

DEPARTMENT OF SCIENCE AND TECHNOLOGY

SCIENCE ENGAGEMENT STRATEGY IMPLEMENTATION PLAN



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA



SAASTA

South African Agency for Science
and Technology Advancement





TABLE OF CONTENTS

ABBREVIATIONS	iii
GLOSSARY	v
EXECUTIVE SUMMARY.....	vi
1. INTRODUCTION	1
1.1 Background	1
1.2 Purpose of the Implementation Plan	1
2. TARGET PUBLICS	2
2.1 Learners	2
2.2 Educators	3
2.3 Students	3
2.4 Science interpreters	3
2.5 Journalists	4
2.6 Industry	4
2.7 Scientists and researchers	4
2.8 Decision makers and policy makers	5
2.9 Tourists	5
2.10 Indigenous knowledge holders	5
2.11 General public	5
3. PROJECTS AND ACTIVITIES TO IMPLEMENT THE STRATEGY.....	6
3.1 Making science education and careers appealing	6
(a) Science career awareness	6
(b) School-based science engagement initiatives	7
(c) Science activities for children	8
(d) Popularisation of human capital and research capacity development policy interventions.....	8
(e) Advocating Life Orientation curriculum enrichment	8
(f) Public participation programmes	8
3.2 Developing publics that engage critically with science issues	8
(a) Citizen-centred dialogue platforms	9
(b) Making public engagement a condition of research grant awards	9
(c) Incorporating science engagement outreach into continuing professional development for scientists	9
(d) Taking science to decision makers	10
(e) Science Forum South Africa	10
(f) Science engagement conferences	10
(g) Online public social sciences initiative	11
(h) Public seminar and lecture series	11
(i) Proactive and reactive agenda setting	11
(j) Science shop	11
3.3 Science communication advancement.....	12
(a) Development of science communication skills	12
(b) Interfacing corporate communication with science communication.....	13
(c) Promoting science communication through competitions.....	13
(d) Positioning media as a science engagement and dialogue platform	13



3.4	Profiling South African science, technology and innovation	15
(a)	Establishment of a web portal for published papers	15
(b)	Development and deployment of complementary learning and teaching support materials	15
(c)	Sustaining sector-specific science engagement initiatives	15
(d)	Exhibition of South African inventions, innovations and discoveries	15
(e)	Raising awareness of RDI-enabling instruments	16
(f)	Showcasing success stories from publicly funded research	16
(g)	Science tourism	16
(h)	Promoting the industry-based visitor centre concept	16
(i)	International relations opportunities	16
3.5	Integrated science engagement initiatives	17
(a)	Mass participation events	17
(b)	Science centres	17
(c)	Website	17
4.	ESTABLISHING CAPACITY TO DELIVER THE PLAN	18
4.1	Enabling legislative framework	18
4.2	Access to science engagement infrastructure	18
(a)	Science centres	18
(b)	Access to other science awareness spaces	18
(c)	Access to the school system	18
4.3	Building SAASTA's capacity to deliver on its new mandate	19
4.4	Science engagement grant management system	19
5.	FISCAL IMPLICATIONS	19
6.	MONITORING AND EVALUATION	20
6.1	Programme-level M&E	20
6.2	System-level M&E	20
7.	ROLES AND RESPONSIBILITIES OF IMPLEMENTATION COLLABORATORS	21
7.1	Department of Science and Technology	21
7.2	South African Agency for Science and Technology Advancement	22
7.3	Generic roles of the DST entities and the specialised service delivery unit	23
7.4	Roles limited to individual entities and specialised service delivery	24
7.5	Higher education institutions	24
7.6	Southern African Association of Science and Technology Centres	24
7.7	Private/non-governmental science promotion event organisers	25
8.	RISK MANAGEMENT	25
9.	REFERENCES	26
	ANNEXURE A: PHYSICAL SPACES FOR SCIENCE ENGAGEMENT	27
	ANNEXURE B: IMPLEMENTATION ACTION PLAN	28
	ANNEXURE C: RISK MATRIX	30

ABBREVIATIONS

ASSAf	Academy of Science of South Africa
ASSC	After-School Science Club
CBPR	Community-Based participatory research
CPD	Continuing professional development
CREST	Centre for Research on Evaluation, Science and Technology
CSIR	Council for Scientific and Industrial Research
DST	Department of Science and Technology
HSRC	Human Sciences Research Council
LTSM	Learning and teaching support materials
M&E	Monitoring and evaluation
MEME	Micro-enterprise Media Engine
NIPMO	National Intellectual Property Management Office
NRF	National Research Foundation
NSW	National Science Week
SAASTA	South African Agency for Science and Technology Advancement
SAASTECH	Southern African Association of Science and Technology Centres
SACNASP	South African Council for Natural Science Professions
SANEF	South African National Editors' Forum
SARCHI	South African Research Chairs Initiative
SAYAS	South African Young Academy of Science
SEIMS	Science Engagement Information Management System
SES	Science Engagement Strategy
STEMI	Science, Technology, Engineering, Mathematics and Innovation
RDI	Research, Development and Innovation
TIA	Technology Innovation Agency

GLOSSARY

The science promotion sphere is characterised by inconsistent nomenclature and use of concepts. To ensure clearer understanding of the concepts embraced by the Science Engagement Strategy, which in turn inform the design of projects and activities in this Implementation Plan, explanations of the various terms used are set out below.

Community-based participatory research (CBPR) - a partnership approach to research that equitably involves, for example, community members, organisational representatives and researchers in all aspects of the research process and in which all partners contribute expertise and share decision-making and ownership. The aim of CBPR is to increase knowledge and understanding of a given phenomenon and integrate the knowledge gained with interventions and policy and social change to improve the health and quality of life of community members (Wikipedia, 4 March 2017).

Corporate communication - the message issued by a corporate organisation, body, or institute to its publics. Publics can be both internal (employees or stakeholders) and external (media, government, industry bodies and institutes, and the general public). Corporate communications help organisations explain their mission and combine its many visions and values into a cohesive message to stakeholders (IACACT, 2012).

Indigenous knowledge - the local knowledge that is unique to a given culture or society. This is usually passed down from generation to generation by word of mouth. It is the basis for agriculture, fishing, health care, food preparation, education, carpentry, tool making, environmental conservation and a host of other activities (UNESCO, 2010).

Industrial tourism - visits to sites that showcase a particular type of expertise from the past, present or future to the general public. Industrial tourism can be divided into three categories, namely industrial heritage tourism, visits to companies that open their doors to visitors to highlight their production methods and science tourism (France, 2007).

Programme – When not referring to a Department of Science and Technology branch, a programme is a portfolio comprising multiple projects that are managed and coordinated as one unit with the objective of achieving outcomes and benefits for the organisation (Independent Consulting Bootcamp, 2017).

Project – a project in the context of this Implementation Plan refers to initiatives in which resources are expended in pursuit of the society envisioned by the Science Engagement Strategy (Gittinger, 1984).

Public awareness of science – aims to stimulate awareness of and positive attitudes (or opinions) towards science (Burns, O'Connor and Stocklmayer, 2003).

Public engagement with science – a dialogue and mutual learning between the public and the scientific community to advance greater public participation in and understanding of complex decision-making on matters related to science and technology.

Public understanding of science – focuses on understanding science, its content, processes and social factors (Burns, O'Connor and Stocklmayer, 2003).

Science – encompasses systematic knowledge spanning natural and physical sciences, engineering sciences, medical sciences, agricultural sciences, mathematics, social sciences, technology, all aspects of the innovation chain and indigenous knowledge.

Science café – an event that takes place in a casual setting such as a pub or coffee shop, is open to everyone, and features an engaging conversation with a scientist about a particular topic. A science café starts with a short introduction by experts that present themselves and the subject of the discussion, after which the microphone is offered to the public and the rest of the event is driven by questions (Bagnoli and Pacini, 2011).

Science communication – the use of appropriate skills, media, activities and dialogue to produce one or more of the following personal responses to science: awareness, interest, enjoyment, opinion forming and understanding (Burns, O'Connor and Stockmayer, 2003).

Science engagement – an overarching term that includes all aspects of public engagement with science, science communication, science literacy and science outreach and awareness (SES, 2015).

Science interpreter – someone who reflects upon the significance of science and technology in society, and promotes mutual communication and coexistence between the wider society and the scientific community (University of Tokyo, 2010).

Science literacy – knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity (Literacynet.org, 2009).

Science shops – organisations that do pro bono or low-cost research for community groups. They solicit research questions from the community groups and then find university researchers to conduct research into these questions in the natural, technical, and social sciences (Farkas, 2002).

Scientific literacy – where people are aware of, interested and involved in, form opinions about and seek to understand science (Burns, O'Connor and Stockmayer, 2003).

Town hall meeting – a public meeting, where members of a community are given an opportunity to speak or share their views on a science topic or related issues. Such a meeting could be held in a local municipality or tribal council building (Wikipedia, 3 May 2017).

EXECUTIVE SUMMARY

The Science Engagement Strategy (SES) was approved by the Minister of Science and Technology in January 2015. The SES formalises and provides strategic direction to the science engagement programme led by the Department of Science and Technology (DST), which dates back to 1998. An SES Implementation Framework providing an overview of projects and initiatives towards the implementation of the SES was drafted and approved by Executive Committee of the DST in March 2015.

This document provides more detail on how the SES will be executed. The level of information provided in the Implementation Plan is adequate to inform the development of individual project implementation strategies, through either the conceptualisation of new project strategies or the alignment of existing projects and activities with the SES. The Implementation Plan will be reviewed every five years and adjusted accordingly.

Projects and activities outlined in the Implementation Plan are intended to contribute collectively to building a society that is scientifically literate/knowledgeable about science, and engages critically with science issues. Eleven groupings will be targeted to achieve this - learners, educators, students, scientists and researchers, science interpreters, decision makers and policy makers, journalists, tourists, industry, holders of indigenous knowledge and the general public.

