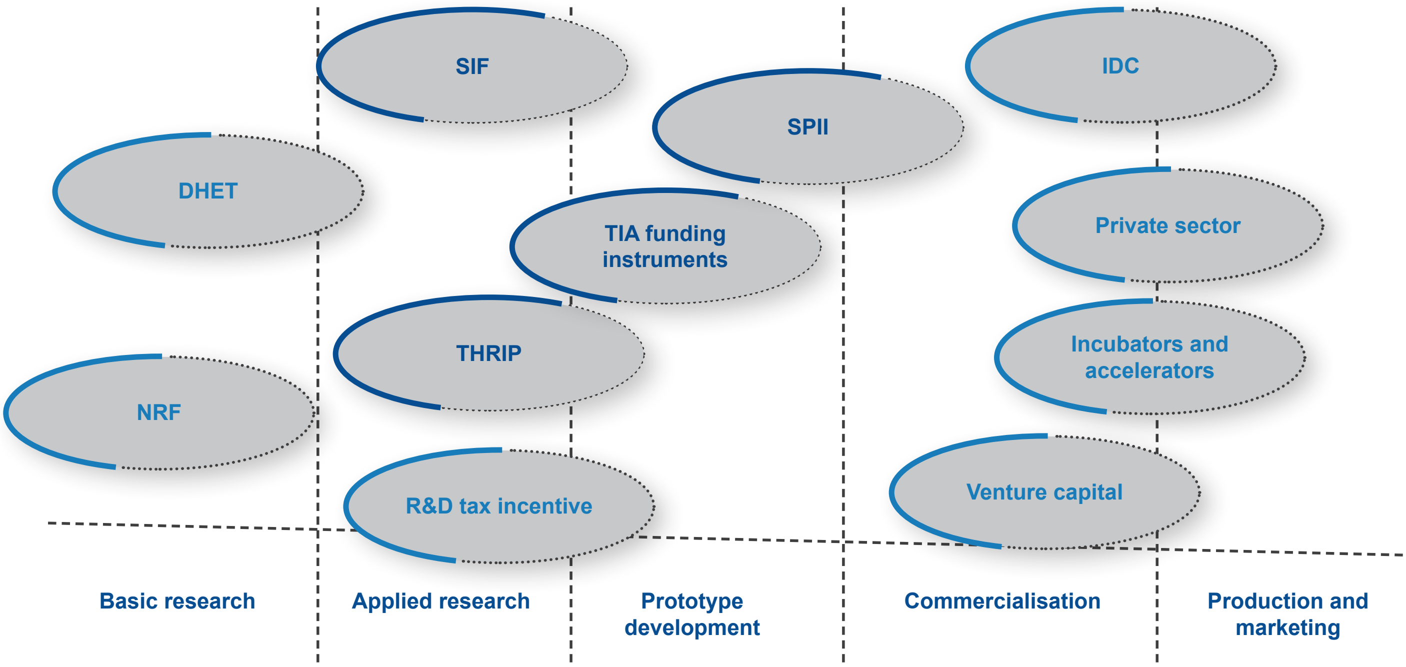

Figure 3.4: Location of innovation funding programmes in the innovation value chain

Another point of concern during this workshop is how the location of the SIF programme within the innovation value chain can lead to the competitiveness of the industrial sectors, especially if technologies and innovations are not taken up. However, it should be noted that industry will invest its money where there is a return on investment, although a lack of verification of industry co-funding might defeat the purpose.

Contribution to BERD

The main findings of the SIF programme evaluation is that the programme remains relevant within the South African innovation ecosystem. This assertion is driven by the observations that BERD, as a proportion of gross domestic expenditure on R&D (GERD), remains low, and the competitiveness challenge remains an issue within several key industries, as articulated by IPAP 2018.

The IPAP 2018 makes strong reference to research, development and innovation as key drivers of industrial competitiveness. For example, one of the SIF programme's supported consortia is within the minerals and metals sector. The IPAP recognises the need to ensure that South Africa's domestic steel production is globally competitive and supports an increasingly global, competitive, value-adding, technology-intensive downstream sector. Furthermore, IPAP recognises that the key drivers of the country's competitiveness is in the beneficiation of any product related to technology mastery, skills and investment in plant and enabling infrastructures. The SAMMRI's model is meant to ensure a wider pool of students and research academics in the minerals and metals sector.

The SIF programme attracted applications from consortia and companies from a range of key industries and sectors, such as the platinum, automotive, energy, boat building, clothing and textile, agro-processing, agriculture, and forestry and fisheries sectors. Applications from some of these industries and sectors were not successful for reasons beyond the control of the SIF programme. For example, MIASA's SIF-supported innovation programme was aimed at developing and supporting research and new innovative technologies in the boat building and marine sector in order to maintain and strengthen the global competitiveness of the industry. The marine sector is an important part of the ocean economy, a prioritised Operation Phakisa focus area.

In terms of the country's objective of increasing R&D expenditure in the private sector, the SIF programme is a useful and relevant programme considering the continued decline of BERD as a proportion of GERD (see Figure 3.5).

The SIF programme is a direct competitive funding instrument, which stimulates the industrial sectors to spend more on R&D, technology and innovation. Considering that much of the country's R&D expenditure is shifting towards the higher education sector, through the SIF programme, the business sector is able to access much-needed applied research from university experts.

As shown in Table 3.4, the SIF programme is a relatively small programme, and contributes about 8% of government's funding of BERD (shown in column 1). The SIF disbursements from DSI to the sectors were R10.0 million, R16.1 million, R44.3 million, R37.0 million and R11.6 million in 2013/14, 2014/15, 2015/16, 2016/17 and 2017/18 respectively.

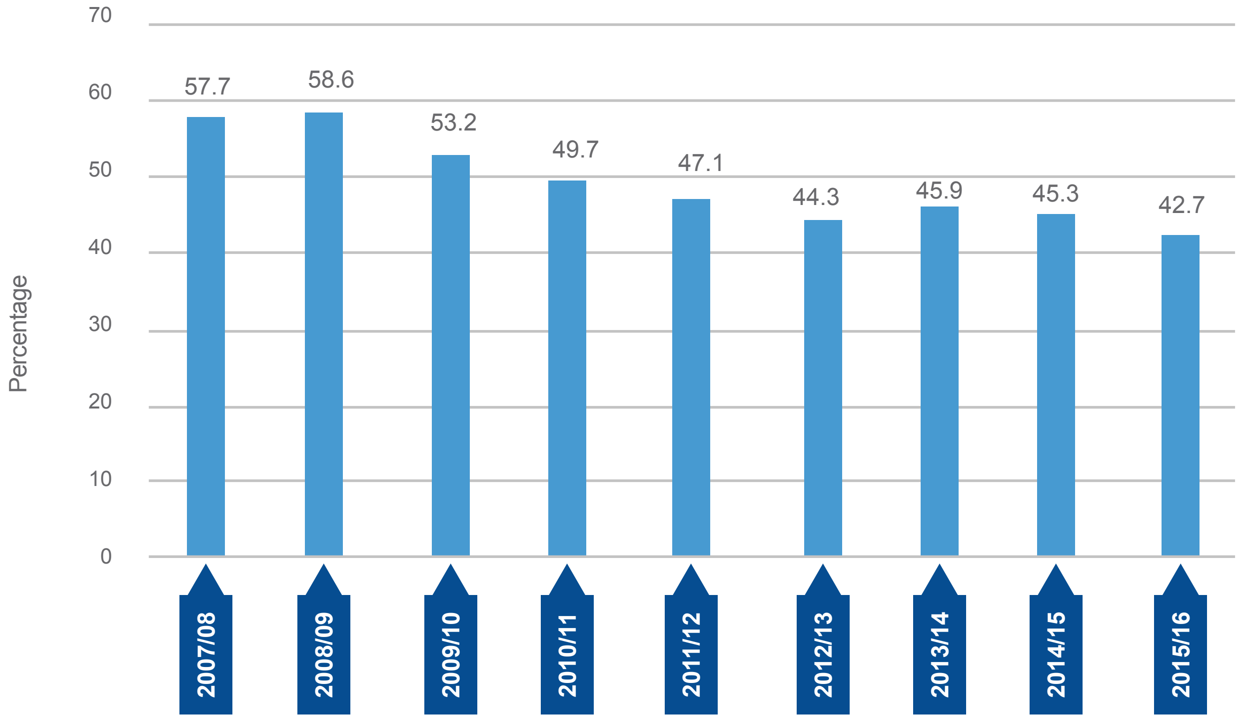

Figure 3.5: Trend of BERD as a proportion of GERD

Table 3.4: The SIF programme's contribution to business expenditure on R&D

	SIF disbursements and government funding of BERD)	SIF industry co-funding and business funding of BERD	SIF funding/ BERD
2013/14	1.5%	0.00%	0.08%
2014/15	2.3%	0.04%	0.35%
2015/16	8.5%	0.14%	0.60%
2016/17	8.2%	0.37%	0.33%

One of the objectives of the SIF programme is to increase R&D expenditure in the business sector. It emerged during interviews with government officials that this increase in R&D expenditure is measured through the industry co-funding of R&D projects. As shown in the second colomn of Table 3.4, these co-funding values are very low as percentage of BERD (0.37% in 2016/17), as is also the case for total SIF funding as a percentage of BERD (0.60% in 2015/16) (shown in the third column of Table 3.4). The financial contribution of the sectors is poorly monitored and is not reported well in the quarterly monitoring reports. This is, however, stated as a vital performance measure for the programme in the SIF Concept Note.

As shown in Table 3.5, the level of contribution of the private sector differs from sector to sector, and averages at 38% (~1:3) from 2013/14 to 2017/18. To our knowledge, there is no policy with regard to the minimum amount that the sector should contribute.

According to the application form for funding, applying consortia are asked what percentage of funding they are able to commit to the envisaged programme over the next funding period. It is also possible that some sectors will still contribute funding since the projects are still incomplete.

Table 3.5: Percentage of R&D expenditure contribution of sectors to the SIF programme

	CRI	FSA	PAMSA	PHI/FPEF	SAMMRI	SMRI	WINETECH	MIASA	MFFASA	All
2013/14	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
2014/15	0	N/A	0	34	0	50	38	0	0	23
2015/16	12	27	0	26	30	41	29	N/A	0	26
2016/17	9	60	30	6	16	88	33	0	0	55
2017/18	0	100	100	N/A	12	26	N/A	N/A	0	39
Total	**7**	**38**	**27**	**20**	**17**	**72**	**32**	**0**	**0**	**38**

To summarise, the design of the SIF programme is very similar to THRIP and some of the TIA's technology development instruments. It is, however, very different to the SPII. As one of the participants in the roundtable discussion that was arranged to discuss the preliminary evaluation of the SIF programme mentioned:

"The SIF does not have a value proposition to differentiate itself especially from THRIP."

However, the programme is relevant because it addresses issues such as the decline of BERD and seeks to incentivise the private sector. As the data that is presented in the tables in this section shows, the overall current level of contribution to BERD is too small to make an impact.

3.2 ASSESSMENT OF SIF PROGRAMME IMPLEMENTATION

The evaluation results that are presented in this section address the implementation and management of the programme. The evaluation questions that this section seeks to address include the selection of participating sectors, their characteristics and the nature of projects that are supported. The challenges that the programme faces and governance structures are also examined.

3.2.1 Selection of participating sectors

Appraisal of the selection criteria

The Concept Note of the SIF programme and its applications guideline outline some key factors that were considered for the selection of the participating industries.

The first requirement is the need for the industry association to be a registered legal entity. As mentioned by the DSI official, an internal audit was used to verify this, as well as that of the sector's governance readiness.

Secondly, the applicants had to meet the eight evaluation criteria (see Figure 3.6) and demonstrate that they represented the broad needs of the stakeholders in their sector. During a pre-screening, some individual applicants that did not represent the interests of the sector or sub-sector were rejected outright.

Thirdly, there was a preference for existing consortia that were previously funded by DSI before the SIF programme was initiated (e.g. PHI/FPEP and SAMMRI), and potential new entrants were encouraged to join these initiatives.

Fourthly, the industry association had to show its ability to determine the needs for the RDI interventions that were required to enhance the sector's competitiveness.

Lastly, it was recognised that some sectors might not be able to fully identify the RDI priorities. In such instances, provision was made to fund the initial activities, which could include studies to identify needs, a workshop between industry and the research institutes, technological benchmarking, an evaluation of international trends and development, the identification of gaps and opportunities, and the identification of the RDI agenda and priorities.

A review panel, chaired by the DSI, included members from line departments such as DSI, the dti and the Department of Economic Development. The decision-making process combined a mathematical approach, the analytical hierarchy process (AHP), as well as cognitive and mental processes. The SIF programme evaluation's AHP model shown in Figure 3.6 has eight criteria that are weighted differently. For the purpose of this evaluation, it is important to analyse whether the criteria and weights selected are useful to achieve the objectives of the SIF programme.

The criteria that are associated with the first SIF programme objective of broadly addressing the challenges around the economic competitiveness of a particular sector are Criterion 1 (good articulation of sector challenges and needs), Criterion 3 (good articulation of the sector's S&T innovation agenda to address the identified needs and challenges) and Criterion 4 (realistic, effective and outcome-oriented operational model). These three criteria have a combined weight of 50%, which signifies the relative importance of the first objective.

The second SIF programme objective of increasing the DSI's interaction with the private sector is associated with Criterion 2 (the alignment to the economic development priorities) and Criterion 5 (promoting DSI's outcomes, such as HCD, SMME support and job creation). The programme's second objective has a combined weighting of 15%. The third objective (increasing private sector investments in R&D) is achieved through Criterion 6 (level of or opportunities for R&D co-funding). This has a weight of 15%. The fourth objective (usage of the identified requirements in a sector to stimulate other sectors or create new economic sectors) is realised through Criterion 7 (opportunities for partnerships) and Criterion 8 (representivity of industries and companies within a sector). This objective has a combined weight of 20%.