The Implementation Plan is broadly aimed at -

- encouraging learners and young people in general to participate in science;
- enabling citizens in general to develop independent, informed opinions on science issues;
- positioning science communication as an effective enabler of science engagement;
- creating opportunities for citizens to realise the value of science.

For the Implementation Plan to be successfully executed, the following are needed:

- An enabling legislative framework - The South African Agency for Science and Technology Advancement (SAASTA), which is assigned the role of national coordinator of the SES, is part of the National Research Foundation (NRF). In its current form the NRF Act does not include a science engagement mandate. The legislation therefore needs to be amended to incorporate SAASTA's science engagement role.
- Enhanced access to science engagement infrastructure - Science centres are the key infrastructure for science engagement. Existing science centres would have to be strengthened and, where funds permit, new centres established. The Implementation Plan does not deal with how the development of science centres will be supported; this will be dealt with in a separate support framework for science centres. Efforts will be made to secure access to other forms of infrastructure, particularly in the quest for broadening the geographic coverage of the SES. Annexure A presents a list of such infrastructure.
- Capacity building at SAASTA - The form in which SAASTA currently exists is aligned to its present role in the NRF, which is to coordinate science engagement within the NRF. In addition to properly resourcing SAASTA, it is necessary to align the organisation to the new mandate.
- A grant management system - SAASTA's responsibilities will include awarding grants to institutions involved in science engagement. A grant management system will therefore be developed.
- A stable funding model for science engagement - Additional funding and a stable funding source for science engagement is required. This will be achieved by top-slicing up to 4% of the annual transfer budgets of designated DST Programmes (branches), namely Programmes 3 to 5. A similar or related approach is envisioned with the annual baseline funding allocations to the entities of the DST.

The execution of the Implementation Plan will be the responsibility of multiple stakeholders, with SAASTA playing a coordination role and the DST acting as the line department. Attempts have been made to clarify the roles and responsibilities of key stakeholders and role players. Part of SAASTA's key responsibilities is to ensure that stakeholder involvement is aligned to the SES and relevant data is collected accordingly.

The Implementation Plan does not include details on monitoring and evaluation, but simply provides an overview (Figure 2) of the Science Engagement Monitoring and Evaluation Framework that will be developed as a separate process. The execution of the Implementation Plan will be tracked in terms of the action plan in Annexure B.

In an attempt to identify and mitigate against potential risks to this Implementation Plan, the Directorate: Science Promotion will develop a risk register and risk management plan every year in collaboration with the Directorate: Enterprise Risk Management. These will be linked to the risk matrix in Annexure C, which will be updated annually.

I. INTRODUCTION

I.1 Background

The DST seeks to develop a society that is literate/knowledgeable about science and engages critically with science issues. Endeavours to do so date back to 1998 and have continued over the years without adequate strategic coherence. In order to formalise and guide a national programme towards the envisioned society, the DST adopted the SES in January 2015. In terms of the strategy, the envisioned society will be realised by pursuing four objectives that will shape all future DST-led science engagement initiatives and provide a basis for realigning existing initiatives. These objectives are the following:

- (a) To popularise science, engineering, technology and innovation as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers.
- (b) To develop a critical public that actively engages and participates in the national science and technology discourse to the benefit of society.
- (c) To promote science communication that will enhance science engagement in South Africa.
- (d) To profile South African science and technology achievements domestically and internationally, demonstrating their contribution to national development and global science, thereby enhancing their public standing.

The implementation of the SES should be preceded by a carefully executed planning process. A point of departure in that regard was the approval of the SES Implementation Framework by the DST's Executive Committee in March 2015. The Implementation Framework provides a broad overview of programmatic approaches to address the four strategic aims, measures to create an enabling implementation environment (which includes strengthening existing systems and establishing new ones) and indicators for monitoring and evaluation (M&E).

I.2 Purpose of the Implementation Plan

The execution of the SES entails (a) establishing the systems necessary to pursue a science engagement programme aligned to its four objectives, and (b) the implementation of a series of intervention projects. The purpose of this Implementation Plan is to provide an outline of the systems to be established and projects to be undertaken. The information provided by this plan is enough to inform the development of detailed individual project business plans. The plan also outlines the resources required to execute the SES in terms of programmatic cost estimates and administration costs, roles to be played by various institutions in the implementation of the programme and ways of increasing access to programme delivery infrastructure. The Implementation Plan will be reviewed every five years.

2. TARGET PUBLICS

The strategic aims of the SES will be realised by designing and implementing projects that target the 11 designated sections of society (publics) depicted in Figure 1. It will be useful to establish the reasons for targeting these publics, which in turn provide a contextual basis for designing projects.

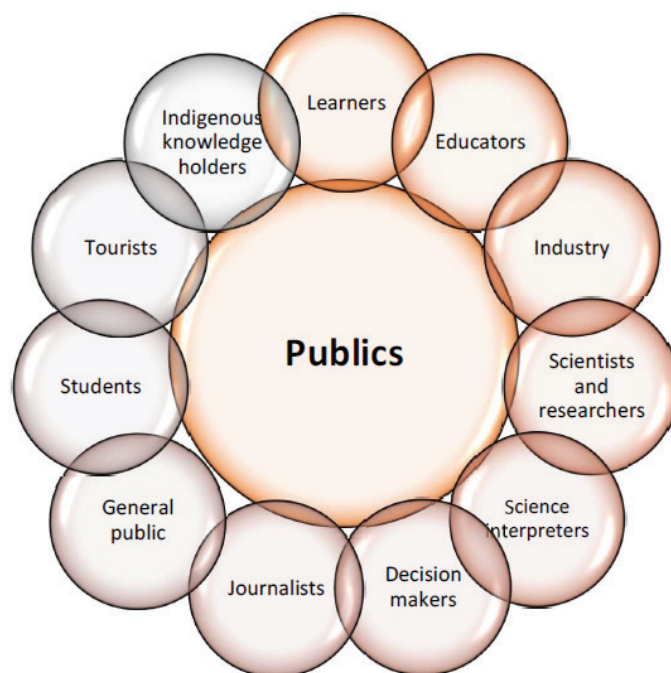


Figure 1: Publics targeted by the SES

2.1 Learners

Learners constitute between 20% and 25% of the country's population and are therefore a vital part of building the society envisioned by the SES. Learners are fundamental to the development of the skills necessary for the development of a well-functioning national system of innovation. Science engagement projects targeting learners will therefore seek to achieve the following:

- (a) Stimulate interest in and build positive attitudes towards science subjects and careers. In approaching this issue, attention should be given to establishing initiatives and/or activities appropriate to various phases of basic education, namely the Foundation Phase (Grades R–3), Intermediate Phase (Grades 4–6), Senior Phase (Grades 7–9) and Further Education and Training Phase (Grades 10–12).
- (b) Provide a platform for expressing and extending the knowledge gained from formal classroom learning, giving learners a sense of purpose in learning science.
- (c) Enable learners to engage with science mentally and physically through school innovation projects as part of nurturing problem-solving skills.
- (d) Create an enabling environment for the development of science communication skills among learners showing science-related talent and potential.
- (e) Use informal and less formal means to complement the learning and teaching of science subjects, with a particular focus on making learning and teaching of these subjects stimulating.
- (f) Teach learners about the protection of intellectual property and the innovation value chain.

- (g) Develop science as a recreational activity among learners.

2.2 Educators

All the expected outcomes from science engagement projects targeting learners are easily attainable with support from science and mathematics educators at schools. In their daily role, these educators impart scientific and mathematical information to their learners. In order to enhance the educators' ability to provide the necessary support, relevant science engagement projects will attempt to achieve the following:

- (a) Position science educators as promoters and facilitators of learners access to information on science-related careers.
- (b) Make available informal and/or non-formal approaches that make the teaching and learning of science and mathematics stimulating. These will include skills to develop science enrichment tools from readily available materials and promoting the use of inquiry-based learning.
- (c) Give science educators the skills to communicate scientific concepts to learners in a way that links them to real-world examples relevant to their immediate environment, and the ability to identify sources of additional information.

2.3 Students

These are aspirant scientists, researchers and innovators. Science engagement projects targeting them will aim to achieve the following:

- (a) Create familiarity with the innovation value chain and management of intellectual property.
- (b) Encourage lifelong learning.
- (c) Develop and sharpen science communication skills.
- (d) Encourage the pursuit of postgraduate studies and generate exposure to existing support instruments to enable students to pursue such studies. These include bursaries and research programmes such as the centres of excellence and the South African Research Chairs Initiative (SARChI).
- (e) Encourage the development of interest in scientific fields beyond their areas of specialisation.
- (f) Create opportunities for willing university students to provide mentorship to high school learners who are involved in extracurricular science activities.

2.4 Science interpreters

These are science communication practitioners found in places like science centres, natural science museums and botanical and zoological gardens. They are intermediaries between science and society. Science engagement projects targeting these practitioners aim to achieve the following:

- (a) Enhance the practitioners ability to explain science to anyone (including the non-scientific community) in understandable and user-friendly ways that stimulate two-way engagement.
- (b) Develop their skills to communicate science through interactive exhibits and related tools.

- (c) Enhance their skills in conceptualising science engagement activities and creative science communication tools, such as exhibits.

2.5 Journalists

The kind of work done by journalists in reporting news for electronic and print media positions them as another group of intermediaries between science and society. The 2013 South African Social Attitudes Survey found television to be the main source of scientific information among South Africans, followed by radio and then print media. Science engagement projects targeting journalists are intended to enhance their skills and confidence in the following:

- (a) Reporting and writing newsworthy and accurate science stories.
- (b) Obtaining the information they need from scientists in a way that encourages scientists to participate more in knowledge sharing through media.
- (c) Identifying sources of science stories, including locating scientists to provide scientific opinions on their prepared stories prior to publishing.
- (d) Integrating science storylines in social news reports.

2.6 Industry

Industry uses science to contribute to the economic growth of the country (part of the knowledge-based economy). Science engagement projects targeting industry will attempt to achieve the following:

- (a) Popularise existing science and technology policy instruments intended to encourage and build capacity for research and development.
- (b) Provide a platform for local industry to be exposed to technologies that can improve their operating efficiency.
- (c) Encourage the development of industrial tourism anchored on the visitor centre concept.
- (d) Create opportunities for industry-based science professionals to contribute to science talent and nurture potential at school level.

2.7 Scientists and researchers

Scientists and researchers are the key source of knowledge and information that makes public engagement with science necessary, and they need to bridge the gap between science and society using this knowledge. Science engagement projects targeting them will therefore seek to increase participation in science engagement and help them to excel in this role. Such projects will focus on achieving the following:

- (a) Inculcate a culture of engaging the public on science issues.
- (b) Develop science communication skills, including in writing media articles and handling media interviews.
- (c) Establish science dialogue opportunities and platforms for scientists and researchers to engage with the public.

- (d) Raise awareness among scientists and researchers about existing instruments and/or institutions to enhance research, development and innovation such as the Technology Innovation Agency (TIA), the research and development tax incentive, etc.

2.8 Decision makers and policy makers

These include members of Parliament, members of the Portfolio Committee on Science and Technology, policy makers and traditional leaders. In the execution of its responsibilities, Parliament passes new laws, amends existing laws and repeals old ones. Furthermore, government departments annually table their budgets in the legislature for consideration. This means that any meaningful participation in science debates in the legislature and parliamentary committees requires that members of the house have the relevant insight. Science engagement projects targeting members of the National Assembly will therefore focus on the following:

- (a) Imparting knowledge about the national system of innovation.
- (b) Raising awareness about the priorities of the DST.
- (c) Communicating the work and achievements of the DST and its entities.
- (d) Strengthening MPs' participation in science and technology debates by enhancing their access to relevant sources of information.
- (e) Positioning both political and traditional leaders to encourage their constituencies and subjects to follow science-related subjects and careers.

2.9 Tourists

Endeavours to promote South African science include targeting both local and international tourists. Projects in this regard will focus on the following:

- (a) Incorporating science into the country tourism and recreational activities mix.
- (b) Positioning South Africa as a country that is making a meaningful contribution to global scientific and technological progress.

2.10 Indigenous knowledge holders

Holders of indigenous knowledge will be targeted with initiatives or activities aimed at the following:

- (a) Empowering them to be active in the protection, promotion, development and management of indigenous knowledge systems.
- (b) Facilitating the interface between mainstream science and indigenous knowledge.

2.11 General public

Any section of society not covered in paragraphs 2.1 to 2.10 is considered the general public. The science engagement projects targeting the general public do not have outcomes unique to this group. The science engagement projects targeting the general public also have benefits for the other publics, and those targeting other publics can also directly or indirectly benefit the general public. Overall, science engagement projects targeting the general public are expected to achieve the following:

- (a) Create familiarity with and understanding of the environment in which they live and the science related to this.
- (b) Enable the formulation of independent, informed opinions on science and technology issues, including ensuring that science and technology are used for the public good.
- (c) Improve the attitude towards and appreciation of science.

3. PROJECTS AND ACTIVITIES TO IMPLEMENT THE STRATEGY

The SES will be implemented through a series of projects that are meant to achieve the results or outcomes associated with the publics outlined in par. 2. Figure 1, which depicts the publics targeted by the SES, shows the interconnectedness of these publics. The nature of science engagement means that benefits generated by an initiative targeting one of the publics usually also benefit other publics. Projects and activities in this Implementation Plan are therefore not necessarily structured to match each target public precisely.

In this regard, science engagement encompasses five concepts: public engagement with science, public awareness of science, public understanding of science, scientific literacy, and science communication.

3.1 Making science education and careers appealing

The focus of projects and activities in this category is on young people in school and higher education systems, as well as sections of society considered to have an influence on young people. The intention is to encourage young people's participation in science and contribute to efforts to achieve the National Development Plan (Vision 2030) target of increasing the number of students eligible to study towards mathematics and science-based degrees to 450 000 by 2030 – necessary for the development of skills required by the knowledge-based economy.

(a) Science career awareness

This will be pursued in a number of ways:

- (i) Science career awareness is one of the four strategic focus areas of science centres that are aligned to and supported by the DST. In all these science centres (there are currently 35), the career awareness function will be strengthened where it exists and established where it does not exist. In both instances, the science career services offered will be aligned to the Department of Higher Education and Training's Framework for Cooperation in the provision of Career Development (Information, Advice and Guidance) Services in South Africa (October 2012). Aligned to this framework, the science centre-based science career development services will include career advice, career planning and career information.
- (ii) The existing science career publication that is updated every three years will be continued. The booklet carries well researched content on key science-related careers of the present and future and maps out career paths up to the level of researcher. The signing of collaboration agreements under way between the DST and the provincial departments of education will reinforce the direct distribution of the publication to schools, where it will complement the delivery of Life Orientation and science lessons.
- (iii) Further science career development services will be provided through career fairs hosted by stakeholders as required, and through DST-led integrated science engagement initiatives such as the annual National Science Week. Integrated science engagement initiatives are detailed in par. 3.5.
- (iv) Contact sessions between science professionals and learners or students will be

used to provide role models to young people. SAASTA's role model initiative will be strengthened through partnership with the South African Council for Natural Scientific Professions (SACNASP) and the South African Young Academy of Science (SAYAS). The two organisations will facilitate access to a pool of professionals to participate in the role modelling initiative.

- (v) Innovative technologies, mainly online, will be used to enhance learners' and students' knowledge about science careers, as well as to provide science career planning tools.

(b) School-based science engagement initiatives

In collaboration with the provincial departments of education, a structured school-based science engagement initiative will be established to make learning and doing science fun and appealing to learners. Where possible, the initiative will be linked to the delivery of the Department of Basic Education's National Strategy for Mathematics, Science and Technology Education and/or provincial mathematics, science and technology education strategies (where they exist) as a collaborative effort between the DST and voluntarily participating provincial education departments.

Implementation of a structured school-based science engagement initiative will entail the establishment of an after-school science club (ASSC) in one, or a group of, participating schools. The exact approach will be determined by taking the situation in each province into consideration, and in consultation with the relevant provincial department of education. An ASSC will be a hub of extracurricular science activities, and learners who join an ASSC will do so by choice. In order to encourage ownership among learners, ASSCs may be managed by a committee of learners, with technical support provided by SAASTA directly or through a third party.

The actual programme content cannot be prescribed, but will encompass the following:

- (i) Nurturing learners' problem-solving skills through participation in science Olympiads and competitions. The intention is to provide learners with an opportunity to apply the scientific and mathematical concepts learnt from formal classroom lessons to problem-solving environments. The initiative will incorporate mentorship and coaching of learners by professionals enlisted through SACNASP and SAYAS, among others.
- (ii) Stimulating scientific research curiosity in learners using programmes such as the Global Learning and Observations to Benefit the Environment. This is a science and education programme that provides learners and the public with an opportunity to participate in data collection and the scientific process, and contributes meaningfully to people's understanding of the Earth system and global environment.
- (iii) Training of learners in science communication (particularly those involved in science fair projects) and involving them in scientific debates. In this regard, the SAASTA debate competition will be strengthened, expanded and made more accessible.
- (iv) Exposing learners participating in science fair projects to the innovation value chain, intellectual property protection and intellectual property rights. This is meant to enable progression of science fair project ideas to the market and ensure that learners reap the full benefits of their ideas or inventions, where possible.

(c) Science activities for children

The intention is to make children enthusiastic about science at an early age. There is no evidence of research done in South Africa on the subject, and a study is being carried out to establish appropriate ages and approaches to introduce science activities for children in the South African context, taking the country's socio-economic environment into account, among other factors.

(d) Popularisation of human capital and research capacity development policy interventions

There will be a campaign targeting undergraduate students and graduates participating in work preparation programmes across government, entities and industry to raise awareness of and/or facilitate access to the following opportunities:

- (i) Postgraduate bursaries and scholarships offered by the NRF.
- (ii) Publicly funded research programmes that have been established in order to develop the country's research and innovation capacity, such as SARChI and the centres of excellence.
- (iii) Institutional interventions to enable the development of ideas from concept to commercialisation and intellectual property management, currently offered by TIA and the National Intellectual Property Management Office (NIPMO).

The campaign to popularise human capital and research capacity development instruments will be incorporated into selected existing initiatives like university open days, integrated science engagement initiatives such as the annual National Science Week (NSW) and special orientation sessions for graduates participating in work preparation programmes. Further opportunities will be created through collaborations with student associations for specific science fields. An example is the Postgraduate Students Association for Natural and Agricultural Sciences at the University of Pretoria, which promotes postgraduate activities in these fields at the university.

(e) Advocating Life Orientation curriculum enrichment

Not only learners belonging to ASSCs need to know about intellectual property rights. Holders of indigenous knowledge, musicians and artists are vulnerable to exploitation. Through its collaboration arrangement with the Department of Basic Education, the DST will advocate for the incorporation of intellectual property management in the Life Orientation curriculum.

(f) Public participation programmes

As required by Cabinet, the Minister of Science and Technology conducts public meetings (sometimes known as izimbizo) to consult with communities. These gatherings, although intended to allow participants to interact directly with the Minister, have also proved useful as a platform for the DST and its partners to engage with the community on science. As a way of formalising izimbizo as a science engagement platform, the programme for every such gathering will incorporate a science exhibition, fun science experiments and related demonstrations. Where possible, the science engagement part of the izimbizo programme will extend over two days, potentially including outreach up to 60 km from the main venue.

3.2 Developing publics that engage critically with science issues

The focus is on creating an enabling environment for dialogue to take place among scientists, and between scientists and the non-scientific community; and ordinary citizens to have access to scientific research, and opportunities to influence the selection of research priorities. As a general guideline, the determination of dialogue topics will be informed by proposals or recommendations from stakeholders (including communities), natural phenomena that need to be studied by scientists and government policy considerations involving the possible use of technologies that could affect society and the environment.