It is not clear if the weightings of these four SIF programme objectives were designed purposefully or

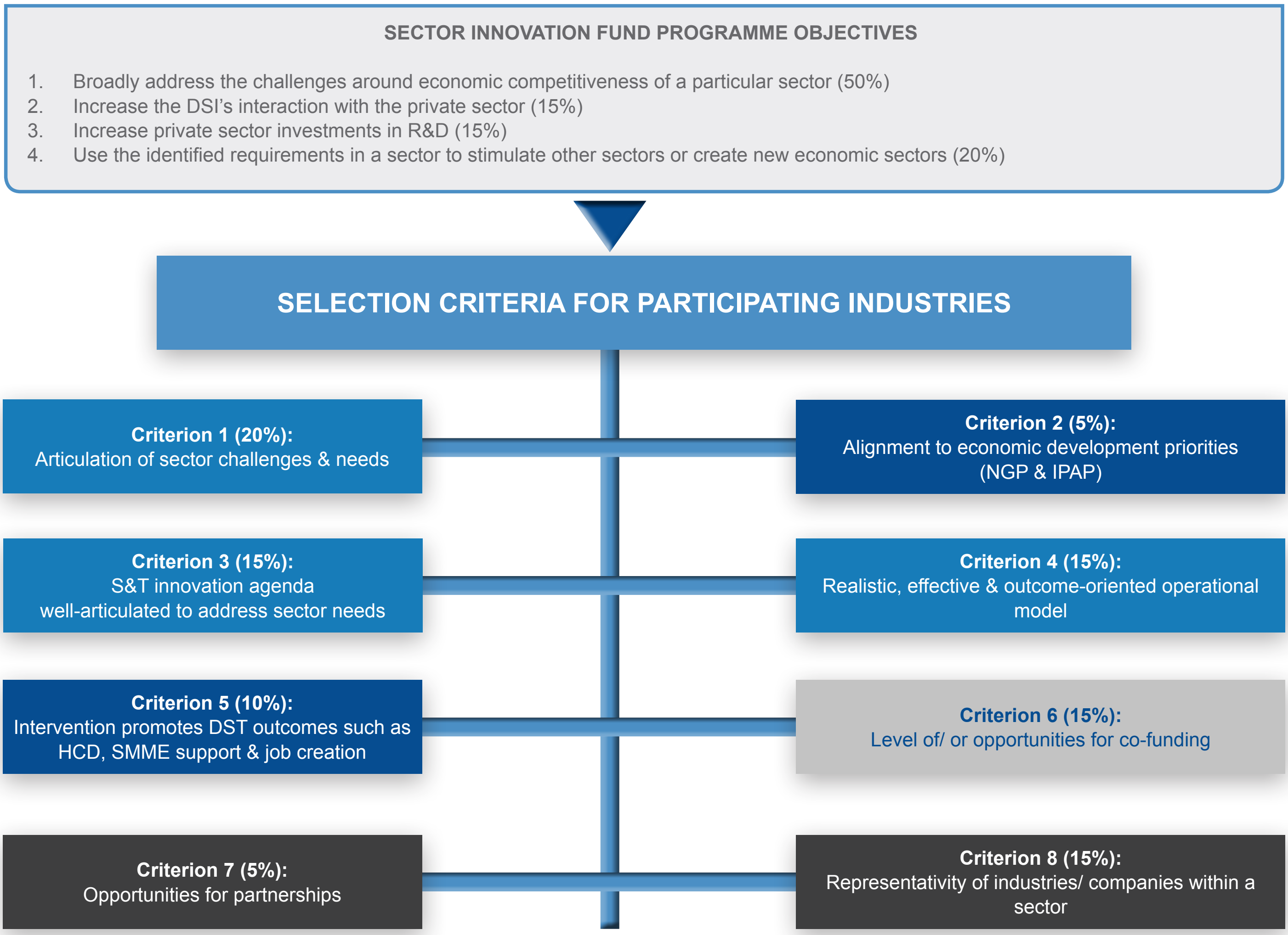

Figure 3.6: Selection criteria for SIF programme's participating sectors

subconsciously, as there is no documentation to explain the logic behind these criteria and why these weightings were assigned. Nonetheless, the large weighting of the first objective and its associated criteria show a huge bias towards the well-organised industries.

It is these well-organised industries that are able to articulate their sector challenges and needs well, as well as the S&T innovation agenda to address these needs and challenges. These industries also have a proven operational model with appropriate governance structures and procedures.

The fourth objective of the SIF programme attempts to stimulate the emerging industries through the leadership of existing organised sectors. A working example of this objective is the FPEF. Through the PHI programme, it is supporting other industries, such as CRI (the post-harvest component), the South African Table Grape Industry, the Subtropical Growers' Association, the Tomato Producers' Association, the Onion Growers' Association, the Pomegranate Association of South Africa and Cape Flora South Africa. Under this objective, the programme contributes towards industry renewal.

Industry renewal occurs when traditional sectors that are losing their competitiveness diversify by entering new growth areas and product lines. For example, SMRI is developing a bio-refinery to produce new products and high-value commodity chemicals from sucrose. On the other hand, PAMSA is exploring the use of forestry biomass and paper sludge to produce bio-oil. Another project that is supported by this consortium is the Nano-cellulose Project, which will be of use in work related to nano-cellulose research using industry-generated biomass.

However, it is not clear how other non-represented sectors such as those in the high-technology category (e.g. pharmaceuticals, electronics and advanced manufacturing) can be attracted to participate in this programme. High-growth, technology-based emerging industries are important if the SIF programme is to realise its objective of realising an increase in R&D expenditure by the private sector. The importance of this issue is elaborated on in the following section.

Characteristics of the SIF-supported sectors

To determine the characteristics of the industrial sectors that were selected, their technology intensity was examined. The purpose of this exercise was to determine whether they are high-, medium- or low-technology sectors. This was done to understand the pattern and intensity of their R&D expenditure. There are various methods that can be used to characterise sectors. Technology intensity is one of the options.

The SIF-supported sectors are mapped in Table 3.6 using the framework of the Organisation for Economic cooperation and Development (OECD), which classifies industries according to technology intensity.

Table 3.6: Classification of sectors according to technology intensity

Sector	Sector classification	SIF-funded sectors
High technology	• Pharmaceuticals • Office, accounting and computing machinery • Radio, television and communication equipment • Medical, precision and optical instruments, watches and clocks	
Medium-high technology	• Chemicals, excluding pharmaceuticals • Machinery and equipment not classified elsewhere • Electrical machinery and apparatus not classified elsewhere • Motor vehicles, trailers and semi-trailers • Railroad equipment and transport equipment not classified elsewhere	
Medium-low technology	• Coke, refined petroleum products and nuclear fuel • Rubber and plastics products • Other non-metallic products • Basic metals and fabricated metal products • Building and repairing of ships and boats	• SAMMRI • MIASA
Low technology	• Food products, beverages and tobacco • Textiles, textile products, leather and footwear • Wood and products of wood and cork • Pulp, paper, paper products, printing and publishing • Manufacturing not classified elsewhere and recycling	• FPEF • PAMSA • FSA • SMRI • WINETECH • MFFSA • CRI

The OECD framework classifies industrial sectors as high technology, medium-high technology, medium-low technology and low technology. The classification is based on a ranking, which uses data on R&D expenditure divided by value added.

None of the funded sectors fall in the high-technology and medium-high-technology categories. Only the marine (boat-building) and minerals to metals sectors are classified as low- to medium-technology sectors. The others are all classified as low-technology sectors. As previously stated, one of the crucial goals of the SIF programme is to contribute to achieving the proposed Medium-term Strategic Framework (MTSF) target of 1.5% of GERD by 2019. To achieve this goal, government wants to stimulate BERD, which has been in a decline.

The classification of Pavitt, a scholar in the field of science and technology policy and innovation management, is used in Table 3.7 to assess the typical R&D intensity and innovation behaviour of the participating sectors in the SIF programme. Pavitt demonstrated that the innovation behaviour of firms in various industries differs significantly. This has a bearing on R&D expenditure.

Table 3.7: Mapping of SIF-funded sectors according to Pavitt's taxonomy

Sector characteristics	Industries	Sources of innovation
Supplier-dominated	• CRI • MFFSA • FPEF • WINETECH • FSA	Relies on sources of innovation external to the firm
Scale-intensive	• SAMMRI • PAMSA • SMRI	Internal and external to the firm with a medium level of appropriability
Specialised suppliers	• MIASA	There is a high level of appropriability due to the tacit nature of the knowledge
Science-based		In-house sources and university research, high degree of appropriability from patents, secrecy and tacit know-how

Pavitt's taxonomy of industrial sectors characterises industries according to the determinants and patterns of technological change. It uses the nature and sources of innovation, the technology user type and means of appropriability as factors in the industrial classification. As shown in Table 3.7, the mapping of the SIF-supported sectors shows that five are in the supplier-dominated category, which typically relies on external sources for research and innovation.

Typically, these sectors have low R&D intensity. Three sectors are classified as scale-intensive categories, and only the marine (boat-building) sector is regarded as a specialised supplier. The conclusion that can be reached is that the participating sectors are dominated by low R&D-intensive industries.

The implications of these findings are that, if the programme's selection criteria are to support industrial sectors that traditionally have low R&D expenditure, it will be difficult to increase private sector R&D expenditure.

Specialised suppliers and science-based firms were found to have higher rates of innovation than supplier-dominated and scale-intensive ones.[2] Specialised supplier and science-based sectors tend to focus more on new product development, while the supplier-dominated and scale-intensive sectors typically focus more on process innovation. That being said, the knowledge derived from the MIASA case as a specialised supplier industry is the inability of the members of such a sector or industry association to agree on common sector challenges and the nature of R&D projects that can address such challenges.

Some of the government officials that were interviewed acknowledged that the SIF programme is used mainly by the agricultural and agro-processing sectors, while other sectors, such as manufacturing, are under-represented.

However, it was emphasised that this choice was not deliberate, as it was mainly these sectors that met the selection criteria.

A challenge in selecting sectors that are not well organised (that have weak business ecosystems) is evident with regard to MIASA, which found it difficult to identify cross-cutting issues in the boat sector. The DSI attempted to assist this industry association by appointing a consultant to assist MIASA with the development of its innovation roadmap through the Economic Impact Study, a project that resulted in three identified R&D projects, although the sector prioritised one project (the tooling facility).

However, this partnership between DSI and MIASA did not succeed in the end.

This is disappointing if one considers that the ocean economy is one of the seven Operation Phakisa focus areas. One of the identified critical areas for the ocean economy is marine transport and manufacturing, a function that MIASA was well positioned to nurture.

MIASA's previous executive was interviewed, and acknowledged an effort shown by the DSI in assisting this industry association to participate as part of the SIF programme. In addition to the inability to identify cross-cutting sector needs and challenges, this industry association had its own challenges, such as a lack of contribution from its members to the SIF programme's co-funding amount, a lack of willingness to share the intellectual property (IP) and non-existent networks with universities.

3.2.2 SIF programme management and governance

Identification and selection of projects

For the identification of sector challenges and needs, the results of the quantitative survey show a predominant usage of industry trends and forecasts (65% of respondents) and the sector strategy or plan (65%) for agenda setting within the industrial sectors that are part of the SIF programme (Figure 3.7). The trends and forecasts are typically the analytical tools that analysts use as background to inform decisions, hence they did not feature much during the interviews.

A strategic planning process involves several tiers of decision making, starting from the industry association members (such as participation in think tank sessions to discuss industry challenges and needs), to intermediaries, such as experts and technical committees (who need to interpret the industry representatives' priorities and do a gap analysis) and the Board or Steering Committee (who, by means of a strategic planning session, need to decide on an R&D portfolio and the innovation areas to be pursued).

The intermediaries also interpret whether the industry representatives' priorities are R&D-related or not. It was observed that the absence of intermediaries in the sectors that are not well coordinated contributes to their inability to identify cross-cutting issues in the sector (as in the case of MIASA).

The industry trends, forecasting and strategic planning methods are incremental in nature and rely mainly on

[2] Souitaris, V. (2002). Technological trajectories as moderators of firm-level determinants of innovation, *Research Policy,* 31(6), pp. 877–898.

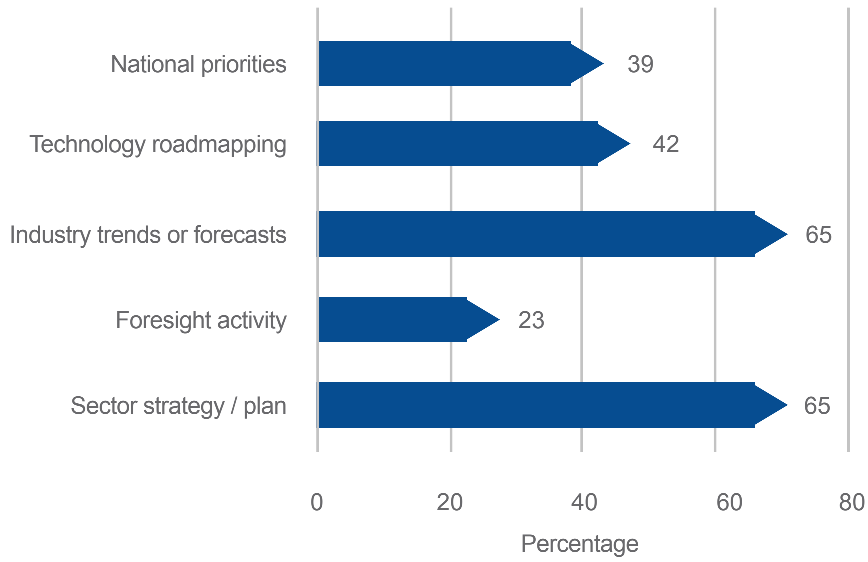

Figure 3.7: Methods used for the identification of sector challenges and needs

past and current performance to predict and shape the future. This is confirmed by the nature of the projects that are ultimately funded through the SIF programme (Figure 3.8), as the majority of these are incremental innovations (62% of respondents).

Radical and disruptive innovations result from long-term, focused agenda-setting approaches such as foresights and technology roadmapping.

Once the sector has announced a call for proposals to all potential role players, including sector research organisations, universities and others, some sectors use research programme coordinators and portfolio managers to screen the proposals. These proposals typically include those of the sector researchers, based on their extensive knowledge and experience of the sector. This potential conflict of interest is discussed in detail below. Discipline-specific technical committees scrutinise and shortlist potential proposals to be funded based on their relevance, scientific nature and costing. These committees comprise relevant experts from universities, research councils, private industries and industry association members. The Board or Steering Committee gives the final approval of the proposals to be funded.

These steering committees, as envisaged by the DSI, comprise representatives from corporate industry and government, although university experts are also occasionally members of these committees.

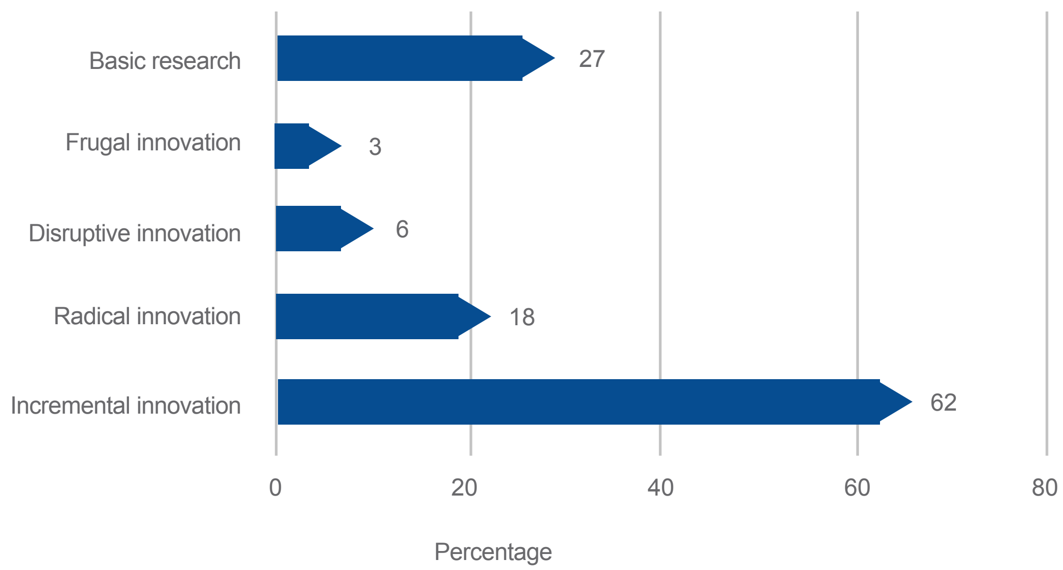

Figure 3.8: Nature of innovation for SIF-supported projects

The DSI has raised its concern that participation from other government departments has not been as great as initially anticipated. Some industry associations, such as FSA, had no government official with a seat on the Steering Committee, while others only have a DSI representative with a seat on several steering committees. The challenge is therefore to secure relevant line government representatives to participate in the SIF programme's steering committees. The Steering Committee on Space Science and Technology is an example that was mentioned during the interviews.