(a) Citizen-centred dialogue platforms

In the context of this Implementation Plan, citizen-centred dialogue platforms refer to the use of social and recreational spaces for public engagement with science. Citizen-centred dialogue platforms under consideration include the following:

- (i) Science cafés** – Entertainment venues, clubs and restaurants are examples of places where scientists and patrons can engage with one another. The endeavour will be built on the success and experiences of the Science & Cocktails initiative. The website of this non-profit initiative describes it as “bring[ing] science and entertainment closer together by creating a series of public lectures intertwined with music/art performances and smoky dry-ice chilled cocktails in your hand” (Science & Cocktails, 2015). Science & Cocktails “aims to create a relaxed platform where researchers and audience are on equal footing and conversations can be easily followed while sipping a Famous Penicillin cocktail side by side with your favourite scientist.” Started in July 2015, a Science & Cocktail event now happens monthly at the Orbit Jazz Club in Johannesburg and is supported by, among others, the National Institute for Theoretical Physics, which is currently funded by the DST through the NRF.
- (ii) Town hall meetings** – These meetings will be organised at set intervals. An arrangement will be sought with district and metropolitan municipalities towards having one town hall meeting per year in their area. Lessons will be drawn from the strong partnership that has been established between the DST and the City of Tshwane Metropolitan Municipality.

In both instances discussed above, grant funding will be made available to scientists who are prepared to make their own arrangements to engage people through such platforms, and freelancers who organise such activities, securing strategic partners, scientists and venues.

(b) Making public engagement a condition of research grant awards

Through the NRF, the DST, and in some instances other government departments like the Department of Higher Education and Training, provide training grants for postgraduate study opportunities in the quest to build and improve research capacity in the country. To the same end, 198 DST-NRF research chairs were awarded to public universities between 2006 and 2015 through SARChI. Furthermore, 15 DST-NRF centres of excellence were established between 2004 and 2014 at public universities and research councils.

In future, the conditions for research training grants and programmes awarded to science councils and universities will make it mandatory for recipient individuals and organisations to engage with the public on their research. Platforms that will be used by scientists and researchers in this regard will include the citizen-centred dialogue platforms mentioned in par. 3.2(a), integrated science engagement initiatives, conferences, public lectures and seminars.

(c) Incorporating science engagement outreach into continuing professional development for scientists

The South African Council for Natural Scientific Professions, the legislated regulatory body for natural science professionals in the country, registers professional, candidate and certificated natural scientists in 24 fields of science practice. SACNASP’s responsibilities include the renewal of professional registrations. It has developed a fully fledged continuing professional development (CPD) system, and professionals have to complete the required CPD activities over a five-year cycle to renew their registration. There are currently three categories in which professionals can claim credits, but SACNASP has agreed in principle to incorporate public engagement in science as an additional area in which credits can be claimed.

(d) Taking science to decision makers

Initiatives will be developed to target decision makers identified in this plan. Lessons will be drawn from international partners with well-established initiatives in this regard.

(e) Science Forum South Africa

The inaugural Science Forum South Africa was held over two days in December 2015 and a second forum was held in 2016. The experience from these two events, with efforts for continuous improvement and international benchmarking, will help to shape the future of this initiative. The Forum is intended to -

- create a platform for a vibrant debate on the role of science in society in South Africa;
- strengthen South Africa's strategic international science partnerships;
- create a platform for senior government leaders, academics, scientists, industry, civil society and students to interact.

The Forum is an opportunity for scientists to engage each other and the non-scientific community on science issues, including the social sciences.

(f) Science engagement conferences

A two-pronged support approach will be adopted to position conferences as reliable science engagement platforms:

(i) Automatically supported conferences - The financial needs of these conferences will be included automatically in SAASTA's annual science engagement budget:

- Annual Conference of the Southern African Association of Science and Technology Centres - This conference is already receiving support from the DST. It is a conference for practitioners where science interpreters from science centres and related facilities engage each other. Lately, the conference has been attracting interest from scientists outside the science interpretation environment.
- Annual Science, Technology, Engineering and Mathematics (STEMI) Olympiads and Competitions Community of Practice Conference - This conference brings together government officials, educators, professional associations, researchers and other groups that are interested in enhancing the status and role of STEMI Olympiads and competitions in South Africa. The inaugural conference was in March 2016.
- Public engagement with science conference - In an endeavour to promote intellectual discourse in science engagement, a new Department of Higher Education and Training -accredited conference will be held every three to four years. The proposed timing would be after the release of the report on a public attitude to science study planned by the DST. Such a conference could well be the responsibility of a higher education institution or the Human Sciences Research Council (HSRC). The necessary investigations and consultations will be made in this regard.

(ii) Ad hoc conferences - A conference fund will be set up and based on a set of criteria yet to be developed. Grants will be awarded for local conferences and local scientists' participation in selected international conferences under the following circumstances:

- Local professional and related bodies in the field of sciences that hold scheduled conferences to further their own objectives. Such conferences will be eligible for funding from the science engagement fund. Conferences will be considered for funding if their programmes have space for professionals to engage in some form of science communication. Alternatively, conference delegates can embark on outreach science engagement activities in communities near the conference venue.

- Financial support will be considered for South African scientists and postgraduate students wishing to present papers at international conferences. The funding criteria will include the requirement that the papers to be presented at such conferences should enhance South Africa's image in international science circles.

(g) Online public social sciences initiative

An online resource will be created to document projects in which social scientists are working with community partners and cultural institutions to produce new knowledge. The initiative will explore social media platforms to establish a network of connection between higher education institutions, science councils, cooperatives and local communities by creating a virtual community where issues relating to active citizenship, public engagement and the contribution of social sciences to civil society may be debated beyond strictly academic circles, and where opportunities for future collaborations may be sought.

(h) Public seminar and lecture series

The existing seminar and lecture series by the NRF (Science for Society), the HSRC (Seminar Series, Human and Social Dynamics Seminar Series, and Innovation for Inclusive Development Policy Seminars) and the Academy of Science of South Africa (ASSAf) (Public Lectures by Distinguished Visiting Scholars) will be retained, enhanced and expanded. Other stakeholders and role players involved in knowledge generation, for example higher education, could be involved, particularly as part of their community engagement programmes. An inventory of existing initiatives will be established to help identify existing public seminars and lectures that should be enhanced within the context of the SES.

(i) Proactive and reactive agenda setting

Global and local issues will form an integral part of setting the science engagement agenda, and SAASTA will therefore establish and maintain an effective information gathering system that enables both proactive and reactive science engagement.

Proactive engagement with science - Surveillance of global science issues will be conducted on a continuous basis to establish megatrends in the science space that could affect people and/or the environment in one way or another. Where considered necessary, public engagement activities will be pursued to enable South Africans to gain the necessary knowledge and awareness of such matters.

Reactive engagement with science - As government seeks to improve service delivery and business seeks to maximise profits, they may want to adopt technologies that could be perceived as being dangerous to human life or the environment, triggering controversy. In such instances, a public engagement initiative focusing on the controversial technology will be instituted. Furthermore, communities exposed to environmental conditions that could negatively affect their lives, can manage these conditions better with access to the relevant information. An example is the increased use of unsafe borehole water, particularly in rural areas. In this regard, SAASTA will find a way of identifying potential problematic issues and mitigate the potential hazards through science engagement with communities. Such an approach could be considered as responsible science engagement.

(j) Science shop

A science shop is a facility, often attached to a specific university department or a non-governmental organisation, which provides independent, free, community-based participatory research support in response to problems experienced by the community. It is a demand-driven and bottom-up approach to research.

A desk study shows that the advantages of locating a science shop at a university outweigh any disadvantages. At a university, research capacity is supplied by students (as part of their studies) under staff supervision. Universities have some standing in society as being independent and objective reservoirs of knowledge. The benefits of science shops working within a university (or across a number of universities) include the following:

- (i) Access to academics and students in many disciplines; it is crucial to have a supply of knowledge and research capacity to answer questions from civil society groups.
- (ii) Students are easily able to volunteer at science shops, thereby enhancing the capacity of science shops to carry out their mandate.
- (iii) As academic university staff supervise the students, the quality of research outputs can be monitored.
- (iv) Efficiency resulting from physical proximity and organisational coherence.

Against the above considerations, the appropriate location of the envisioned science shop will be a university. It would also be prudent to locate this initiative at a university that hosts DST-NRF research programmes with science engagement relevance. The intention is to establish the first science shop in the country at Stellenbosch University because its Centre for Research on Evaluation, Science and Technology (CREST) hosts the DST-NRF Centre of Excellence in Scientometrics and Science, Technology and Innovation Policy, as well as the SARChI Chair in Science Communication. CREST has the social science research background and skills required.

3.3 Science communication advancement

The SES directs that science communication be developed as a domain and structured in a way that contributes to the attainment of a society that is knowledgeable about science, scientifically literate and critically engaged in science-related matters. The projects below have been identified because of their potential ability to achieve these goals.

(a) Development of science communication skills

The development of science communication skills will occur at three broad levels:

- (i) **Basic science communication skills** - To a significant extent, the attainment of the society envisioned by the SES depends on the dissemination of information by scientists and researchers, science interpreters, educators, journalists, students and learners. Therefore, a sustainable and enabling environment has to be created for these publics to acquire basic science communication skills. Given the lack of capacity to provide training in basic science communication skills, the starting point will be to work with a local university to establish an appropriate science communication course.

Work is at an advanced stage to establish the required training capacity at the University of Limpopo, which was chosen for two reasons: (1) it is a historically disadvantaged institution, and (2) the intention is to model the envisioned course on the science communication course offered by the Canadian-based Laurentian University. The programme at this university is offered in collaboration with a science centre. The University of Limpopo has a science centre at its Turfloop campus, and its School of Physical and Mineral Sciences has an existing collaboration agreement with Laurentian University.