Managing potential conflict of interest

The triple or quadruple helix model has proven to be successful for the forging of synergies across different sectors and among different stakeholders. During these interactions, an unspoken challenge was that of managing a conflict of interest as a result of an individual's involvement in two or more spheres.[3] A potential conflict of interest includes the allocation of project funding, especially in cases where the funder is also a potential beneficiary of the funds. Such situations are sometimes unavoidable within multi-stakeholder collaborations. The setting up of proper governance mechanisms can mitigate some of the potential risks. As the SIF programme was not originally designed as a triple helix model, no governance framework has been put in place to manage conflict of interest.

Industries that have their own R&D divisions have the dilemma of being in two spheres: both as a funder and as the receiver of funds. To illustrate this dilemma, it is critical – without prejudice – to discuss the characteristics of some sectors.

The Citrus Growers' Association has its own research arm: the CRI, which is financed mainly through the Export Levy Fund. The CRI coordinates and funds research conducted by members of the CRI Group, which includes close collaboration between the CRI and a wide range of partners. Another complexity with regard to the CRI is the fact that it benefits directly from the SIF programme for its pre-harvest RDI projects and receives funds from the PHI programme for post-harvest projects.

The southern African sugar milling and refining industries also have a central scientific research organisation, SMRI, which performs research and provides technical services for the industry. Similarly, the mining industry has a research institution in the form of SAMMRI, which is located at the University of Cape Town.

The conflict of interest resulting from being both the funder and the receiver of funds can be managed through a number of innovative interventions. The first is the requirement of the DSI and the industry association to create a separate banking account that will host both the DSI and industry's co-funding.

Some industries in which potential conflict of interest exists reported that the affected R&D managers are not present at the Steering Committee meetings when decisions are made regarding the projects to be funded.

Other mechanisms have been reported such as the use of technical committees and experts in recommending the R&D projects to be funded. Some available best practices that are used elsewhere to manage conflict of interest are the performance of a due diligence process by means of targeted enquiries into potential cases of favouritism and hidden personal or other connections between project promoters and programme operators.[4] Risk management and auditing expertise is used continuously to monitor and report on such cases.

The mode in which SIF calls for funding are announced by different sectors can also have an impact on real or perceived conflict of interest. As indicated in Figure 3.9, the SIF programmes's calls for funding by the different sectors are mostly announced through industry association websites (73% of respondents) followed by university websites (62% of respondents).

Indeed, as shown in Figure 3.10, most of the principal researchers (41% of respondents) receive SIF calls for funding through their industry association websites, followed by "other" (29% of respondents) and the university research or faculty office (27% of respondents). The majority of the respondents who indicated "other" went on to elaborate that this is mainly through word of mouth.

The announcement of SIF calls for funding through word of mouth should be celebrated as it illustrates the maturity of the triple helix collaboration. However, this can also be a potential source of conflict of interest that should be carefully monitored and managed. To illustrate this point, one principal researcher who participated in the quantitative survey said that he received a call for funding through the meeting of the Steering Committee of which he is also a member.

[3] Etzkowitz, H. (2008). *The triple helix: University-industry-government innovation in action,* Routledge.
[4] Demmke, C., Blomeyer, R., Henokel, T., Beke, M. and Moilanel, T. (2017). Codes of conduct and conflicts of interest at any governance level of management of EU funds, Policy Department for Budgetary Affairs, European Parliament.

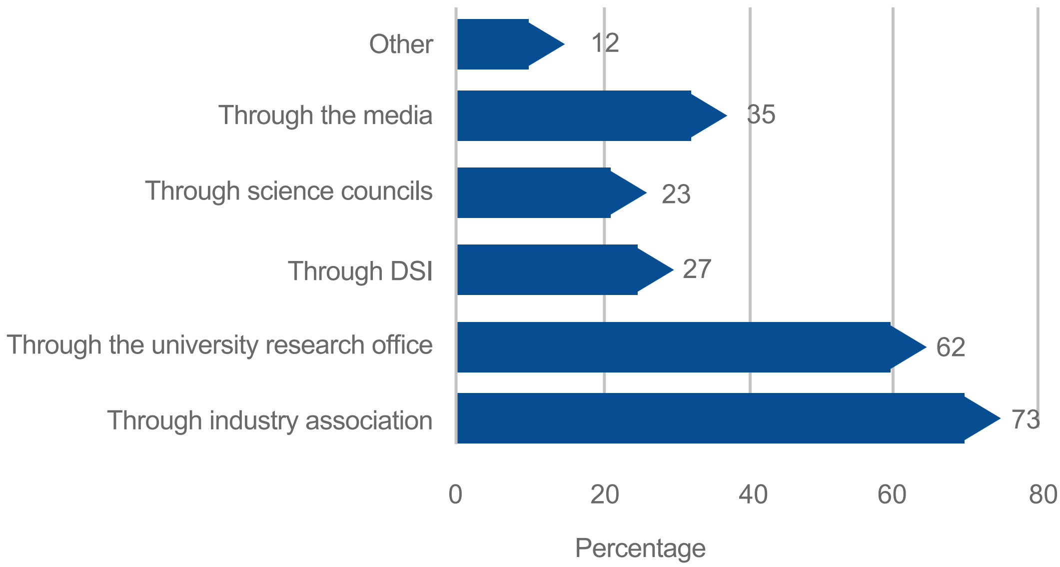

Figure 3.9: Modes of announcing SIF calls for funding by the sectors

3.2.3 SIF programme implementation challenges

The key implementation challenges and issues that the programme faces are summarised below.

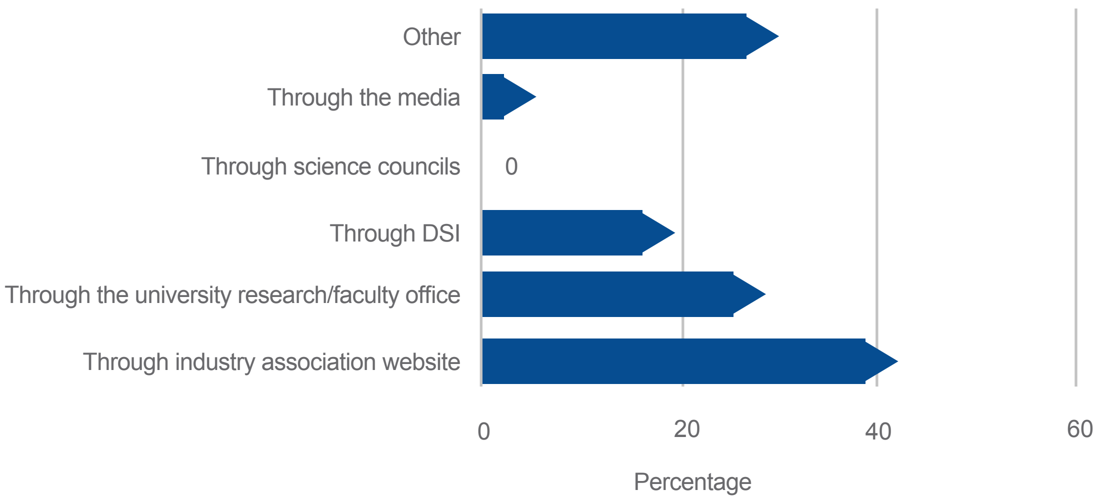

Figure 3.10: Sources of information for SIF calls for funding

Performance on transformation and inclusivity

Both the quantitative survey and the qualitative interviews raised several issues regarding transformation and inclusivity. According to the DSI's list of indicators for the SIF programme, progress on transformation is monitored through variables such as the number of technologies transferred to SMMEs, suppliers, emerging players or previously disadvantaged individuals and BEE companies, the number of direct or indirect jobs created, the number of jobs supported or saved, and the number of beneficiaries who are women or young people.

One critical observation about these indicators is that they consider transformation at the point of impact, not as a key component of the inputs and activities of the SIF programme's operations. The first indicator regarding the number of technologies transferred to SMMEs, suppliers, emerging players or previously disadvantaged individuals and BEE companies is difficult to quantify, as the R&D conducted at universities and public research institutions is to the benefit of everybody within the sector. An achievement of this target is dependent on other variables, such as the structure and membership of the industry.

This target should typically be accompanied by a strategy that encourages the structural transformation of the beneficiary industries. Such a huge undertaking might be beyond the mandate of the SIF programme and will require a coordinated effort from other government departments, such as the dti and the Economic Development Department. The DSI can gain control of this target through the initial choice of industries that are supported through the SIF programme.

The indicators of direct or indirect jobs created, as well as the number of jobs supported or saved, seem to be incomplete, as they do not specify which jobs are desirable to foster transformation within the SIF programme's partner industries. A more specific target would be to specify the category or type of jobs that should be created, supported or saved (e.g. by gender, race, location or occupation).

The indicator of the number of beneficiaries who are women and young people is well placed, as South Africa has a tremendous challenge in terms of the need to support women and young people to realise their full potential and to be economically active. However, this indicator is missing the important component of race, as highlighted by a high proportion of white male principal researchers, who are the beneficiaries of SIF funding (Figure 3.11).

Both government and the members of the sector Steering Committee acknowledge this challenge and that they are willing to work together to achieve transformation. One achievement that is highlighted by both parties is the large number of black students that are funded by the SIF programme.

Transformation and inclusivity issues extend further to the involvement of principal researchers from previously disadvantaged universities. This was interrogated more in-depth during the face-to-face qualitative interviews. The industry indicated that when a call for funding is issued, it is looking for the best expertise possible, irrespective of where it comes from. In most cases, such expertise is found at the top five universities in South Africa: the University of Cape Town, the University of the Witwatersrand, the University of Pretoria, the University of KwaZulu-Natal and Stellenbosch University. Table A12 (Appendix A) shows that 92% of the respondents who are project managers or Steering Committee members select projects to fund based on the relevance

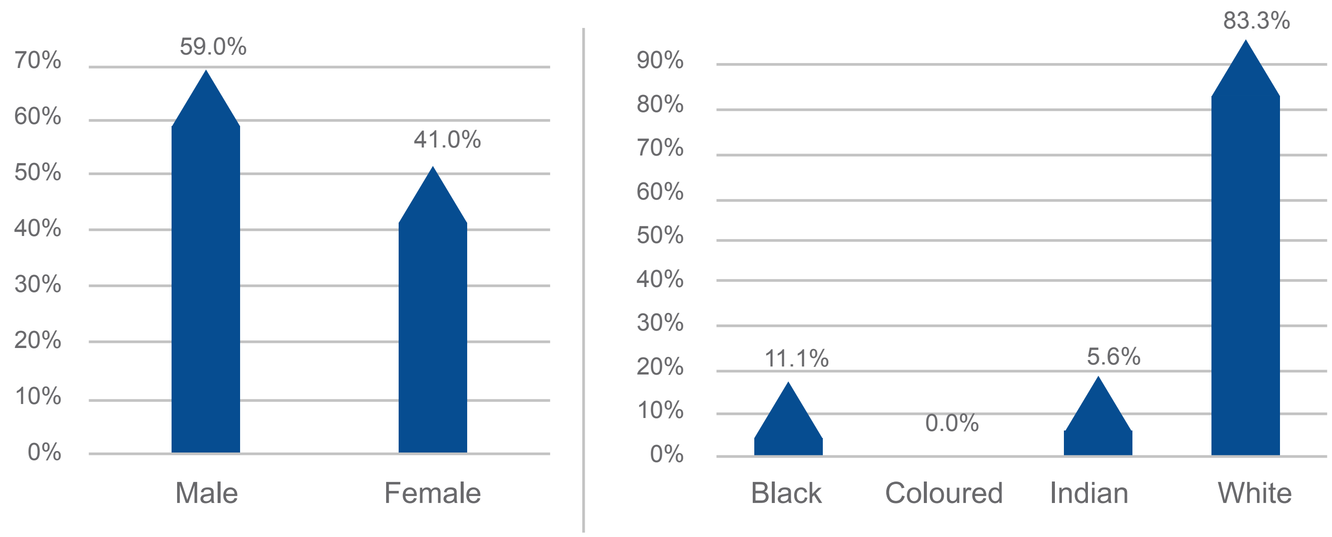

Figure 3.11: SIF principal researcher beneficiaries by gender and race

of R&D projects to sector challenges or priorities. Only 42% of the respondents select projects to fund based on affirmative action.

Some of the frustrations encountered by industry when collaborating with previously disadvantaged universities include management's lack of administration capacity and the effective accountability for SIF funds, the lack of an R&D infrastructure and critical mass, and the discomfort of working with unproven researchers.

Some sectors, such as the wine industry, are considering some innovative interventions to address these challenges, including the need to engage with non-participating universities to institute a joint qualification.

The consortia are expected to provide information on their efforts to transform their sectors. As indicated in Table 3.8, very little has been achieved in terms of this objective.

Table 3.8: Transformation: opportunities for emerging new players

Sector	Number of technologies transferred to SMMEs, suppliers, emerging players or previously disadvantaged individuals and BEE companies	Number of jobs created	Number of jobs supported or saved	Number of beneficiaries who are women and young people
CRI	0	0	0	0
FSA	0	13	0	0
PAMSA	0	0	0	0
PHI	0	0	0	0
SAMMRI	0	0	0	0
SMRI	0	0	0	0
WINETECH	0	0	1	1

Based on the monitoring reports, PHI is the only industry sector that has made efforts to support rural communities and to provide short courses to emerging farmers. However, as the theory of change model shows, unlike outputs, outcomes such as transformation take longer to accrue, and this must be taken into consideration when collecting performance data. Nevertheless, there is a need to investigate the underlying causes of this issue.

Other implementation challenges

The results of the quantitative survey from a sample of sector programme managers and Steering Committee members (Figure 3.12) indicated that the dominant challenges in terms of the implementation of the SIF programme are low industry association revenues and being under financial constraint (46% of respondents), as well as ownership of IP arising from R&D outputs (39% of respondents).

The low revenues of the industry associations highlight the competitiveness challenges that are facing the industrial sectors, and can partly explain why the SIF programme's co-funding from the sectors is low. The ownership of IP is a complex issue in this type of multi-stakeholder collaboration. The IP from the universities' and science councils' baseline R&D is protected through the Intellectual Property Rights (IPR) Act, although it might be difficult to distinguish between knowledge generated prior to this type of collaboration and knowledge generated through the SIF programme. The open innovation type of SIF programme also makes it difficult to attribute the IP generated from projects to certain companies, and high spill-overs from R&D outputs are likely.

3.2.4 The implementation enablers of the SIF programme

Knowledge transfer and the role of intermediaries

The triple helix model, which was discussed earlier in this report, is centred on the transfer of knowledge between academic institutions, government and the private sector. For the purpose of this evaluation, and guided by the SIF programme's logic model, the knowledge transfer that is considered is from research organisations, including universities, public research institutions and organisations in the private sector that perform their own R&D.