It is envisioned that two types of science communication qualifications will be offered once the systems are in place, namely a postgraduate diploma and a short course. The long-term intention is to offer a BSc in Science Communication.

- (ii) **Science communication research skills** - The capacity to develop science communication research skills exists in South Africa under journalism studies, and science and technology studies in two local universities. Rhodes University and Stellenbosch University have DST-NRF SARChI Chairs for Science Communication.

This will improve the country's capacity to produce science communication graduates at master's and doctoral levels, and generate knowledge to shape the science communication domain.

- (iii) **Science journalism internship** - The intention is to approach the South African National Editors' Forum (SANEF) with a proposal for a jointly funded internship programme. Various media houses are running general internship programmes. The envisioned science journalism internship programme would entail providing annual grant funding to SANEF, which in turn would be accessed by media houses participating in the science journalism internship programme to top up the stipends for the interns they would be hosting. The duration of the internship programme will be determined in consultation with SANEF. The main responsibilities of the interns would be researching and pitching science stories.

(b) Interfacing corporate communication with science communication

The DST and its entities have the corporate communications functions that are meant to communicate messages associated with organisational image building aimed at stakeholders. If carefully structured and executed, corporate communication messages disseminated by these organisations may raise people's awareness of and interest in science. In this regard, whenever practically possible, the corporate communications of the DST and its entities will aim to generate awareness, understanding, enjoyment of, interest in and the forming of opinions about science. To achieve this, corporate communicators will collaborate with scientists, researchers and/or science engagement practitioners in developing their messages.

(c) Promoting science communication through competitions

Relevant competitions will be used to promote science communication. There are already two such competitions for which support will be continued and expanded:

- (i) **Science slam** - This competition originates in Germany and was introduced to South Africa through the German-South African Year of Science in 2012. It is a science communication activity where young scientists explain their research projects in 10-minute talks that should be easy to follow. The audience is then given an opportunity to vote for the most clearly articulated talk. The idea is to explain science in an understandable, entertaining and concise way. Science Slams take place outside universities and lecture halls, in cultural centres, theatres or clubs.
- (ii) **FameLab** - This is a training initiative in the form of a competition, which aims to get people talking about science. It originates in the United Kingdom and is led by the British Council, which is already collaborating with the DST and SAASTA to entrench the initiative in South Africa. FameLab participants progress through various competition stages, with winners of the national finals invited to travel to the United Kingdom and participate in the Cheltenham Science Festival. FameLab participants have three minutes to present a concept from their field of study to a panel of judges. The presentation has to be conducted in a manner that displays creativity without compromising the scientific accuracy of the concept being communicated.

(d) Positioning media as a science engagement and dialogue platform

- (i) **Mainstream electronic and print media** - The following approaches will be prioritised:
- **Television**
 - Integrating science storylines into popular local drama series is an opportunity to communicate science. The choice of programmes will be informed by the number, demographics and Living Standards Measure of the viewers.
 - Airtime will be secured with television stations for the airing of science documentaries that will be shot as and when deemed appropriate.

- Negotiations will be conducted to secure current affairs slots (at least one episode a year) to host a panel discussion on a science topic that will encourage critical engagement with science issues and policies.
- The “Mzansi for Science” television advertisement will be revisited. It has to be realigned with the SES. The advert should be understood as a science communication tool and its development should prioritise creating personal responses to science (i.e. awareness, interest, enjoyment, opinion forming and understanding).

- **Radio**

As per television, science stories will be integrated into radio theatre and radio current affairs programmes that accommodate interactive panel discussions. Such opportunities exist across public broadcasting radio stations. The possibilities offered by community radio stations will be explored further.

- **Print media**

A four-pronged focus will be adopted using print media as a platform for professionals to share information and get the nation thinking about science issues. Spaces will be secured from carefully selected print media houses to publish –

- articles on science topics;
- responsive articles prompted by developments in local and international science, including natural phenomena;
- periodic articles on developments and awareness regarding the science policy space;
- periodic articles to highlight how science is changing the lives of people.

In executing the above media-based science communication plan, the appropriateness of the media houses to be used will be prioritised, taking into consideration factors such as the target readership and accessibility.

(ii) **Mobile Internet television broadcast technology** - The Meraka Institute of the Council for Scientific and Industrial Research (CSIR) has created a platform called Micro-enterprise Media Engine (MEME). This new patented technology is a South African media innovation that is appropriate for high and low infrastructure regions. It is intended to broadcast live television streams over the mobile Internet with better picture quality than is currently possible with existing solutions, and at significantly lower cost. This initiative has been developed with the aim of creating entrepreneurship opportunities for the youth and a business model has been put in place seeking to create at least 20 South African mobile Internet television micro-enterprises. The initiative will be developed into a science communication platform.

(iii) **Social media** – Social media provides a huge potential as a platform for dialogue between scientists, and between scientists and the non-scientific community, as well as for the dissemination of science information. The decision on the appropriate social media science communication model will be preceded by a feasibility study. However, the focus will mainly be on the biggest mainstream networking sites in South Africa, namely Twitter (more than seven million users), Facebook (more than 13 million users), YouTube (more than eight million users) and LinkedIn (more than four million users).

3.4 Profiling South African science, technology and innovation

Local scientific and technological advancements will be profiled in order to enhance South Africans' appreciation of the value of science, to lobby for public support for government's continuous investment in science and technology, and to allow the public to hold government accountable for using science for the public good. Attention will also be given to popularising instruments that government, in particular the DST, has put in place to enable research, development and innovation (RDI) in the country.

(a) Establishment of a web portal for published papers

A web portal will be established, preferably under the NRF (because of its role in knowledge generation), as a repository of published science papers by South Africans. Authors will be able to upload versions of their published papers. As with the Academia.edu portal, those registered with the portal will receive a notification each time a new paper is uploaded.

(b) Development and deployment of complementary learning and teaching support materials

In order to contribute to the development of an exciting learning and teaching environment for science and related subjects, the DST has undertaken to produce and distribute complementary learning and teaching support materials (LTSM). Such materials are meant to provide real-world examples to assist in the teaching and learning of science in schools. The examples will be aligned with the DST's priority areas. In each instance, sections of the Curriculum Assessment Policy Statement will be mapped to the relevant priority areas of the DST to determine the appropriate approach to be followed in the development of complementary LTSMs.

(c) Sustaining sector-specific science engagement initiatives

Existing DST-led science engagement initiatives include raising public awareness of the DST's priority areas. Although not all the areas have been widely publicised to date, notable progress has been made in areas like biotechnology, nanoscience and technology, and indigenous knowledge systems. Science engagement focused on priority areas will be sustained through the following:

- (i) The design of the existing initiatives will be revisited to ensure their alignment with the SES and the expected outcomes for the target publics.
- (ii) Additional science engagement initiatives will be started on all outstanding priority areas.
- (iii) Awareness of priority areas will be mainstreamed in all cross-sectoral integrated awareness initiatives. Integrated awareness campaigns are detailed in par. 3.5.

(d) Exhibition of South African inventions, innovations and discoveries

Two approaches will be adopted to develop and make a compendium of local inventions, innovations and discoveries accessible to citizens:

- (i) **Enhancing the existing local inventions travelling exhibition** - With financial support from the DST, a travelling exhibition on great South African inventions was launched in 2015 and, under the custodianship of SAASTA, is deployed to science centres and cross-sectoral science engagement initiatives. The exhibition will be enhanced by updating it regularly to include new developments and to make it more exciting. Exhibits will also be made physically stronger to prevent damage when they are moved from one place to another. The upgrade of the existing exhibition will include the introduction of scale models and the increased use of interactive digital displays.
- (ii) **Virtual exhibition of local inventions, innovations and discoveries** - Using appropriate software applications, a digital exhibition of South African inventions,

innovations and discoveries will be developed to allow people to enjoy a virtual tour. A free downloadable application compatible with the most common operating systems, including mobile devices, will be developed for easy access to the virtual exhibition.

(e) Raising awareness of RDI-enabling instruments

The DST has established a number of RDI-enabling instruments such as the research and development tax incentive, technological innovation support and the research infrastructure programme. Such instruments will be publicised to facilitate access by their intended beneficiaries and to increase awareness of the nature of investments government is making in science. The exact approaches to be used will be determined from time to time.

(f) Showcasing success stories from publicly funded research

This will be pursued in two ways:

- (i) **Dedicated exhibition** - Notable progress has been made in this area. In February 2015, the DST in partnership with TIA, NIPMO and the Southern African Research and Innovation Management Association hosted the inaugural Innovation Bridge Technology Showcase and Matchmaking event. The event will take place every two years and brings together technology-based companies, industry and funding partners to create an opportunity for local and international technology-based companies, entrepreneurs and financiers to scout for technology solutions and investment opportunities.
- (ii) **Database of publicly funded research** - The DST funds research in order to enable the emergence of new ideas and innovations that would contribute to economic growth and improve quality of life. In order to facilitate access to such research for academic purposes, and possible further pursuit of some ideas by industry, a database of publicly funded research will be established. Research conducted using government-funded infrastructure will also be included.

(g) Science tourism

Science tourism will be pursued in two contexts. South Africa has some of the world's best research infrastructure, and geographic and/or knowledge advantages in several areas. Initiatives will be established to attract local and international scientists and researchers to explore opportunities offered by these features in their areas of interest. Existing South African tourist attractions include a significant presence of scientific attractions, which unfortunately are not always recognised as such. In collaboration with the tourism authorities, such attractions will be promoted in a manner that enhances science engagement. Additional scientific attractions that have the potential to boost tourism, but are not yet part of existing local tourist attractions, will be identified.

(h) Promoting the industry-based visitor centre concept

There are several firms in the country that are involved in science. The way they manufacture their products, the research and development they embark upon in the process, as well as the technologies they employ would provide useful opportunities to raise science awareness and make science appealing. To exploit this opportunity, a campaign will be initiated to encourage science-based industries to establish visitor centres to showcase the science and technology behind their operations.