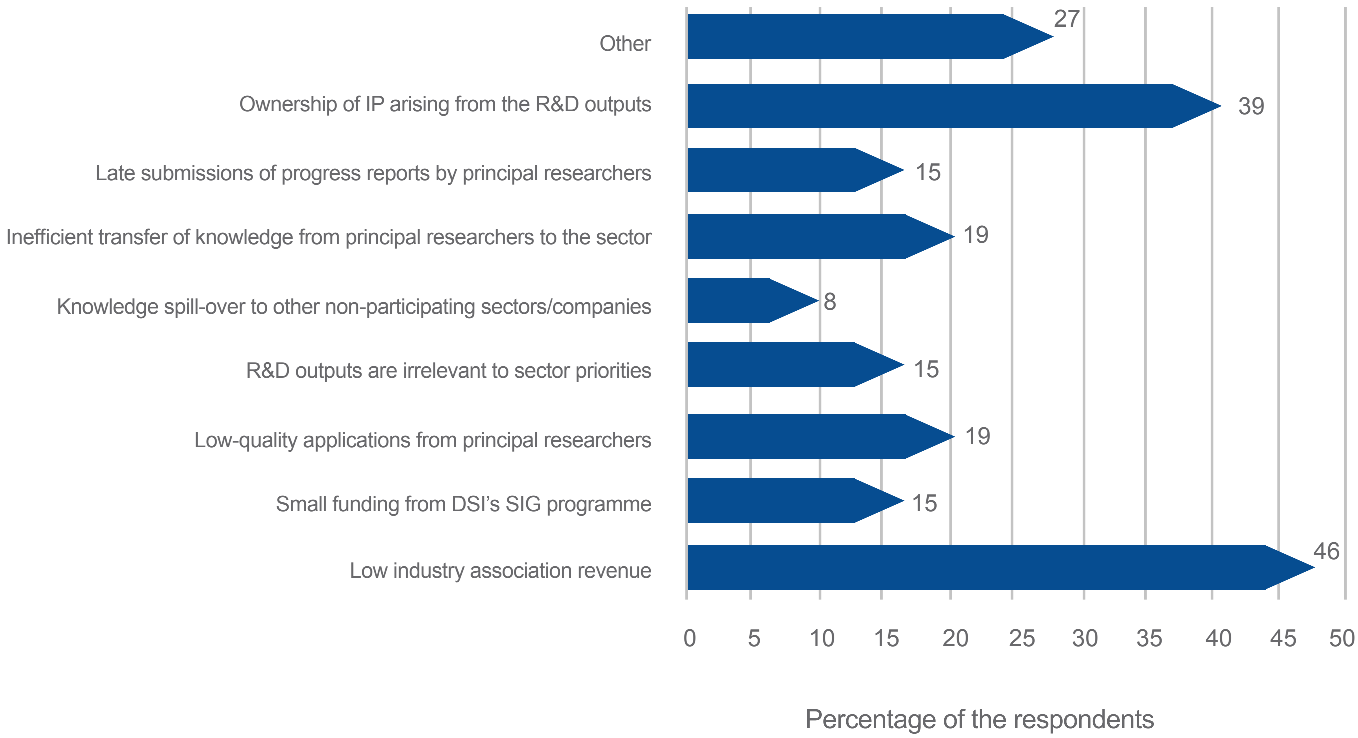

Figure 3.12: Implementation challenges of the SIF programme

As indicated in Figure 3.13, the R&D outputs expected from projects funded by the SIF are mainly scientific publications (88% of respondents), followed by HCD (79% of respondents) and technology (74% of respondents). This is not surprising, as the main output of researchers is typically knowledge generation, which is disseminated through publications. Human capital development was also shown to be one of the priorities of this programme.

The predominance of scientific publications as a measure of R&D outputs introduces questions around how they are translated into competitiveness for the sectors. To probe this further, the principal researchers were asked to indicate how they transfer knowledge that they have generated back to the industry.

Figure 3.14 illustrates that the researchers' delivery of presentations at workshops is used as the major mode of knowledge transfer (85% of respondents), followed by scientific publications (78% of respondents) and the writing of reports to the SIF programme administrators (62% of respondents). These modes of knowledge transfer could still not show a direct link between R&D outputs and industry competitiveness.

An effective and efficient knowledge transfer mechanism was found to be complemented by the sectors' knowledge and technology transfer intermediaries. These intermediaries are typically the industry's own R&D and innovation organisations, which either perform their own in-house R&D, or outsource R&D to universities and other research institutions. These intermediaries function as the bridge between university researchers and the industry. Some of them are also affiliated to universities or make regular trips to these universities to narrow the technological distance.

Some of the human capital capacity employed by these intermediary organisations lies in the knowledge transfer officers who translate R&D outputs such as publications into a more understandable language for the industry.

They synthesise and publish R&D outputs in an easy-to-understand format in various forms, such as items on social media, electronic newsletters, magazines, journals, technical articles, internal research reports, case studies, books, websites, seminars, workshops, meetings and symposia. Several examples were provided to illustrate work done by these intermediaries.

Evidence of early impact

Although none of the sectors are indicating an improvement in competitiveness in the quarterly reports, during the qualitative interviews, some cases of early evidence of impact were mentioned as some of the industry representatives interviewed indicated that the SIF programme assisted them to retain or increase the export market share. This is achieved by eliminating the technical barriers to trade by complying with international and local standards, among other issues.

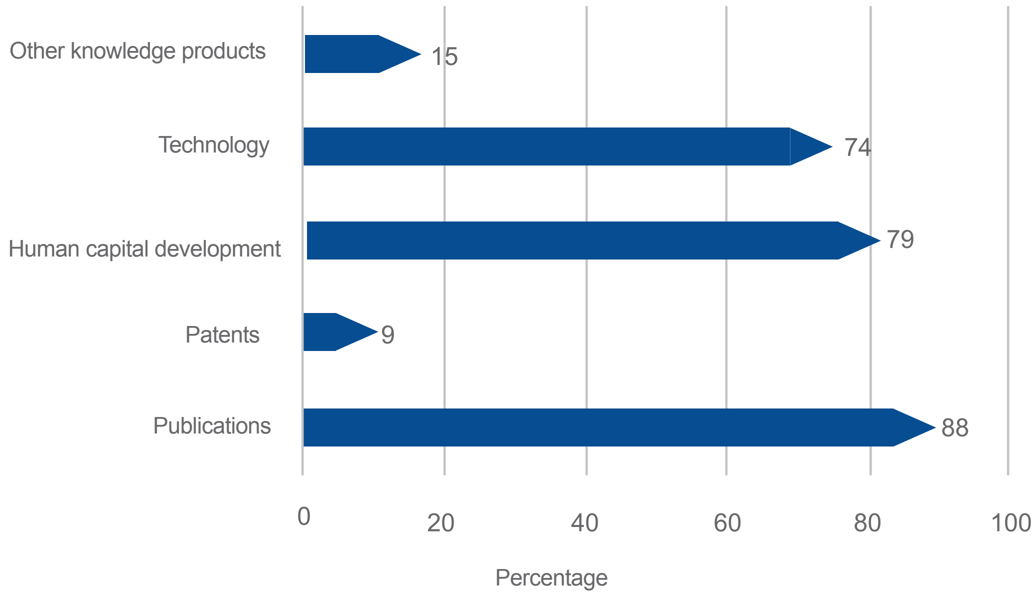

Figure 3.13: Outputs expected from SIF-funded projects

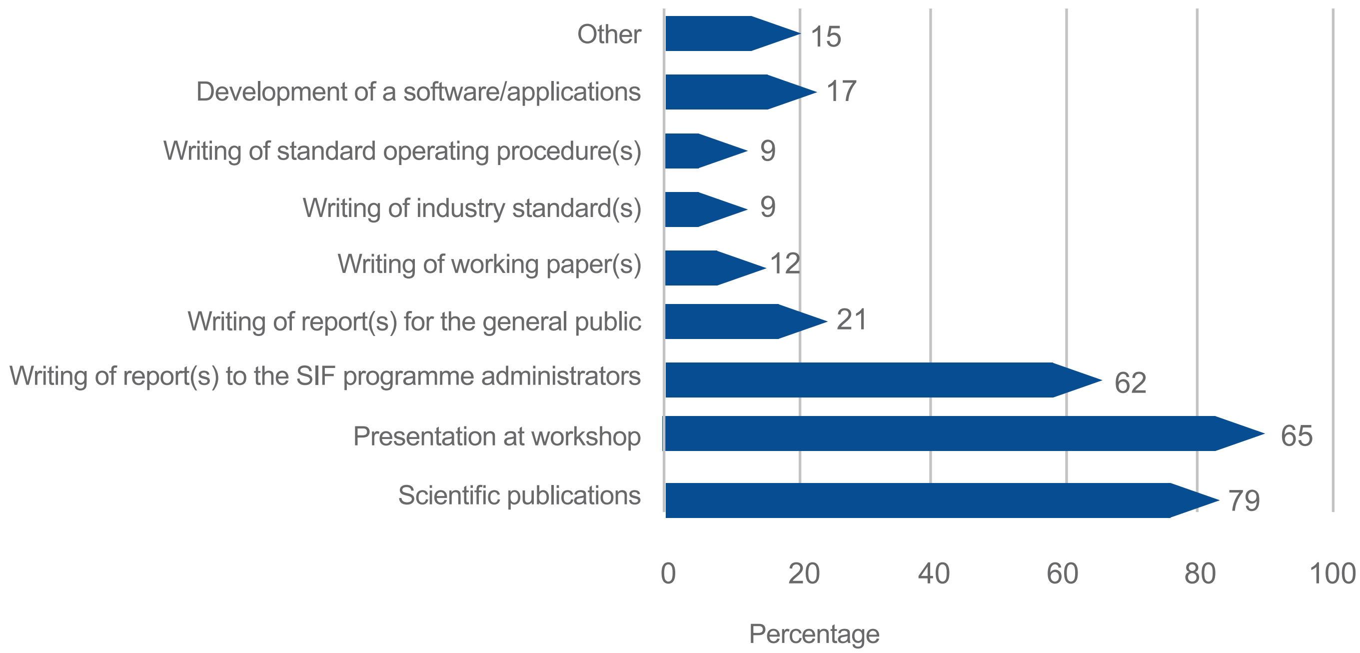

Figure 3.14: Modes of knowledge transfer used by SIF-funded researchers

Overall, the sectors experience an incremental improvement, which results from their participation in the SIF programme. Some of the benefits that are derived from this programme are the retention of export markets or global competitiveness and access to new markets, the funding of expensive, short- and long-term, high-risk projects, an improvement of the R&D and innovation capabilities of the industry, the development of skills within the industry, and the creation of a linkage with public research organisations.

4. INTERNATIONAL BENCHMARKING OF THE DESIGN AND IMPLEMENTATION OF THE SIF PROGRAMME

This section presents the findings of the international benchmarking of the SIF programme with similar international programmes in terms of design and implementation. As indicated in the methodology section of this report, four similar programmes were chosen from Brazil (the sector funds), Canada (the Business-led Network of Excellence (BL-NCE) Programme), Finland (SHOK) and Sweden (Vinnvaxt). Although an attempt was made to include other suitable benchmarks from other developing countries, relevant information and reports were not available. Brief overviews of these programmes are presented in Appendix D. This section therefore summarises the key findings of the comparative analysis. The SIF programme is summarised n Table 4.1 , with the various programmes compared.

4.1 INTERNATIONAL BENCHMARKING ON PROGRAMME DESIGN

According to the information shown in Table 4.1, the SIF programme is still very young compared to other programmes, as it was only established in 2013. The oldest such programme is Brazil's sector funds, which have been in existence since 1999.

The information shows that the programmes' main motivation is to address challenges in selected industrial sectors to improve competitiveness. Other common drivers are skills development and the commercialisation of research. All have adopted the triple helix model of innovation, which seeks to increase collaboration and networking among government, industry and academia. In general, the aim is to promote joint innovation projects between industry and public research organisations to improve the industrial competitiveness of the sectors.

Beyond these motivations, the various programmes also tend to place different emphasis on context-specific challenges. For example, one of Sweden's primary goals is to stimulate regional growth, while Finland emphasises increasing public funding of R&D. Like South Africa, one of the goals of Brazil's sector funds is to increase private sector financing of R&D.

Table 4.1: Comparative analysis of the SIF programmes with similar innovation funding programmes

	SIF (South Africa)	Vinnvaxt (Sweden)	SHOK (Finland)	BL-NCE (Canada)	Sector funds (Brazil)
Date of establishment	2013	2001	2007	2008	1999
Rationale and objectives	• Increase private sector funding • Increase competitiveness • Encourage industry-academia collaboration	• Growth of regional clusters • Industry academic collaboration – triple helix • Increase competitiveness • Industry renewal	• Improve productivity and competitiveness • Increase public R&D expenditure by 7% per year • Industry renewal	• Increase private sector research funding; • Increase competitiveness; • Support training of scientists • Create growing companies • Accelerate research commercialisation	• Stimulate growth in business R&D investment and improve the industrial sectors' competitiveness
Supported sectors	• Mining minerals to metals • Citrus research • Marine aquaculture • Paper manufacturing • Forestry • Sugar milling • Fresh produce • Marine industry	• Process IT Innovations • Steel industry • Optic Valley, broadband, sensor technology • Health-related sector to address health among the ageing • Biolife science • Robotics • Food Innovation Network • Biorefinery • Chemicals, fuels, new energy solutions • Peak Innovation – winter sport products, tourism and outdoor • Smart textiles – innovation in textiles • Smart housing • Geographic information • Paper – new value chains for paper industry	• Environment and energy • Energy and engineering • Health and wellbeing • ICT and digital services sector • Built environment • Finnish Bio-economy Cluster	• Canadian Forest Nano-products Network • Green Aviation Research and Development Network • Quebec Consortium for Drug Discovery • Sustainable Technologies for Energy Production Systems • Set aside funds for SMMEs	• Approximately 20 sector funds are in the areas of aeronautics, agriculture, biotechnology, space, hydro resources, information technology, mining, health, energy, oil, natural gas, transportation, telecommunication, etc. • Two funds – University-Industry Collaboration (UIC) Fund and Infrastructure Fund – are not related to any particular industrial sector
Criteria for funding	• RDI that will impact on competitiveness, high-end skills development, job creation and sustaining existing jobs	• Excellent growth potential • Renewal of traditional strengths and clusters of regions • Formation of new combinations with other sectors • Strong research and innovation milieu • Strong regional leadership • Active participation of the public, private and research sectors • Geographic proximity • Exploit regional comparative advantage	• Industry cluster must be able to compete globally • Sectors of strategic importance • Emphasis on radical innovations,quality and relevance • Added value, resources and cooperation • Only if the sector wants to be globally competitive	• Benefits to Canada • Track record and potential of applicants • Strength of business plan	• Some 30% of the funds are to go to proposals from the country's depressed northern and north-eastern regions
Governance structure	• Industry consortia (non-profit) • Programme Management Unit or Steering Committee	• Targets regional authorities • Cluster organisation receives funding	• Establishes non-profit limited company with participants as shareholders including research organisations	• Targets industry consortia	Oversight by Science and Technology Secretariats Council (CONFAP) with the represent-tation of all 27 states