(i) International relations opportunities

Multilateral and bilateral opportunities for the implementation of the SES have been identified:

- (i) **United Nations observances** - Informed by a resolution of its General Assembly, the United Nations observes designated days, weeks, years and decades, each with a theme or topic. If the theme is of a scientific nature or can be related to science, it offers South Africans an opportunity to show its citizens and the world the local scientific and technological advances aligned to the theme.

- (ii) **Intergovernmental engagements** - Countries that have science and technology relations with South Africa sometimes invite the DST to participate in science engagement and related campaigns. To date, the DST has participated in science focus weeks hosted by other African states like Uganda, Mozambique and Lesotho. Events to mark bilateral relations milestones are celebrated between South Africa and other countries, for example the German-South African Year of Science 2012/2013 that celebrated the 10-year anniversary of the science and technology relations between South Africa and Germany. Local science achievements will be profiled when such opportunities arise.

3.5 Integrated science engagement initiatives

Integrated science engagement initiatives are multi-activity events or platforms that draw together various activities and/or projects, as well as different publics targeted by the SES to contribute to the initiative.

(a) Mass participation events

- (i) **National Science Week** – This annual DST-led event, which takes place in August, is a countrywide celebration of science. The NSW has been held since 2000. The NSW will be retained as a flagship mass participation event, but will have to be realigned with the SES.
- (ii) **Provincial science festivals** – Currently the DST supports eight science festivals per annum – seven small festivals and Scifest Africa, the biggest festival in South Africa, in the Eastern Cape. Under the SES, each province will annually host one festival of Scifest Africa’s magnitude. Scifest Africa, which is already significantly funded by the DST, will be retained as the festival for the Eastern Cape. Negotiations will be held with Sasol and the Unizulu Science Centre to explore the possibility of having the Sasol Techno X and Zululand Science Festival as provincial science festivals in the Free State and KwaZulu-Natal, respectively. A strategy will be developed to build existing smaller festivals into provincial initiatives to serve the remaining six provinces. Science festivals may be held on a rotational basis in different district municipalities in each province. Partnership with local municipalities will be sought, since some of them have event centres or showgrounds that have the appropriate infrastructure for hosting science festivals.

(b) Science centres

Science centres are the only permanent DST-supported institutions that have science engagement as their full-time responsibility. Centres that are supported by the DST will be expected to provide a broad spectrum of science engagement activities that are consistent with the SES. In this regard, this Implementation Plan will include the following:

- (i) The provision of a development support package for science centres that are strategically aligned to the DST. The package, comprising funding and technical support, will be linked to the Framework for the Promotion of Excellence in a National Network of Science Centres, and will be detailed in a separate document (a support framework for a national network of science centres). The intention is to have a strong science centre network that contributes to the aims of the SES.
- (ii) Exploring the establishment of a national flagship science centre. A concept document will be developed in this regard.

(c) Website

The Mzansi for Science website is an initiative with great potential and will be taken forward. However, its scope will have to be realigned to the SES and include dynamic approaches that use technology to full effect to excite interest.

4. ESTABLISHING CAPACITY TO DELIVER THE PLAN

Successful delivery of this Implementation Plan depends on the existence of an enabling environment, comprising the following:

4.1 Enabling legislative framework

The role of coordinating science engagement is assigned to SAASTA, which is a business unit of the NRF. In its current form, the NRF mandate does not include science engagement. The NRF Act therefore needs to be amended to incorporate the science engagement role. The process of amending the NRF Act is under way, but it is not expected that this process will be finalised before March 2018.

4.2 Access to science engagement infrastructure

The three broad categories of infrastructure vital for the delivery of this Implementation Plan are the following:

(a) Science centres

Science centres are the basic infrastructure for science engagement. Their core business is science engagement, which usually happens in an enjoyable environment as edutainment. To facilitate access to science centres, development and operational support will be provided to existing science centres. Depending on the availability of funding, support towards the establishment of new science centres will also be provided. In 2006, the DST adopted a support framework for science centres, namely the National Roll-out Plan for a National Network of Science Centres. The plan, which describes development support interventions for science centres and models for establishing new science centres, has so far not been fully implemented owing to funding constraints. The plan will be revised to align it with developments in the local science engagement environment. The framework will cover the following:

- (i) Forms of development and operational support provided.
- (ii) Criteria for strategically positioning new science centres.
- (iii) Development models for new science centres.

(b) Access to other science awareness spaces

To improve the geographic coverage of the DST-led science engagement programme, additional infrastructure is required. In 2015, the HSRC produced the first part of a two-part report on science awareness spaces in South Africa. In addition to science centres, the report identified 10 more categories of physical spaces for science awareness (set out in Annexure A). The report shows the potential contribution of such spaces to the implementation of the SES. However, the report recommends some interventions to exploit their potential to the full. The DST can implement these recommendations as part of executing this Implementation Plan.

(c) Access to the school system

Learners and educators will not have to leave their school's premises to participate in science engagement. The intention is to have as many initiatives as possible on school premises targeting learners. To facilitate this approach, the DST will enter into collaboration agreements with the provincial education departments.

4.3 Building SAASTA's capacity to deliver on its new mandate

In its current form, SAASTA is meant to coordinate science engagement within the NRF, and its systems and resources are commensurate with and aligned to this role. In order for SAASTA to be an effective and efficient national coordinator of science engagement, additional funding will be made available. SAASTA has organisational culture, processes and structure will also need to be realigned for its new role. The recommendations of the 2015 NRF review report should also be taken into consideration.

4.4 Science engagement grant management system

SAASTA has responsibilities as a national coordinator include awarding grants to independent institutions that organise science engagement activities in the country. The legal status of such organisations varies, which dictates that a clear set of criteria should be developed and adopted to guide the process. Currently, SAASTA uses supply chain management procedures as a system for awarding science engagement grant funding. A tender is advertised and interested institutions respond by submitting their proposals, which are then adjudicated in terms of Treasury Regulations. This approach is highly inefficient and will not be suitable for the implementation of the SES. An appropriate grant management system will be developed.

5. FISCAL IMPLICATIONS

The execution of this plan will be funded through a new funding model, which has already been separately approved by the Executive Committee of the DST. The funding model will comprise two income streams:

- (a) Top-slicing from the DST: Up to 4% of the annual transfer budgets of the DST's Programmes (branches) 2 to 5 will be top-sliced to fund science engagement. Funds generated in this way will be accumulated into the Science Promotion transfer budget account, from which they will be disbursed to relevant implementing agencies.
- (b) Top-slicing from the baseline budgets of DST entities: Up to 4% of the entities' annual baseline budgets will be ring-fenced for science engagement. Twenty-five per cent of the ring-fenced funds will be contributed to the Science Promotion transfer budget and the remaining 75% will be used by entities to fund their own science engagement activities.

An incremental approach will be adopted in implementing the funding model, starting at 3% in the first year and increasing to 4% in the second year. Current spending on science engagement will be included in the top-slicing.

DST top-slicing will not begin before 2018/19 or after 2019/20. The top-slicing of entities' baseline budgets is not expected to commence earlier than 2019/20, as logistical arrangements will need to be made.

6. MONITORING AND EVALUATION

A separate process will be pursued to develop a science engagement M&E Framework. The framework depicted in Figure 2 will comprise a database (data architecture) that will be a repository of raw and processed data required for performance measurement and understanding of the system landscape; the M&E tools that will provide the basis of generating data necessary for performance measurement; and the broad forms of evaluation that will be conducted, including the clear delineation of the roles of SAASTA and the HSRC in this regard. Two broad forms of evaluation will be conducted.

6.1 Programme-level M&E

The M&E at this level will, based on adopted indicators, establish whether the initiatives and activities in this Implementation Plan are meeting their intentions, taking into consideration the expected outcomes for the various target publics.

6.2 System-level M&E

System-level M&E will establish the progress made towards realising a society that is knowledgeable about science, scientifically literate and able to form opinions on science issues. At this level of M&E, further studies will be conducted to measure change in the South African science engagement landscape.

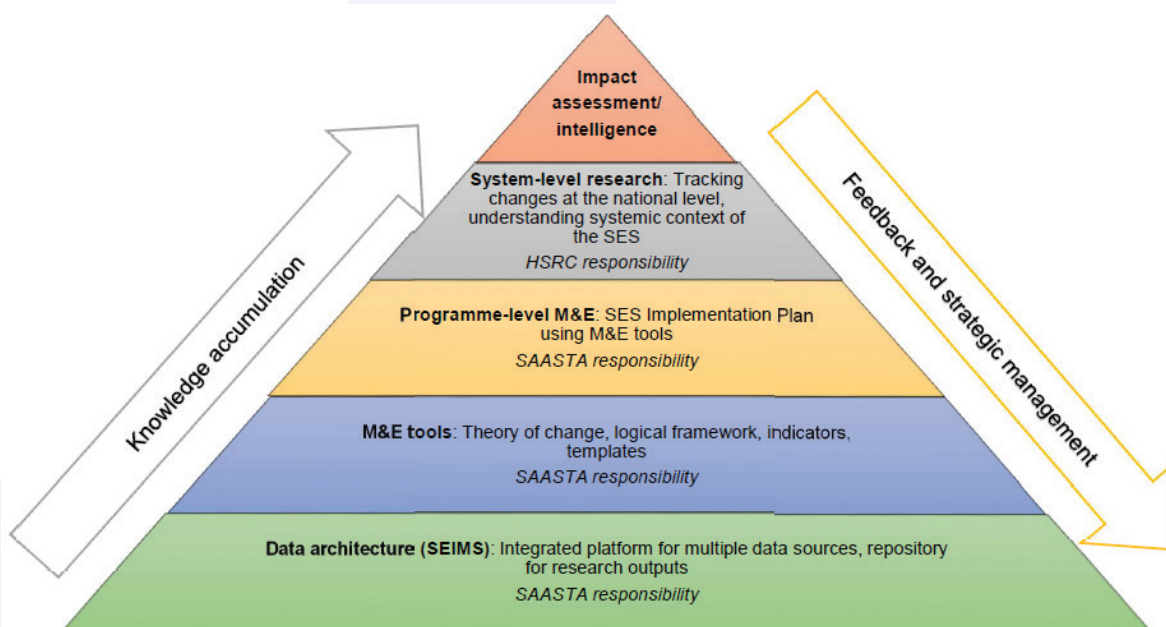


Figure 2: Overview of the Science Engagement M&E Framework

The execution of the Implementation Plan will be tracked to establish that progress is being made. This will be done as set out in the action plan in Annexure B, which will be updated annually.