	SIF (South Africa)	Vinnvaxt (Sweden)	SHOK (Finland)	BL-NCE (Canada)	Sector funds (Brazil)
Design and Implementation	• All sectors eligible to apply • Based on competition between industrial sectors • Industry-academic partnerships	• All sectors are eligible • Competitive funding of regions • Triple helix partnerships	• Priority sectors for funding • Competitive funding • No regional requirement	• Priority sectors for funding • Competitive funding • No regional requirement • Industry-academic partnerships	• Infrastructure Fund is directed to improve research facilities, laboratories and equipment at public research institutions
Financing and funding cycle	• Short-term funding of three years • Co-funding required from industry (minimum of 25%)	• Long-term funding of 10 years • The initial funding is for three-and-a-half years, but continues • Co-funding: 50% from government and 50% from other actors • Sources funds from other programmes and EU Structural Funds	• Five- to ten-year funding cycle • Average co-funding (40% from companies, 10% from research organisations and 50% from government) • Other funding sources, Academy of Finland and EU Structural Funds • Critical mass of funding of at least €50 million per year by each SHOK	• Four-year funding period • Co-funding of 50% from government and 50% from consortium partners	• Each sector has a different revenue formula with the resources coming from a redirection of existing shares of taxes and levies on sectors' services and operations
Implementing agency	• DSI, national government	• Vinnova, national innovation agency	• Tekes, Finland's national innovation agency	• BL-NCE, on behalf of the Government of Canada	• Funding Authority for Studies and Projects (FINEP), Brazil's national innovation agency
Intellectual property rights	• The ownership of IP that emanates from the project shall be managed by the recipient in accordance with the IPR from Publicly Financed Research and Development Act, 2008	• Academics retain their IP rights	• IP rights belong to all consortia members	• Networks develop plans for the management of IP, IPR reside with the researchers as long as they are a network members	
Monitoring and evaluation	• Minimum quarterly reports • Site visits by SIF Secretariat	• Winners are evaluated every three years by international experts to ensure compliance with Vinnova's terms • Assessments are carried out each year (every six months, but a more extended version every 12 months) • International evaluation	• Independent external evaluation	• Annual progress reports • External evaluation	• Sectors' management committees are charged with the establishment of objectives, goals, guidelines and orientation for the Fund's operation

Sweden and Finland explicitly underline the importance of industrial renewal. South Africa, Brazil and Canada include increasing private sector expenditure on R&D as one of their primary objectives.

The industrial sectors that are supported are very diverse in terms of technology intensity, except for South Africa. In Brazil, Canada, Finland and Sweden, participating sectors are a mixture of low-, medium- and high-technology sectors. On the other hand, the South African sectors that are supported are predominantly in traditional low-technology sectors, such as agriculture and mining, except for the boat-building industry, which is a low-medium-technology sector.

Another observation is that, in Canada and Finland, priority sectors are selected for funding. In Sweden, which has adopted a regional approach, regions select sectors with excellent growth potential and comparative advantage. Sweden and Finland implicitly encourage cross-fertilization among sectors.

The programmes are initiated and partly funded by government, which takes on a new role as network facilitator. This reflects the triple helix model, which argues that, in trilateral partnerships, government undertakes new roles. As a result of government intervention, there is a change from a laissez-faire mode of industry participation to academic bilateral cooperation, in which RDI is left to market forces. Government intervention in the innovation process provides the impetus for innovation networks. Moreover, the government provides the institutional and funding structures for the formation of innovation networks.

Governance structures, such as steering committees that include various actors from government, industry and academia, serve as mechanisms for coordination.

As reflected in the information in Table 4.1, the governance structures differ from country to country.

The criteria for funding also differ from country to country, which reflects the countries' specific objectives and priorities. For example, Finland explicitly states that the innovations that should be funded should be radical.

On the other hand, Canada requires a sound business plan, track record of the applicants and clear benefits to the country.

In all the interventions, the target beneficiaries are the private sector, universities and research institutions.

Brazil has an explicit transformation target for the country's depressed northern and north-eastern regions.

4.2 INTERNATIONAL BENCHMARKING ON PROGRAMME IMPLEMENTATION

The primary governance structures are formed by the consortia that are recipients of the funding. A crucial feature is that the research agenda must meet the needs of industry. The consortia approach is network governance, and the networks are expected to self-govern, with government playing a supporting and monitoring role.

To implement the programmes, all the countries select partners through a competitive bidding process. In order to realise the benefits of the triple helix mode of innovation, the programmes are designed to be interactive among the trilateral partners. Industry and academic partnerships are central features, and the active cooperation of universities, industry-based research units and research institutions is encouraged. To develop a critical mass, the programmes enter into agreements with industry consortia, which include a number of industry participants.

As the initiator of the innovation fund programmes, government tends to carry the highest financial burden. The contribution of government varies from country to country. According to Table 4.1, South Africa expects participating consortia to contribute at least 25% of the project costs. With the other programmes, government provides between 40 and 50% of project costs.

The SHOK programme in Finland expects universities and research institutions to provide at least 10% of the project costs. The funding period also varies. South Africa funds projects for at least three years. On the other extreme, Sweden can fund projects for up to ten years if acceptable progress is achieved.

As indicated in Table 4.1, the programmes have adopted various IPR arrangements, which differ from country to country. From the review of the programme evaluation reports, IPR is a source of controversy and conflict. For example, in Canada, this was a significant factor in delays in implementing the programme. Problems with the network member agreement negatively affected the willingness of some firms to participate in and contribute to the network. Different sectors might also require different IPR arrangements. In Finland, IPR issues remain unresolved and the SHOK decided to deal with this issue on a case-by-case basis.

A good practice that is common to all the programmes is monitoring and evaluation. The programmes are generally evaluated internally through progress reports and by external evaluators, including international experts. The programmes from Canada, Finland and Sweden have all been evaluated by external evaluators.

5. LESSONS LEARNT FROM THIS EVALUATION

This section presents an account of what are considered to be the major lessons learnt from the evaluation of the SIF programme. It also draws from best practices from the international comparison that are covered in sections 2 and 3 of this report.

The lessons learnt are structured around the five programme evaluation dimensions in the terms of reference. These are as follows:

- Identify the SIF programme's theory of change (logic model) or derive one if it does not exist
- Determine the relevance and overlap of the SIF programme with other government-private sector innovation grants
- Benchmark the SIF programme with other similar local and international programmes in terms of its administration efficiency
- Measure earlier evidence of the impact of the SIF programme
- Recommend SIF programme improvements in terms of its design, implementation or impact

5.1 PROGRAMME DESIGN THEORY OF CHANGE

The construction of an explicit theory of change in the programme design phase is crucial during the planning stage. The theory of change behind the policy describes how and why change will be achieved, and depends upon beliefs and theories about how impacts come about. A good practice is to display the theory of change graphically to illustrate how the intervention will lead to the desired impact and linkages. A good example of such a well-displayed intervention logic was observed from the Canadian BL-NCE programme. Developing a theory of change is an iterative process and should ideally include the programme beneficiaries. It is good practice to have a complete M&E framework in place during this phase, including data collection strategies for each indicator. In principle, during this phase, a baseline study should be carried out for outcome and impact indicators in order to set realistic yet ambitious targets.

5.2 RELEVANCE AND OVERLAP OF THE SIF PROGRAMME WITH OTHER GOVERNMENT-PRIVATE SECTOR GRANTS

The starting point in designing a public intervention programme is to identify the problem to be solved. This is necessary to justify the rationale and relevance of the intervention. The problems to be addressed by the SIF programme were declining competitiveness of the industrial sector in South Africa and a decline in public sector R&D expenditure. The SIF programme management team also conducted a benchmarking exercise to assess if the SIF programme overlaps with other government funding programmes such as the THRIP, SPII and TIA funding instruments. This was a good exercise to ensure that the programme does not overlap with similar programmes and to avoid duplication.

From our evaluation, we now know that if this assessment revealed no overlap, this is not entirely true. Rather than conducting this comparison internally, DSI could also have solicited inputs from other stakeholders, such as the NRF, which was implementing THRIP at that stage. The overlap between the SIF programme and THRIP was pointed out during the evaluation roundtable discussion by the representative from the NRF, who was previously involved in THRIP. Despite the SIF programme addressing legitimate challenges, if one considers its overlap with existing programmes, its relevance is questionable. In our view, the programme overlaps specifically with THRIP and – to a certain extent – the TIA innovation funding instruments. As one of the speakers at the workshop stated, the SIF programme does not have a unique value proposition to differentiate it from other private sector programmes.

The positioning of the SIF programme in the innovation value chain is also not well articulated. According to our evaluation, the programme is at an early stage or low technology level in the innovation value chain (basic research and applied research). However, a closer look at innovation funding programmes in South Africa shows that, except for the IDC's Technology Venture Fund, there is limited public funding at the commercialisation stage. If this programme was positioned at the later stages of the value chain to support late-stage TRL projects, the SIF programme could fill a well-defined funding gap.

5.3 BENCHMARKING OF THE SIF PROGRAMME WITH OTHER SIMILAR LOCAL AND INTERNATIONAL PROGRAMMES ON ADMINISTRATION EFFICIENCY

Efficiency measures are important as they assess the management of the programme by the PMU or Secretariat.

Benchmarking administrative efficiency is useful to ensure that administrative costs do not consume the bulk of the programme budget. However, the benchmarking should go beyond only comparing administrative efficiency. Other efficiency measures should be included, such as time to grant, which measures the time it takes for the grant to be awarded.

The time to grant is important because the longer it takes for a product or service idea to be developed and ready for market, the greater the chances of the proposal ideas being overtaken by events or by the competition. Another benchmark that is important is the success rate of applicants.

The DSI could have benefitted from conducting the international benchmarking on the design and implementation of the programme during the design stage, rather than during the evaluation stage. International comparison should be used to identify best practices, not to "copy and paste".

5.4 EVIDENCE OF EARLY IMPACT

When this evaluation was undertaken, it was clear that measuring the impact of the projects was not realistic. Formative evaluation generally focuses on outputs and immediate results; not long-term impacts. Moreover, the programme was only initiated in 2013, and most of the projects were still in progress, except for the PHI.

It is still too early to fully measure the impact of the SIF programme, since participants are at various stages of executing their projects. As one of the respondents remarked, showing improved competitiveness in this quarter is impossible and just increases the reporting burden.

As the impact logic model shows, impacts such as improved competitiveness and an increase in private sector R&D expenditure can take years to be realised, and is difficult to measure. Even if innovation projects are completed, their societal and economic impact can also be felt years after they have been adopted and diffused.

The first projects are only just finishing, so judging the project impact is still somewhat premature. As with all projects, a definitive answer on the impact will only be achieved with a follow-up assessment some years after the projects have been completed.

Although no results have accrued from the programme, a key characteristic of the initiative is that the benefits from the research outcomes will accrue to the whole sector, as opposed to a single entity or company.

5.5 LESSONS LEARNT AND GOOD PRACTICES FROM INTERNATIONAL BENCHMARKING

Several lessons learnt and good practices that are worth noting emerged from the comparative analysis with international programmes.

5.5.1 Prioritisation of sectors

Canada and Finland have selected priority sectors for financial support. In Finland, the argument is that since it is a small country with limited resources, it has to prioritise and select areas that are important to its economy. In Canada, although, in principle, all sectors are eligible for funding, the BL-NCE Steering Committee decided on five sectors for the first competition.

In the future, the Steering Committee will decide on the need to target areas for new BL-NCE networks prior to each competition, taking into consideration the availability of funding, the areas already represented in the ongoing networks, and the need to promote or develop specific areas in accordance with national needs. In Brazil, the sector funds are not selective, but are open to almost all innovative sectors.

5.5.2 Increasing private sector investment in R&D – Brazil's sector funds

According to a report of the United Nations Educational, Scientific and Cultural Organisation (UNESCO), Brazil managed to increase its business investment in R&D between 2006 and 2010, from 0.49 to 0.57% of GDP, before falling back to 0.52% in 2012. This rise was partly attributed to the sector funds that are covered in this report. As a result, other South American countries, such as Argentina and Uruguay, as well as Mexico, have followed Brazil's example. Uruguay launched its own fund for the agro-industry in 2008. Mexico has created a dozen sectoral funds since 2003.

The sector funds might be a more effective approach for developing countries that generally have low private sector investment in R&D.

5.5.3 Setting a target for increasing public R&D expenditure

Finland has one of the highest R&D intensities in the world, with a very high business R&D expenditure. When the SHOK programme was conceived, one of the goals was to increase public R&D expenditure by 7% per annum for at least a decade. The setting of a target for the increase in R&D is good practice and shows commitment from government. In the absence of a target, R&D funding remains an intention in the absence of a measurable goal.

5.5.4 Creating a critical mass

One of the goals of the SHOK programme that is good practice is to create a critical mass. Prior to the establishment of SHOK, cooperative R&D investments were characterised by low investment, resulting in short-term projects. The SHOK provides an environment in which resources can be pooled together, thus creating larger programmes with critical mass and long-term financial commitment. This allows researchers to focus on research instead of worrying about acquiring funding.

5.5.5 Systematic funding approach

Internationally, there is a movement towards treating RDI funding in a systemic way. Instruments are moving away from the one-beneficiary-at-a-time models that dominated programmes such as THRIP and SPII, towards more complex interventions involving networks, especially, industry-academic linkages. This approach is underpinned by the triple helix model of innovation, which drives interaction between industry, academia and the private sector.

5.5.6 Leveraging synergies within the innovation system

An interesting feature of the SHOK programme in Finland is the involvement of the Academy of Finland, which funds basic curiosity-driven research. The SHOK programmes partially overlap with the existing programme of the Academy of Finland. The Academy of Finland aims to strengthen the scientific base of the SHOK clusters. It does this by ensuring that universities (the main partners of the academy) are participating in the SHOK networks. When choosing centres of excellence or creating and funding different research programmes, the Academy of Finland acknowledges research that supports the goals of the different SHOK programmes. In this way, the academy ensures the relevance of the research undertaken for industry. In a way, the SHOK programmes bridge the gap between initiatives financed through Tekes and the Academy of Finland.

The SHOK concept becomes clearer when it is viewed as a new kind of ecosystem for the creation of research programmes. The Academy works in close cooperation with Tekes to develop, fund and monitor the operations of the centres.

Similarly, besides funding and supporting its own research projects, the BL-NCE programme in Canada is also intended to be an interface between existing BL-NCEs, other centres of research excellence and the research community more generally, to help bring the research outputs and outcomes to market.

Brazil's sector funds are more comprehensive as they involve more role players within the sector, and combine other RDI support instruments, such as the R&D tax incentive and infrastructure funding for public universities.

5.5.7 Using technology roadmaps and technology foresight

Technology roadmaps and foresight are increasingly used to determine the future needs of research and technology development to encourage industry renewal and avoid lock-in. Technology roadmaps are industry-led, government-facilitated planning exercises among participants from industry, universities and governments, that are focused on technologies needed by a specific sector. The steps in roadmapping are to assess the technology needs of the sector, to identify the promising technologies that could meet the defined needs, and to plan the best route for the applied research, development and demonstration needed to make the technologies available. Roadmapping and technology foresighting widen the debate and update reference roadmaps, focusing on reaching the highest number of stakeholders and the broader society.