7. ROLES AND RESPONSIBILITIES OF IMPLEMENTATION COLLABORATORS

The execution of this plan will be the collaborative effort of several stakeholders and role players.

7.1 Department of Science and Technology

As the principal of the science engagement programme, the DST will do the following:

- (a) Provide strategic direction to science engagement programmes, ensuring at all times that the implementation of the SES remains aligned to the overall strategic direction of the Department and the government priorities outlined in the National Development Plan and the Medium Term Strategic Framework. This necessitates a structured interface model between the DST and SAASTA (as a national coordinator). Figure 3 is a schematic diagram of the DST-SAASTA interface model. The structuring of the DST-SAASTA interface model took into consideration the Auditor-General's performance compliance expectations, which require some built-in controls to enable the DST to oversee SAASTA. The controls will comprise the following:
 - (i) The DST will hold a joint strategic planning session with SAASTA once a year. The session will be timed to enable the outcome to inform SAASTA's five-year strategic plan, when due, and the annual performance plan.
 - (ii) The DST-SAASTA joint strategic planning session will be preceded by an internal DST science engagement planning session at which Programmes (branches) will formulate inputs into the DST-SAASTA session.
 - (iii) The DST and SAASTA will hold quarterly review meetings.
 - (iv) SAASTA will submit quarterly reports and an annual report to the DST using the reporting format determined by the DST.
 - (v) Where necessary, the DST will communicate special instructions or recommendations to SAASTA. These could be triggered by observations made and/or an immediate need to respond to government imperatives.
- (b) Support SAASTA to carry out its role by unblocking obstacles to working with other entities and stakeholders as and when they emerge.
- (c) Provide financial resources for the Implementation Plan.
- (d) Coordinate corporate communications across all DST entities through its Chief Directorate: Science Communication, to achieve a corporate communication function that enhances science engagement.
- (e) Manage interdepartmental relations to leverage benefits for the implementation of the SES.
- (f) Provide guidance regarding opportunities to advance South Africa's international relations through science engagement programmes.
- (g) Source complementary resources (funding and technical support) for the implementation of the SES through opportunities arising from international engagements.
- (h) Track the execution of the Implementation Plan according to the implementation action plan.
- (i) Institute monitoring and evaluation studies, guided by the M&E Framework.

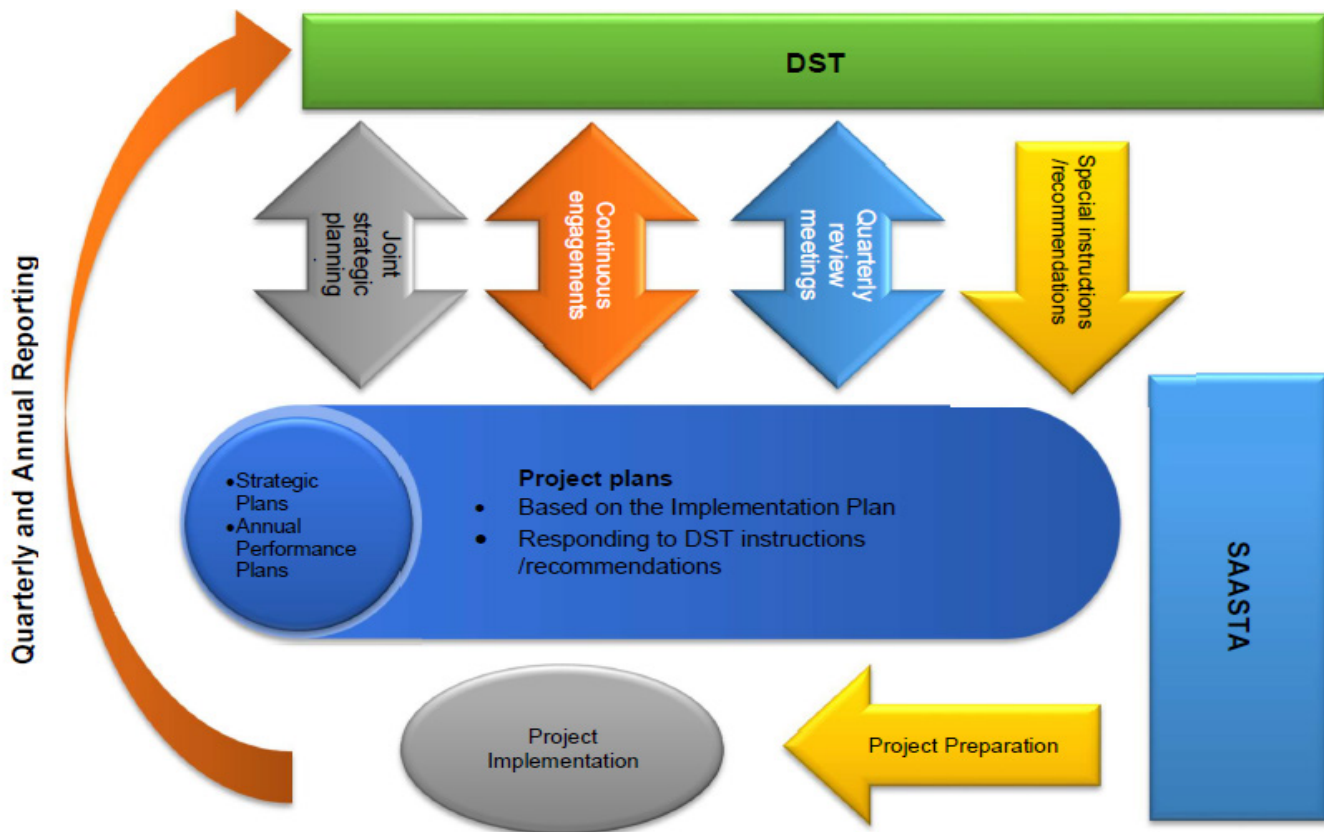


Figure 3: DST-SAASTA interface model

7.2 South African Agency for Science and Technology Advancement

In its capacity as the national coordinator of the DST-led science engagement programme, SAASTA will do the following:

- (a) Develop and implement an effective and efficient science engagement grant management system to support the participation of relevant institutional and sectoral role players in the execution of this Implementation Plan. The grant management system should comply with the Public Finance Management Act.
- (b) Strengthen ties with the existing networks of institutions supporting DST-led science engagement, and expanding such networks. It is essential that these networks be sustained for the delivery of a quality national science engagement programme and their geographic coverage broadened.
- (c) Ensure that all projects and/or activities with no specific owners are implemented. Expected outputs in this area are as follows:
 - (i) Setting up systems appropriate for the implementation of projects and activities.
 - (ii) Developing detailed project concepts in a manner that provides the necessary foundation for future M&E. The DST's Directorate: Science Promotion will assist SAASTA where necessary.
- (d) Devise and implement quality control mechanisms for the science engagement system. This includes the technical accuracy of the content communicated, whether written, spoken, or through tools such as exhibits, posters and demonstrations.
- (e) Ensure that the DST-led science engagement programme is guided by the four principles identified in the SES:

- (i) Access to information will be upheld to actively promote a society that enables citizens to exercise and protect their rights fully.
 - (ii) The implementation of the SES should promote respect for human dignity and cultural, language and religious diversity.
 - (iii) Opportunities will be sought to enhance the intentions of the strategy by interfacing mainstream science and technology with indigenous knowledge systems.
 - (iv) The popularisation of science must be guided by the core principles of ethics and social responsibility.
- (f) Implement system-wide coordination as follows:
- (i) Ensuring that the existing science engagement activities carried out by SAASTA and the DST entities are aligned to the SES. SAASTA will also negotiate with independent stakeholders and role players to encourage the alignment of their initiatives with the SES.
 - (ii) Establishing and managing a Science Engagement Information Management System (SEIMS). This will be an electronic database that carries science engagement information in order to enable system-wide performance measurement according to the M&E Framework. The science engagement programme is a collaborative effort involving various sectoral and institutional role players. As a result, different aspects of the information necessary for M&E are held in various forms by various role players. The information sourced may not necessarily be helpful on its own, and will need to be analysed and processed. Processed system-wide information is necessary for determining performance in terms of the predetermined success indicators, establishing national trends, making international comparisons, carrying out academic research and informing policy direction and investment decisions. SEIMS will be accessible to the public through website links, particularly those of the DST, SAASTA and the HSRC. SEIMS will be the science engagement data recipient and dissemination point where raw data will be processed and processed data, in the form of reports and statistics, will be archived.
 - (iii) Grouping projects and activities that address the SES into categories/clusters in order to establish appropriate data collection methodologies (e.g. a mass participation category). Following the criteria set out in the M&E Framework, SAASTA will collect the data, process it and archive it in SEIMS.
- (g) Oversee the use of resources (financial and human) allocated to the DST-led science engagement programme. Between 60% and 70% of the science engagement budget will be spent through SAASTA, in terms of the Public Finance Management Act.
- (h) Leverage external resources to advance science engagement, particularly infrastructure. Paragraph 4.2(b) deals with the 10 categories of physical spaces for science awareness other than science centres that could potentially serve as infrastructure for science engagement.
- (i) Conduct programme-level monitoring and evaluation according to the Science Engagement Monitoring and Evaluation Framework. Figure 2, which presents the structure for the framework, shows SAASTA's M&E responsibility at programme level.