5.5.8 Innovation support

The Vinnvaxt programme in Sweden, besides providing finance to successful consortia, provides process management development support to future-oriented processes (looking forward to 10 to 20 years). It also provides analyses and the drawing up of strategies to improve the innovation system, network organisation and learning.

5.5.9 Implementation of innovation funding instruments

From the comparative case studies, the role of the ministries is distinctly separated from the professional implementing role of agencies and their specific instruments. The government has delegated the implementing role to expert organisations.

For example, in Finland, the organisation that is responsible for implementing the SHOK programme is the national innovation agency, Tekes, and a technology funding organisation. In Sweden, the Vinnavaxt programme is implemented by the national innovation agency, Vinnova. Of course, the presence of a competent agency with the required expertise is a prerequisite for government to delegate this role. The stable funding of research public-private partnerships throughout their years of implementation, as well as the competitive process, gives increased confidence to industry to invest and participate in these projects.

5.5.10 Open innovation

One of the interesting features of SHOK is to encourage openness. This is reflected in the general IPR, which allow all the participants rights to use IPR that emanates from the research without providing additional compensation to the originator. The novel feature of the SHOK model is that, while the material and immaterial rights remain with the inventor, it is obliged to grant unlimited and perpetual access rights to the results and IPR to all the participants of the programme in which they are generated. Although this open approach has its merits, it has its drawbacks and can limit participation.

6. CONCLUSION AND RECOMMENDATIONS

Overall, this evaluation shows that the SIF programme remains relevant within the National System of Innovation, especially within the context of low business expenditure on R&D. Both strengths and weaknesses are summarised in this chapter, followed by recommendations that have been made. Lastly, coverage of the research questions is assessed.

6.1 POSITIVE FINDINGS REGARDING SIF PROGRAMME DESIGN AND IMPLEMENTATION

- Business-led projects that are demanded by industry to address industry challenges such as skills, cost and environmental concerns increase potential knowledge transfer and commercialisation.
- Industry-specific or business-specific needs are identified by the private sector to set the agenda for the design and conduct of the research, thereby better ensuring the take-up and use of the results. Through their technical committees, the consortia address sector-wide problems and set the research agenda; not universities.
- The SIF programme is an effective public-private partnership that is implicitly based on the triple helix model of innovation, which enhances interaction between industry and government, together with universities and public research organisations.
- Unlike programmes where government selects sectors that are supported, the SIF programme has adopted an open competitive bidding process, which is bottom up. Government does not pick the winners.
- The programme has set up good governance structure and technical teams, although their effectiveness is yet to be investigated (e.g. the participation of other government departments).
- To monitor progress, the programme integrated a monitoring system with a set of performance indicators. Progress is monitored through quarterly reports.
- The consortia have also been effective in balancing their administrative expenditures in comparison to research funds. The administrative expenditure ranges from 4 to 24% of programme costs. However, some consortia, such as SAMMRI, have low administration costs at this stage because of delays in becoming fully operational.
- Due to the benefit of shared risk, consortia can do research that they could normally not do on their own. Research and innovation outputs can be transferred to a number of organisations, which could lead to better impact.
- The programme supports industries that are of strategic importance to the economy. These industries are important in job creation and exports.

6.2 AREAS OF IMPROVEMENT REGARDING SIF PROGRAMME DESIGN AND IMPLEMENTATION

- The programme has not differentiated itself from existing programmes, such as THRIP, which address similar challenges and are based on the triple helix model. The location of the programme in the innovation funding landscape is similar to THRIP, and there is no evidence of a unique offering. Overall, this suggests that the programme has increased fragmentation of the innovation funding instruments, which results in duplication.
- Compared to similar programmes from Canada, Finland and Sweden, the funding period of three years is short. This might encourage investing in short-term projects, which tend to be incremental.
- In implementing the programme, the unique characteristics of each network need to be taken into consideration. For example, the two consortia, MIASA and MFFSA, were still very immature compared to consortia in well-established sectors such as forestry and mining. A different means of support was therefore required to take into consideration their unique challenges. A diagnosis of the sector system of innovation is necessary to pinpoint system weaknesses before an instrument is proposed.
- The programme has not successfully included previously disadvantaged universities with only a few participating in it. Surprisingly, there is also limited participation by the science councils, which traditionally tend to focus more on applied and translational R&D that is closer to the market. Moreover, science councils tend to work more closely with industry than universities.

6.3 RECOMMENDATIONS

The following are the recommendations that resulted from this evaluation:

The SIF programme design

- **The programme should be continued as it is designed with minor modifications**. However, it is very similar in design and implementation to THRIP. It is advisable that the two programmes should eventually be merged to have a critical mass of funds and avoid duplication and fragmentation. The current R134 million that DSI has invested is modest to eventually make an impact. The opportunity for such a dialogue by the two departments, DSI and the dti, is opportune since THRIP is undergoing changes. Eventually, the programme should be managed by an agency such as TIA once it has created capacity and has the trust of industry.

- **DSI should consider the development of a framework for supporting the emerging sectors, which are not organised** (including capacity for intermediaries that can interpret the industry requirements and R&D outputs). To increase cross-sector and emerging sectors, projects with these elements should be prioritised and given preference in the selection process. This framework can include a criterion for the prioritisation of medium- to high-technology sectors, as well as high-growth and high-job creation industries.

- **Baseline information should be provided regarding the competitiveness of the industrial sectors.** The competitiveness of industrial sectors depends on various factors, including innovation. Before supporting the consortia, their competitive position should be fully understood and the barriers to competitiveness identified. Innovation on its own is not a panacea that can overcome significant barriers that exist. Innovation policy is not about saving dying industries, but about the renewal and growth of the industrial sectors.

- **DSI should consider the development of an appropriate intervention logic model for the SIF programme.** The logic model derived in this report is based on the interpretation of the current programme design and implementation. The new logic model should articulate a unique value proposition for the SIF programme, and appropriate reporting indicators that are aligned to this logic model should be developed. The programme should ensure that the reporting requirements are aligned with industry-led consortia, and are thus less academic in nature. The expected time of the outcomes and impacts should also be clear.

- **Business R&D expenditure should be increased through large-scale sector funds.** One of the rationales of the SIF programme is to contribute towards increasing the national R&D expenditure. The South African government set a target of 1.5% R&D expenditure as a percentage of GDP by 2019. It is, however, doubtful that such a strict target can be achieved, and new radical strategic thinking and instruments are required. Even if the national innovation funding instruments are merged to create a critical mass, collectively they are still very small. The creation of sector funds, such as in Brazil, is worth considering. The Sector Fund is an instrument that has been successful in supporting R&D through levies and specific taxes (extra-budgetary sectoral funds). The approach has the added benefit of neutralising the effect of other government priorities that are competing with investments in R&D. In Brazil, the sector funds have been credited with contributing towards improving R&D expenditure and also protecting R&D expenditure from budgetary variations. Sector levies in South Africa are not new, and were used extensively by the agricultural sector. In South Africa, the WRC is supported through water-related levies that are designed to provide a source of comprehensive and continuous investment in science and technology, since they bind revenues from specific sectors to expenditure in the same sector. The DSI, together with industry and universities, should consider discussing the issue with National Treasury.

The SIF's programme implementation

- **The use of sectoral foresight exercise and technology roadmaps.** Industrial sectors, especially traditional mature sectors that are not research intensive, can be locked in existing technology regimes. As a result, they do not renew and adopt new technology trajectories or enter new growth areas. They tend to invest in process technologies to reduce costs or address environmental problems that could be the result of environmentally unfriendly technologies. The DSI should consider the introduction of foresight studies and technology roadmaps at national or sectoral level, which constitute integral parts of STI policy. Foresight encourages "thinking the future", "debating the future" and "shaping the future". Foresight and technology roadmapping are useful, among others, for planning science and technology funding, strategic decisions, defining the strategy of an industry or sector, improving long-term competitiveness, coping with changes in the socio-economic framework and attracting the attention of political authorities.

- **The SIF programme should consider setting a minimum contribution amount by the industrial sectors.** The programme should continue funding consortia that have performed well and are willing to commit to contributing at least 50% to the project costs. Such contribution needs to be audited as the actual contribution can be much lower than the amount that was pledged by the industry.

- **Setting minimum funds for targeted sector innovation projects.** To create a critical mass of funds, the programme should set a minimum amount of funds for a sector, e.g. R20 million per sector.

- **Increase the SIF funding period from three to five years.** A short funding period will likely result in an inclination towards incremental innovation and less novel innovations.

- To address inclusivity, **a percentage of the budget should be allocated to peripheral or rural regions and universities.**

- **Monitoring and evaluation of early-stage technology development.** The current reporting of progress on research projects provides very little information regarding the maturity of the technology development effort. This makes it difficult to monitor meaningful progress towards reaching technical success. The consortia should consider using the TRL tool, which provides more granular and quantitative progress between scales of 1–9. The TRL should be combined with the market or commercial readiness level to assess the commercial readiness of development projects. External experts in research fields should also be called upon to participate in and provide independent evaluations.

- **The introduction of annual reports by the DSI's PMU.** Although the DSI's PMU receives quarterly reports, there is no evidence of how this information is used as a monitoring tool. As a result, some of the reports are incomplete and the information is inconsistent. This makes the evaluation of the programme difficult, especially for external evaluation. The opportunity for programme managers to learn is also lost. The PMU should produce annual reports based on the quarterly reports by analysing the data in real time to identify problems that are experienced in implementing the programme. For example, if one of the consortia is falling behind and has hardly spent its budget. Annual reports are one of the key elements in monitoring the operational programme progress towards achieving the objectives of the programme. Unlike the quarterly reports, annual reports should focus on a set of well-selected key performance indicators and should also provide cumulative values for output and outcome indicators. The results should be made public to show progress that has been made by the programme.

6.4 COVERAGE OF THE EVALUATION QUESTIONS

Table 6.1 gives a summary of the coverage of the evaluation questions that relate to the SIF programme's design.

Table 6.1: Coverage of the SIF programme's design: evaluation questions

Category	Evaluation questions	Summary of findings and conclusions
Programme design	What is the SIF programme's logic model or theory of change?	No formal model existed and, as such, one was derived from the SIF Concept Note, the programme's quarterly reporting indicators and from survey and interview information collected.
	Is the programme designed to address market or system failures or both?	The programme addresses both market and system failures.
	Which market or system failures does it seek to address?	It provides funding to projects in which the private sector is not willing to invest (due to risk or appropriability) and addresses interaction failures between the DSI and industry by forming public-private partnerships and collaboration with public research organisations.
	Are indicators aligned with the programme`s objectives and do they match the SMART criteria (are they specific, measurable, achievable, relevant and time bound)?	Most indicators are aligned with the programme`s objectives. Some indicators, e.g. transformation and the creation of start-ups, are not aligned with the programme`s objectives.
	Which indicators are missing from the current set?	There are no indicators for measuring interaction between the DSI and industry, or the creation of new sectors.
	Is the programme designed to address problems across the RDI value chain?	The programme is located upstream to primarily address basic research, applied research and prototype development.

Table 6.2 gives a summary of the coverage of evaluation questions that relate to the SIF programme's relevance within the National System of Innovation.

Table 6.2: Coverage of the SIF programme's relevance: evaluation questions

Category	Evaluation questions	Summary of findings and conclusions
Programme relevance	What is the relevance of the SIF programme? Has its relevance changed since its inception?	The SIF programme remains relevant. It addresses the policy objective of increasing R&D expenditure and the interaction of DSI with industry to improve their competitiveness.
	How does this funding instrument differ from existing funding programmes?	The programme is very similar to the current THRIP programme in terms of its objectives, positioning and industry-led projects. There is no compelling differentiation or unique value proposition.
	If it differs from existing programmes, how does it complement them?	In the context of the low funding of BERD by government, the SIF programme provides the necessary funding for applied research.
	Where is the SIF programme located in the innovation value chain?	The programme seems to lie more on applied research, although it borders between basic research and experimental development.

Table 6.3 gives a summary of the coverage of evaluation questions that relate to the SIF programme's implementation.

Table 6.3: Coverage of the SIF programme's implementation: evaluation questions

Category	Evaluation questions	Summary of findings and conclusions
Programme implementation	How is the programme implemented? Are there clear implementation steps?	The programme was designed to operate as a partnership between government (DSI) and industrial sectors. It appears to have evolved towards a triple helix model, which includes government (DSI), industry and academia.
	Does the programme have implementation indicators? What are they?	The indicators include HCD and knowledge generation, contribution to the IP portfolio, transformation, increasing RDI levels within the sector, improving sector competitiveness, as well as increased private sector investment in RDI.
	What is the performance against the implementation indicators?	Most of the funded projects are still in progress. Some of the main deliverables achieved are publications, training and employment opportunities.
	Are the implementation activities resulting in the anticipated outcomes?	It is still too early to tell, although there is early evidence of impact in terms of knowledge transfer to the industry for the improvement of competitiveness.
	What are the challenges in implementation?	Transformation and inclusivity (there is a lack of R&D capacity at the previously disadvantaged higher education institutions and the principal researchers are mainly white males), a short funding period, undesirable indicators, low revenues for industrial sectors and complications regarding IP ownership.
	What does it cost to implement the programme? Is it cost effective?	Administrative costs are between 5 and 10% (see Table A8 in Appendix A). Industry associations say that the SIF programme is very efficient.
	Are the existing governance structures inclusive? Are they working well in terms of participation and coordination?	They consist of industry, government and academia. It is not clear how participants or members were recruited and there is a lack of participation by other government departments and science councils.
	Are the projects only sector-specific or do they operate across sectors?	The projects are mainly sector-specific.
	What are the characteristics of projects?	The projects are mostly incremental innovation. There is very limited radical innovation and there is a strong need to give preference to such projects.

APPENDIX A: QUANTITATIVE SURVEY RESULTS

Table A1: Sample for quantitative survey

Sector	Number of potential respondents	
	Steering Committee members	Principal researchers
CRI	5	10
FSA	7	8
FPEF/PHI	13	29
PAMSA	9	5
SAMMRI	28	39
SMRI	13	22
WINTECH	7	7
Total	**82**	**120**

Table A2: Number of quantitative survey responses received

	Number of responses	Number of valid responses	Response rate (%)
Steering/Technical Committee members	40	26	48.8
Principal researchers	51	35	42.5

PROGRAMME DESIGN: SECTOR PROGRAMME MANAGERS OR STEERING COMMITTEE MEMBERS

Q1: Which of the following market or system failures does the programme or SIF address?

Table A3: Market or system failures addressed by the SIF programme

Category	Percentage
Low business R&D and innovation investment	50
Lack of long-term innovation planning within the sector	42.3
Lack of corporation between government, business and research institutions	53.8
Low economic competitiveness	26.9
Lack of cooperation among the sectors	15.4
Infrastructure failure	7.7
Human capital	57.7
Lock-in into an established competitive advantage	7.7

Q2: Which elements of the innovation value chain does the programme or SIF address?

Table A4: Elements of the innovation value chain that the SIIF programme addresses

Category	Percentage
Knowledge generation	85
Knowledge transfer	62
Research and innovation skills development	81
Technology development	81
Technology transfer	62
Product or process development	54
Open innovation	12
Commercialisation	35

Q3: Which success indicators are used for the programme or SIF?

Table A5: Success indicators that are used for the SIF programme

Category	Percentage
Increase in R&D expenditure	77
Human capital development	89
Innovation cluster development	19
Improved competitiveness of the sector	69
Number of knowledge products produced	54
Level of R&D collaboration between the industry and universities	62
Level of R&D collaboration between the industry and science councils and government	42
Other	12

PROGRAMME IMPLEMENTATION: SECTOR PROGRAMME MANAGERS

Q4: How does the sector prioritise the research, technology or innovation to be pursued to address its challenges or objectives?

Table A6: Method for prioritisation of research, technology and innovation

Category	Percentage
Sector strategy or plan	65
Foresight activity	23
Industry trends or forecasts	65
Technology roadmapping	42
National priorities	39

Q5: In addition to the SIF's contribution, what are the other sources of revenue for your industry association?

Table A7: Sources of revenue for the industry association

Category	Percentage
Statutory levy	39
Industry association levy	58
TIA fund	12
THRIP fund	35
WRC fund	8
ARC fund	8
DAFF fund	4
Foundations, charity organisations or non-governmental organisations	4
Other	19

Q6: What percentage of revenue dedicated to the programme or SIF is used for administration costs?

Table A8: Percentage of SIF funds used for administration costs

Category	Percentage
Less than 5%	12
Equal to or greater than 5%, but less than 10%	31
Equal to or greater than 10%, but less than 15%	23
Equal to or greater than 15%, but less than 20%	3.8
Equal to or greater than 20%, but less than 30%	3.8
Equal to or greater than 30%, but less than 40%	3.8
Equal to or greater than 40%	3.8

Q7: Which research institutions do you collaborate with in your sector innovation programmes?

Table A9: Research institutions that collaborate with industry associations

Category	Percentage
Universities	96
Science councils	69
National laboratories	8
International organisations	15
Other sectors' R&D institutions	31
Other	4

Q 8: Which RDI activities does your industry's sector innovation programme support?

Table A10: Research, development and innovation activities that are funded

Category	Percentage
Sector-related R&D projects	92
PhD research bursaries	89
MSc or MEng research bursaries	89
Conference attendance and international mobility	50
Conference hosting sponsorship	12
R&D infrastructure	35
R&D consumable	54

Q 9: How does your industry association issue a call for SIF applications?

Table A11: Modes of announcing a call for SIF projects' funding applications

Category	Percentage
Through industry association website	73
Through the university research or faculty office	62
Through DSI	27
Through science councils	23
Through the media	35
Other	12

Q10: What criteria is used to select successful applications?

Table A12: Criteria used to select SIF-funded projects

Category	Percentage
Relevance of R&D projects to sector challenges and priorities	92
Relevance of qualifications to sector challenges and priorities	50
Criteria set by the DSI	31
Affirmative action (gender and race)	42
Proximity to the industrial sector	15
Future R&D capacity development	42

Q 11: How is the programme implementation monitored and/or evaluated?

Table A13: Monitoring and evaluation of SIF-funded projects

Category	Percentage
Submission of monthly reports by principal researchers	8
Submission of quarterly reports by principal researcher	65
Submission of half-yearly reports by principal researchers	31
Submission of annual reports by principal researchers	46
Programme evaluation reports	39
Site visits	50
Other	8

Q12: Which implementation challenges have been encountered?

Table A14: SIF implementation challenges encountered

Category	Percentage
Low industry association revenue	46
Small funding from DSI's SIF programme	15
Low quality applications from principal researchers	19
R&D outputs are irrelevant to sector priorities	15
Knowledge spill-over to other non-participating sectors and companies	8
Inefficient transfer of knowledge from principal researchers to the sector	19
Late submission of progress reports by principal researchers	15
Ownership of IP arising from R&D outputs	39
Other	27

PROGRAMME IMPLEMENTATION: PRINCIPAL RESEARCHERS AND PROJECT LEADERS

Q13: Where did you see a call for this funding?

Table A15: Sources of information for SIF programme calls

Category	Percentage
Through industry association website	41
Through the university research or faculty office	27
Through DSI	18
Through science councils	0
Through the media	3
Other	29

Q14: On average, how long does it take to receive notice of funding award from the application date?

Table A16: Time taken to decide on SIF project funding award

Category	Percentage
~6 months	32
~3 months	47
~1 month	6
~1 year	12
>1 year	3
Other	29

Q15: Which scientific field(s) was this funding used for?

Table A17: Classification of projects funded through the SIF programme

Category	Percentage
Natural sciences	3
Engineering and technology	53
Medical and health sciences	3
Agricultural sciences	41
Social sciences	0
Humanities	0

Q16: What would have happened if the project had not received SIF funding?

Table A18: Status of projects in absence of SIF funding

Category	Percentage
Project would not have been undertaken	65
Project would have continued	9
Other funding sources would have been sought	29
Other	9

Q17: In what form have you participated in setting the research and innovation priorities of this SIF project?

Table A19: Participation of researchers for the agenda-setting of the sector

Category	Percentage
Not at all	56
As a member of the sector Steering Committee	12
As a workshop or survey participant	21
As a contracted consultant	3
Other	12

Q18: What is the nature of innovation being addressed by this SIF?

Table A20: Nature of innovation for SIF-funded projects

Category	Percentage
Incremental innovation	62
Radical innovation	18
Disruptive innovation	6
Frugal innovation	3
Basic research	27

Q19: What is the time perspective of your R&D that is funded by the SIF?

Table A21: Time horizon of SIF-funded R&D projects

Category	Percentage
Short-term research	29
Medium-term research	59
Long-term research	27

Q20: What outputs were expected from you for the SIF funding you received?

Table A22: Outputs expected from the SIF-funded projects

Category	Percentage
Publications	88
Patent	9
Human capital development	79
Technology	74
Other knowledge products	15

Q21: How do you ensure that your research outputs reach the relevant SIF-funding industry?

Table A23: Modes of knowledge and technology transfer

Category	Percentage
Scientific publications	79
Presentation at workshop	85
Writing of report(s) to the SIF's programme administrators	62
Writing of report(s) for the general public	21
Writing of working paper(s)	12
Writing of industry standard(s)	9
Writing of standard operating procedure(s)	9
Development of a software/ application	17
Other	15

Q22: How do you provide the reports or feedback to the SIF's programme administrators?

Table A24: Method of reporting for SIF-funded projects

Category	Percentage
Submission of monthly report	0
Submission of quarterly report	65
Submission of half-year report	15
Submission of annual report	50
Project evaluation report	27
Site visits	12
Other	3

Q23: Please rate the quality of the SIF's programme administration and impact on implementation (1 = low; 5 = high)

Table A25: Administration and implementation efficiency of the SIF programme

Category	Percentage of respondents				
	1	2	3	4	5
Application process	0	6	27	53	15
Ability to handle queries	0	3	32	41	24
Fairness of evaluation	6	0	24	47	21
Reporting and feedback	0	12	18	44	27
Monitoring and evaluation	0	9	27	41	24
General efficiency	0	3	29	38	29

APPENDIX B: QUALITATIVE INTERVIEW RESULTS

A list of organisations and categories of respondents interviewed is given in Table B1:

Table B1: Characterisation of the qualitative interview's respondents

Organisation	Number of respondents	Category
Department of Science and Innovation	3	National government department
Department of Trade and Industry	1	National government department
Technology Innovation Agency	1	Government agency
Sugar Milling Research International	1	Industry association
Citrus Growers Association of Southern Africa	1	Industry association
Citrus Research International	3	Industry association
Fresh Produce Exporters` Forum	1	Industry association
Marine Industry Association of South Africa	1	Industry association
South African Minerals to Metals Research Institute	1	Industry association
Wine Industry Network of Expertise and Technology	2	Industry association
University of KwaZulu-Natal	1	Higher education institution

SUMMARY OF RESPONSES FROM GOVERNMENT OFFICIALS

Table B2: Key issues emerging from interviews with government officials

Evaluation variable	Emerging issues	Frequency	Comments by the respondents
Government's rationale for the SIF programme	Human capital development	2	• Human capital development does not necessarily mean students only
	Cooperation with Industry	1	• Some industries were approaching the DSI for a cooperation opportunity
	Increase in business R&D expenditure	1	• BERD decreased due to the global economic crisis
	Industry competitiveness improvement	2	• The PHI initially focused on industry competitiveness
The relevance of the SIF's programme design to national objectives related to innovation and competitiveness	Changing nature of the SIF programme's objectives	1	• It is not clear how the objective of stimulating other sectors or creating new economic sectors is fulfilled
	Experimental design of the SIF programme	1	• Evident experimentation about industry co-funding (minimum contribution to be considered in future)
	Increase in national exports	1	• The programme design supports the dti's goals of increasing exports, competitiveness and job creation
	Indicators to track the achievement of objectives	1	

Evaluation variable	Emerging issues	Frequency	Comments by the respondents
Selection of participating industry associations	The use of a multi-criteria spreadsheet	2	• The following multi-criteria were used for the selection of sectors: good articulation of the identified challenges and needs in the sector, alignment to the economic development priorities (NGP and IPAP), science and technology innovation agenda well-articulated to address the identified challenges and needs in the sector, proposed operational model is realistic, effective and outcome-oriented to ensure the success of the initiative, the proposed intervention broadly meets the DSI's requirements pertaining to outcomes such as HCD, support for SMMEs and job creation, level of or opportunities for co-funding, opportunity for partnerships, and representativity. • It was hard to identify cross-cutting issues in the boat sector (MIASA). • There is an internal audit validation process under way of whether the sectors have proper systems to manage public funds. • There is an under-representation of the manufacturing sector. • It was not deliberate to select mainly the agricultural sector; it happened to be the best organised. • In future, criteria can be defined for the selection of certain sectors.
Governance structure of sector or industry innovation funds	The common governance structures used are the Technical Evaluation Committee, as well as the Steering or Management Committee	4	• The technical evaluation committees make recommendations to the steering committees. • The process is sometimes too bureaucratic; a few indicators should be used. • People who experience conflict of interest recuse themselves from the Steering Committees and principal investigators do not form part of this committee • There are governance, and M&E frameworks; they are just not well documented. • The framework is formalised at three essential levels: governance, management and alignment • The framework can be developmental or policing (a developmental framework is preferred).
	Governance, as well as the M&E framework	1	
Comparison of the SIF with similar government instruments	The SIF is a sector-wide programme, while THRIP is a company-wide programme	3	• Although THRIP also addresses industry competitiveness, it is aimed at helping companies solve their own problems. • Lifting the R&D base for everyone takes place efficiently at the sector level (coordination). • The SIF is not project-based, but is funding based and focused on industry needs. • When the PHI (pilot programme) was revised, the dti gave DSI the guidelines of THRIP. • The TIA has a role to play in radical innovations. • There is a need for targeted instruments (ARC, DAFF, etc.)
	The TIA's programmes are mainly for publicly funded R&D technology development and commercialisation, whereas the SIF is relevant to the sectors	1	
Intellectual property ownership	All contracts that are signed clearly define that all IP that results from the research will be managed through the IPR Act	1	• There is a view that IP ownership should not interrupt the goal of improving the competitiveness of industries.

<table>
<tr><th>Evaluation variable</th><th>Emerging issues</th><th>Frequency</th><th>Comments by the respondents</th></tr>
<tr><td rowspan="4">Challenges associated with the SIF programme’s design and implementation</td><td>Lack of broad representation within the steering committees</td><td>3</td><td rowspan="4">• Bringing other government departments to the steering committees has not been successful.
• There is a lack of insight on how to link RDI to competitiveness.
• There should be a shift from applied research to experimental development.
• There is a need to ensure that the researchers are clear on the expected outputs and outcomes.
• A mechanism should be found to go outside the established industry associations.
• There is a challenge to ensure that whoever is chosen can contribute and will be able to spend the money.
• The collaborating organisation should also be an organised legal entity.
• In-kind contributions (e.g. the time of researchers, use of the instrument) should be allowed so that there is better participation by industry associations that are cash scrapped.
• The timeframe of three years is too short; it needs to be made longer.</td></tr>
<tr><td>Knowledge transfer from the researchers to the industry</td><td>3</td></tr>
<tr><td>Lack of support for emerging industries</td><td>3</td></tr>
<tr><td>A short period of SIF funding</td><td>1</td></tr>
<tr><td rowspan="2">Suggestions for the successful design and implementation of the SIF programme</td><td>Improvement of broad industry participation</td><td>3</td><td rowspan="2">• There is a need to enable the participation of small role-players such as SMMEs and start-ups.
• There will be mandate overlap issues once the participation is broadened.
• Transformation remains a significant issue, especially for the dti.
• A percentage of the budget should be set aside for transformation.
• The transformation objectives of the DSI should come out clearly in the conceptualisation of the SIF.
• There should be a minimum co-funding requirement.
• There should be a restriction on the project management fee.
• We need to be clear on how we measure progress.
• There is a need for the SIF to show impact that is beyond R&D outputs (e.g. revenue, competitiveness and employment)</td></tr>
<tr><td>The need to fine-tune SIF success indicators</td><td>4</td></tr>
</table>

SUMMARY OF RESPONSES FROM THE STEERING COMMITTEE MEMBERS

Table B2: Key issues emerging from the interviews with the members of industry associations

<table>
<tr><th>Evaluation variable</th><th>Emerging issues</th><th>Number of respondents</th><th>Comments by respondents</th></tr>
<tr><td rowspan="5">Perceived value of the SIF programme to industry</td><td>The SIF assists with the retention of export markets, global competitiveness and access to new markets</td><td>5</td><td rowspan="5">• Compliance to international and local standards eliminates technical barriers to trade.
• The SIF allows the sector to do research that it would normally not be able to do by itself.
• The blue-sky research is structured; it is not R&D for the sake of R&D.
• It provides additional funding for extremely high-priority market access issues.
• The SIF is a focused funding model that addresses urgent industry needs.
• These projects would have continued without the SIF, but at a much slower pace.
• R&D doubled or tripled in terms of resources.
• The SIF enabled the industry to take on multiple R&D projects simultaneously.
• Some students finished internships and were employed in the industry. Others moved away from the industry.
• The DSI enabled the sector to create the skills that it did not have.
• More students could be taken in (capacity development and new skills set).
• Collaborative agreements between the industry and public research organisations are very strong.
• More success has been achieved to create linkages within universities.
• One new linkage has been formed with a public research organisation.</td></tr>
<tr><td>The funding of expensive, short- and long-term, high-risk projects</td><td>8</td></tr>
<tr><td>The improvement of the RDI capabilities of the industry</td><td>6</td></tr>
<tr><td>The development of skills within the industry</td><td>3</td></tr>
<tr><td>It provides linkages with public research organisations</td><td>2</td></tr>
<tr><td rowspan="3">Methods used for research, technology and innovation agenda setting by the industry</td><td>Identification of common challenges and needs by the industry association representatives</td><td>8</td><td rowspan="3">• The decision-making process on research priorities has several tiers.
• Levy payers are solicited annually for their opinions on research priorities.
• People from industry (producers, sellers, etc.) are regularly invited to think tank sessions to discuss regional issues.
• Intermediaries facilitate the workshops to do a gap analysis (industry representatives attend).
• Intermediary interpret the industry representatives' priorities (whether related to R&D or not).
• Sector researchers propose their own priorities and prepare their own research proposals, based on their extensive knowledge and experience.
• All potential role players, including sector researcher organisations and universities, receive a call for research proposals.
• Proposals are screened by research programme coordinators and portfolio managers and then submitted to discipline-specific research committees for scrutiny and selection.
• These committees consist of relevant experts, mainly from universities, as well as research councils, private industry and industry association members.
• When evaluating the funding proposals from universities and research institutions, factors such as relevance, the scientific nature of the proposal and costing are examined.
• There is a mixture of short-, medium- and long-term projects.
• Approved projects are reviewed by the Board.
• The Board has a strategic planning session.</td></tr>
<tr><td>The role of intermediaries in interpreting sector requirements into R&D priorities</td><td>7</td></tr>
<tr><td>Criteria used for the selection of qualifying R&D projects</td><td>6</td></tr>
</table>