7.3 Generic roles of the DST entities and the specialised service delivery unit

All the DST entities and the specialised service delivery unit NIPMO are in some way already involved in science engagement. Their existing initiatives will be sustained, but realigned to the SES. In addition, entities will be expected to do the following:

- (a) Encourage their scientists, and scientists in their partner institutions, to use platforms created by this Implementation Plan to engage with the public on science issues.
- (b) Participate in exhibitions and related science engagement opportunities created by integrated engagement initiatives (refer to par. 3.5).

7.4 Roles limited to individual entities and specialised service delivery units

(a) Mandate-driven role

The quest to fulfil their mandate dictates that individual DST entities and specialised service delivery units embark on targeted science engagement initiatives meant to raise awareness among the intended beneficiaries of their service offerings. Beneficiaries include those in immediate need of the services and potential users of the services at a later stage of their work or study life. TIA, NIPMO, SACNASP, the South African National Space Agency, NRF, HSRC, CSIR, ASSAf and the DST's indigenous knowledge systems initiative will be involved in science engagement activities aligned to their mandate.

(b) Assigned operational roles

Whenever there is a need to complement operational processes in the execution of the Implementation Plan with expertise available in any of the entities and the specialised service delivery units, such expertise will be enlisted. Enlisted institutions will provide their expertise based on the terms of reference defined by SAASTA or the DST and a formal service level agreement will be entered into. The HSRC is assigned the role of system-wide monitoring and evaluation of science engagement. Details in this regard will be contained in the M&E Framework.

7.5 Higher education institutions

Using Universities South Africa (formerly Higher Education South Africa) as a point of access, scientists and researchers based in higher education institutions will be encouraged to use platforms created by this Implementation Plan to engage with the public on science and related issues. Furthermore, higher education institutions that have strategic partnerships with the DST or its institutions will play specific roles (see par. 3).

7.6 Southern African Association of Science and Technology Centres

The Southern African Association of Science and Technology Centres (SAASTECC), as a local umbrella body for interactive science centres, will do the following:

- (a) Sustain its existing annual conference to continue providing a platform for engagement among science advancement practitioners, scientists and relevant theoreticians, among others.
- (b) Partner with the DST in conducting outreach activities for Science Forum South Africa. SAASTECC will organise dialogue platforms linked to the main event at strategically chosen locations throughout the country.
- (c) Collaborate with the DST and SAASTA to ensure that science centres in South Africa adequately support the Implementation Plan. This will be possible if science centres respond to the four strategic areas of the national network of science centres (i.e. promoting science literacy and science career awareness, and providing informal science curriculum support and science talent nurturing).

- (d) Annually propose (for consideration by the DST and SAASTA) a national science engagement initiative to be jointly driven by all the science centres. Such an initiative could be a stand-alone event or part of a broader integrated science engagement initiative.

7.7 Private/non-governmental science promotion event organisers

As alluded to in par. 4.3, SAASTA's capacity will be enhanced so that it can play its role adequately in the implementation of the SES. However, SAASTA will never have the capacity to achieve the geographic coverage necessary to build the envisioned society by itself. SAASTA will therefore implement some of its projects and activities through third parties. Depending on the situation, this will be made possible through grant funding and/or service procurement. The third parties considered here are mainly science events management specialists or generic events management firms with science events management capability.

8. RISK MANAGEMENT

Factors have been identified that could negatively impact on the delivery of this Implementation Plan, thereby reducing the chance of achieving the objectives of the SES. Annexure C presents these factors with relevant mitigating measures. The DST's Directorate: Science Promotion and Directorate: Enterprise Risk Management will annually develop a risk log to manage the risks associated with the Implementation Plan.

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ANNEXURE A: PHYSICAL SPACES FOR SCIENCE ENGAGEMENT

Category	Science focus	Main function	Target groups	Type of activities
Museums	Biological science	Education	Schools	Passive
	Environment science	Recreation	General public, including families	Interactive (interactive exhibits)
	Indigenous knowledge			
	Anthropology			
Zoos, aquariums and animal sanctuaries	Biological science	Education	Schools	Passive (mainly observing)
	Environment	Recreation	General public, including families	Interactive (there may be some interaction, in the form of people interacting with the animals)
Nature reserves and game reserves	Biological science	Education	Schools	Passive (observation)
	Environment	Recreation	General public, including families	Interactive (some reserves offer interaction with the animals and provide trails for the public)
	Indigenous knowledge			
	Anthropology (many reserves have Khoisan paintings, etc.)			
Botanical gardens	Biological science	Education	Schools	Passive
	Environment	Recreation	General public, including families	Interactive (interact with nature)
Planetariums	Astronomy	Education	Schools	Passive
		Recreation	General public, including families	Interactive (activities and interactive displays)
Industries	Scientific processes	Education	Schools	Passive
	Technology			Interactive (learners may be involved in an activity)
Libraries	Various	Education	Schools	Passive
		Recreation	General public, including families	Interactive
National research facilities	Astronomy	Education	Schools	Passive
	Biological science	Research	General public, including families	Interactive (tours may be provided and visitors are able to ask questions)
	Physical science			
	Environment			

ANNEXURE B: IMPLEMENTATION ACTION PLAN

CREATING AN ENABLING ENVIRONMENT					
Action	Action target date				
	2017/18	2018/19	2019/20	2020/21	2021/22
Amendment of the NRF Act	X				
Inception of a science engagement funding model		X	X		
Development of an M&E Framework	X				
Building SAASTA's capacity	X	X	X		
Adoption of a science engagement grant management system	X				
Signing collaboration agreements with provincial education departments	X	X			
Establishment of SEIMS	X	X			
Reconstruction of baseline data		X			
Strengthening and securing access to public awareness physical spaces	X	X	X	X	
Alignment of existing initiatives with the SES	X				
Revision of the science centre development support framework	X	X			

MAKING SCIENCE EDUCATION AND CAREERS APPEALING					
Action	Action target date				
	2017/18	2018/19	2019/20	2020/21	2021/22
Strengthening and expansion of science centre-based science career awareness	X	X	X	X	
Role modelling collaboration arrangement with SACNASP	X	X			
Roll-out of school-based science engagement initiatives	X	X	X	X	X
Study on science for children		X			
Instituting a targeted campaign to popularise science human capital and research capacity development instruments		X			

DEVELOPING A PUBLIC THAT CRITICALLY ENGAGES IN SCIENCE ISSUES					
Action	Action target date				
	2017/18	2018/19	2019/20	2020/21	2021/22
Development of concept plans for citizen-centred dialogue platforms			X	X	
Revision of NRF research grant conditions		X			
Formal proposal on the adjustment of SAC-NASP's CPD model to incorporate science engagement	X				
Science initiative for decision makers instituted					X
Development of conference support framework		X			
Conceptualisation and establishment of a first science shop	X	X	X		
Development of concept document on on-line public social sciences initiative	X				

SCIENCE COMMUNICATION ADVANCEMENT					
Action	Action target date				
	2017/18	2018/19	2019/20	2020/21	2021/22
Establishment of an accredited training course on basic science communication skills			X		
Establishment of a science journalism internship				X	
Development of guidelines for interfacing corporate communications with science communication		X			
Development of a MEME-based science communication plan		X	X		
Feasibility study on maximising science communication through social media		X	X		

PROFILING SOUTH AFRICAN SCIENCE, TECHNOLOGY AND INNOVATION

Action	Action target date				
	2017/18	2018/19	2019/20	2020/21	2021/22
Establishment of web portal for published papers			X		
Development of DST priority areas-based complementary LTSMs	X	X	X	X	X
Development of virtual exhibition of local inventions, innovations and discoveries			X	X	
Establishment of a database of publicly funded research			X	X	
Reconceptualisation of the Mzansi for Science initiative		X	X		X
Establishment of provincial festivals			X	X	X
Development of science tourism materials			X	X	
Initiating a campaign to develop industry-based visitor centres			X	X	

ANNEXURE C: RISK MATRIX

No.	Programme risk	Impact description	Risk management
1.	Limited geographic coverage, as SAASTA and the DST are both based in Pretoria and have no provincial or local presence.	Unequal access to the DST-led science engagement programme will make it difficult to achieve the envisioned society.	SAASTA will – <ul style="list-style-type: none"> align the delivery of the SES to service delivery boundaries; facilitate the establishment of a network of independent science event organisers; host major science engagement initiatives on a rotational basis among district municipalities.
2.	Low level of participation by sectoral and institutional role players that are key in the implementation of the SES owing to the cumbersome approach to managing grant funding.	The intentions of the SES will not be fully realised or may take longer to realise.	SAASTA will develop a special science engagement grant funding management system.

No.	Programme risk	Impact description	Risk management
3.	Less appreciation of SAASTA as a national coordinator by sectoral and institutional role players owing to weakened relations stemming from frustrations associated with using the current grant funding management approach and perceiving SAASTA as a competitor.	SAASTA's role will be undermined, with negative consequences for the successful implementation of the SES.	The DST will position SAASTA and rebuild its image.
4.	Scientists' unwillingness to participate in science engagement.	The quality of the science engagement programmes would be negatively affected.	<p>Amendment of the NRF research grant conditions, making it compulsory for grant recipients to get involved in public engagement with science.</p> <p>Equipping scientists and researchers with basic science communication skills.</p> <p>Exposing aspiring scientists to science communication at schoolgoing age through STEMI activities such as science fairs and Science Slam.</p> <p>Inclusion of science engagement in SACNASP's CPD system.</p>
5.	Language poses a barrier as the medium of science communication is mainly English and some scientific terms do not exist in indigenous languages.	Non-English speakers' right of access to information would be violated and the DST-led science engagement programme could be widely criticised, and information communicated to a limited public.	<p>Commission a study on dealing with language diversity in science communication.</p> <p>Educational materials and exhibition text to take into consideration languages spoken by local communities.</p>
6.	Reluctance of SAASTA's staff to do things differently as required by the strategy.	Aims of the SES not adequately realised.	DST to propose to the NRF that organisational reconfiguration be undertaken.

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