Evaluation variable	Emerging issues	Number of respondents	Comments by respondents
Comparison of the SIF with similar government instruments	The SIF has good administration efficiency	2	• The SIF has been run very well in comparison to other related government funding instruments. • THRIP and the SIF are very different. • Some sectors are clear about the differences between each programme as they apply to different funds for various components of the projects. • Some sectors make use of the DSI's SIF for pre-harvest projects and the PHI for post-harvest projects. • There are long-term projects that are funded through both the NRF and DSI. • The SIF allows funding for research directly. Students do not necessarily have to be involved. • The SIF is sector-specific and assists the industry to determine its priorities. • The SIF has a clearer process. It is different from tools where one competes for funding each year. • Some of the industry associations that used to receive THRIP funding have not received it since its reconfiguration. • Transformation requirements and the need for a private company to apply (instead of universities) are some of the stated challenges.
	Recognition that each funding programme addresses different aspects of the innovation value chain	8	
Linkage between R&D outputs and industry competitiveness	Important role of sector knowledge and technology transfer intermediaries	7	• The ultimate aim is to provide growers with products, technologies or recommendations that will improve their competitiveness. • There are case studies to illustrate success. • There is an IP ownership arrangement in the contracts signed with universities. • Proximity to the university is not a problem as regular trips are taken to the universities. • Capacity has been built to ensure knowledge transfer by making sure that there are bridges between the university (researchers) and the industry. • A knowledge transfer officer was appointed to translate the information into a more understandable language. • The research outputs are published in an easy-to-understand format in various forms, such as social media items, electronic newsletters, magazines, journals, technical articles, internal research reports, case studies, books, websites, seminars, workshops, meetings, symposiums, etc. • It took a long time for IPR negotiations to be concluded with the universities. • The industry is aware of the IPR Act, IP ownership belongs to the government when it provides the funding. • It is not a big issue because outputs are widely distributed and available to industry. • There is an agreement that if any IP has to be commercialised, the member will receive royalty-free access (for a limited time), subject to the approval of the National Intellectual Property Management Office (NIPMO) • Normally, there are no IP issues on SIF-funded projects due to an incremental R&D that is driven by market demand. • In the marine sector, there were issues of IP sharing among companies who were unwilling to share the moulds and designs.
	Intellectual property rights ownership	5	

<table>
<thead>
<tr><th>Evaluation variable</th><th>Emerging issues</th><th>Number of respondents</th><th>Comments by respondents</th></tr>
</thead>
<tbody>
<tr>
<td rowspan="3">Challenges associated with SIF programme design and implementation</td>
<td>Lack of R&D capacity at the previously disadvantaged higher education institutions</td>
<td>4</td>
<td rowspan="3">• There is no critical mass at previously disadvantaged universities. None of them are doing citrus research. You have to build the infrastructure first if you are to work with them.
• Small universities do not have administrative capacity. They are unable to account effectively.
• Stellenbosch University is the only university with a true wine science department. There may be a need to engage with other universities to offer a joint qualification.
• Industries were not comfortable using unproven researchers.
• There are complaints that the funding cycle is too short.
• In most cases, a three-year funding cycle is not sufficient to develop a novel usable technology.
• Since SIF funding is short term, some sectors are not able to grow a permanent research base (people cannot be appointed permanently).
• The SIF is used on projects that already have some momentum.
• Five to seven years is preferable to three years.
• A five-year minimum funding period would allow the sector to do more research and plan better over the long term.
• The long-term nature of the SIF is important as the sector also obtained three and a half year funding plus a one-year extension.
• In most cases, a three-year funding cycle is not sufficient to develop a novel usable technology. It is suggested that the SIF programme always provides the opportunity for significant extension of funding within the programme (e.g. for a second three-year term) if the performance and results from the first three-year term were sufficiently promising.
• The sector is asked to submit reports at very short notice (e.g. statistics of the students).
• Some sectors do not want to see the SIF tied too much to the number of students.
• It is difficult to quantify the impact from the short-term funding.
• All industries have a problem with the DSI indicators as they are more relevant to the dti's performance indicators e.g. transformation, technology transfer, jobs created, RDI, the number of start-ups created, etc.
• Showing improved competitiveness within a quarter is normally not possible.
• The funding time of the DSI is not aligned to the academic programme (academic year vs DSI's financial year).
• There were challenges with the online reporting system in the beginning, but they are being resolved.
• There were problems uploading the supporting documents.
• The SIF's portal is inflexible.
• The contract is inflexible for the R&D project (the project's contract milestones are typically not achieved).</td>
</tr>
<tr>
<td>A short period of SIF funding</td>
<td>7</td>
</tr>
<tr>
<td>Undesirable indicators and a complicated SIF reporting system</td>
<td>7</td>
</tr>
<tr>
<td rowspan="2">Suggestions for the successful design and implementation of the SIF programme</td>
<td>A need for less emphasis on students</td>
<td>3</td>
<td rowspan="2">• There should be less emphasis on HCD.
• The SIF fund should not be too tightened up with students as is the case with THRIP.
• Universities are more fixed with publications and students.
• The industry is more interested in the outcome side of the programme (e.g. decision support tools and energy benchmarking programmes)
• In future, the SIF will be used for short-term funding (it would be long term if the funding is long term).
• Some industries (the more matured ones that are more structured) would prefer to receive funding directly from the DSI.</td>
</tr>
<tr>
<td>Ensuring the continuity and sustainability of an SIF programme</td>
<td>4</td>
</tr>
</tbody>
</table>

APPENDIX C: LOCAL BENCHMARKING INFORMATION

In this section, a high-level overview of the local STI-related programmes is presented.

Support Programme for Industrial Innovation

In October 1989, the dti introduced the Innovation Support for Electronics Scheme to promote the local design and manufacture of innovative electronic products. In order to offer wider support, this programme was replaced by the SPII on 1 April 1993. The SPII is a technology innovation programme that is supported and administered by the dti. It aims to assist businesses to finance the cost of technology development and innovation, and the length of the pay-off period associated with it.

The programme consists of two schemes:

- The Product Process Development Scheme provides financial assistance of between 50 and 85% (depending on the extent of B-BBEE ownership) of the total qualifying costs incurred in pre-competitive development activity for small, very small and micro firms during the technical development stage (with a maximum grant of R2 million per project).
- The Matching Scheme also targets SMMEs (medium firms are not included in the Product Process Development Scheme) and large companies. Financial assistance consists of a 50 to 75% grant, with no payback, for the innovative development of new products and processes (maximum grant of R5 million).

The SPII support excludes basic research, and funds projects after proof of concept has been achieved. Support ends at the point where pre-production prototypes have been produced.

The evaluation of the SPII[5] identified a number of constraints, including "limited reporting data, a lower response rate to the survey than anticipated (due in part to a different population group than originally conceived), and the refusal or unavailability of some stakeholders to participate in the evaluation". The report identified the key constraints to innovation as a "lack of available funding and a risk-averse private investment environment, a fragmented innovation landscape where the relevant agencies work in silos, a lack of support of linkages across value chains and between relevant agencies, a lack of business expertise on behalf of innovators and a limited skill base".

Technology and Human Resources for Industry Programme

THRIP is a partnership programme that is also funded by the dti. It aims to boost South African industry by supporting research and technology development and enhancing the number of appropriately skilled people. THRIP promotes partnerships in pre-commercial research between business and the public-funded research base, including universities and research institutions.

As discussed, the design basis of THRIP is based on the triple helix model for collaboration and allows partners to share R&D costs, pool risks and enjoy access to institution-specific know-how and commercialisation resources. Collaboration, furthermore, guarantees that support goes to projects with industry-wide applicability, which is, in turn, characterised by high social rates of return. Collaboration prevents the support of projects that confer proprietary advantages on individual firms.

THRIP is open to qualifying private sector companies and consortia. The research has to be industry-driven and partnerships with the higher education sector and science councils is prioritised. It is a versatile programme that supports small and large companies.

An evaluation of THRIP by the dti and the DPME[6] identified the following beneficial characteristics:

- It provides incentives for local technology development.
- It promotes collaboration among the various innovation system stakeholders.
- It provides for the higher education sector to prioritise their research on the basis of industry needs.
- It is versatile in that it can support different-sized challenges, providing big or small grants.
- Its priorities are industry based.
- It is open to all qualifying organisations and technologies.

[5] Genesis (2014). Impact evaluation of support programme for industrial innovation. Department of Performance Monitoring and Evaluation, Pretoria, South Africa.
[6] The dti and DPME (2015). Implementation and impact evaluation of the technology and human resources for industry programme. Department of Trade and Industry, Pretoria, South Africa.

Technology Innovation Agency Funding Programmes

The TIA, under the DSI, manages various funding instruments. The aim of TIA is to stimulate and intensify technological innovation in order to improve economic growth and the quality of life of all South Africans. The funding support for business enterprises includes a seed fund to support prototype and proof-of-concept of technology. The Technology Development Fund assists innovators to develop technologies along the innovation value chain, from proof-of-concept to technology demonstration. The Pre-commercialisation Support Fund provides financial support to prepare successful innovators for follow-on funding through limited support for market testing and validation.

The funding structure varies from matching ratios, loan funding and royalty investments.

APPENDIX D: INTERNATIONAL BENCHMARKING INFORMATION

Background

Several developed and developing countries have introduced dedicated funds targeting specific economic sectors, rather than fostering innovation across the board. These public funding instruments explicitly focus on investing mainly to address private sector R&D challenges. The overall aim is to stimulate innovation in specific industrial sectors to increase growth and competitiveness to strengthen their international position.

In this section, the SIF programme is compared with similar measures in Brazil, Canada, Finland and Sweden. These are the sector funds in Brazil, the BL-NCE programme in Canada, SHOK in Finland and Vinnvaxt in Sweden.

These programmes were selected because the overall aim is to improve the competitiveness of industrial sectors. Moreover, like the SIF, these programmes have adopted the triple helix mode of innovation, which emphasises interaction and networking among the innovation actors from government, business and research organisations. These programmes are suitable comparators because they have a longer track record compared to the SIF programme, and have undergone several evaluations.

This comparative analysis addresses the rationale for the programmes, sectors that are supported, selection criteria, governance structures, design and implementation, the financial and funding cycle, implementing agency, M&E and IPR regimes. It also examines the features of the partnerships and networking mechanisms, such as clustering and the triple helix model.

Sector funds in Brazil

Brazil was one of the first countries in Latin America to introduce sector funds in 1999. This instrument is designed to channel industry-generated revenues into R&D. In a context of low private sector investment in R&D, the concentration of research in exclusively academic settings and the tendency for short-lived collaboration between academic institutions and the industry, the sector funds were established to stimulate a growth in R&D investment and to improve sectors' competitiveness.

The sector funds have low administrative costs due to the centralisation of funds (except one) under the responsibility of Brazil's Innovation Agency (FINEP), a government agency under the Ministry of Science, Technology and Innovation (MCTI). Each sector has a different revenue formula with the resources coming from a redirection of existing shares of taxes and levies on sectors' services and operations.

The research priorities for each sector are generally set by joint sector-specific public-private commissions. The governance structure was reinforced by the implementation of CONFAP, with the representation of all the 27 states, created in 2006. The Council debates and defines regional and state priorities linked with national priorities, and tries to establish a budget level, or at least identify finance sources in the public and private sectors. The impact of the sector funds so far has been an increase of STI expenditure from US$1 billion to more than US$4 billion.

The Brazilian government identified a need to develop the less developed regions, hence 30% of the funds go to proposals from the country's depressed northern and north-eastern regions.

Some experts identified some of the design flaws of Brazil's sector funds as a lack of prioritisation of certain research disciplines and technology areas of future economic relevance in favour of sector prioritisation and an orientation towards federal universities to favour them with additional revenue. Further criticism is the fact that it is mainly the sectors with well-established industrial R&D that are more likely to benefit from the sector funds.

Business-led Network of Excellence in Canada

In Canada, the BL-NCE is a federal government initiative that was launched in 1989 to fund partnerships between universities, industry, government and not-for-profit organisations to create large-scale research networks. It is a joint initiative of the Natural Sciences and Engineering Research Council, the Social Sciences and Humanities Research Council, the Canadian Institutes of Health Research, Industry Canada and Health Canada. It provides targeted funds in areas of strategic importance to Canada.

The BL-NCE funds 46 networks and centres through its four programmes, which mobilise Canada's best research, development and entrepreneurial talent, and focus it on specific issues and strategic areas. The BL-NCE programme is part of the suite of partnership programmes offered by the Networks of Centres of Excellence.

Strategic Centre for Science, Technology and Innovation in Finland

The SHOK programme in Finland was established in 2007. Its inception was prefaced by an elaborate and wide-ranging review of the Finnish innovation system by the Finnish government, together with the Research and Innovation Council (Premiers Office Finland, 2004).

The review pointed out the need to strengthen R&D efforts in selected key sectors. These sectors were identified as being the most important for both the Finnish economy and its society enterprises.

In order to generate and maintain high-quality competitive excellence in the Finnish industry and education, there was a need to create centres or agglomerations that had a sufficiently larger critical mass in specific sectors (Nikulainen and Tahvanainen, 2009). Strategic choices had to be made, while at the same time facilitating the allocation of limited resources to those sectors of industry and academia that are considered to be the most significant in terms of the competitiveness of the Finnish economy. SHOK was expected to be an internationally recognised programme for RDI.

The establishment of the SHOK was facilitated by the national innovation agency, Tekes, which is supported to some extent by the Academy of Finland.

The Vinnvaxt Programme in Sweden

Since 2003, each of Sweden's 12 counties has been obliged to produce a Regional Growth Plan (RGP) for the following three years. The purpose of these documents is to outline the strategy for long-term economic growth and sustainable development in each of Sweden's counties. The RGP is a central government instrument for sustainable regional economic growth and development. The programme is elaborated in each region within a partnership of local and regional players (representing industry, academia and government). The programme consists of an analysis of regional growth conditions, a programme for sustainable development from an industrial point of view and an agreement between the players on how to finance and implement the activities. Each of the RGPs is based on a separate analysis of the following key strategic areas:

- Labour and skills supply
- Enterprise environment
- Cluster and innovation systems

The Vinnvaxt Programme ("win growth") is a national initiative for leveraging regional processes. It is an important instrument for supporting growth in regions. This is meant to occur through the creation of effective triple helix collaborations. The programme targets regional innovation systems with the potential to develop international competitiveness in specific areas.

Geographical proximity between many different actors brings competitive advantages in cooperation, learning, access to competence and expertise, and business development.

Contact:

NACI Secretariat
Tel: 012 844 0252
Email: naci@dst.gov.za

www.naci.org.za