SAEON STRATEGY 2030

EXECUTIVE SUMMARY

SAEON has grown substantially since inception in 2002, and now supports well over 100 researchers and students per year, at research sites spread across the land and oceans of South Africa. SAEON staff and students contribute to around 70 scientific publications and 20 management policies or plans per year, while the SAEON Environmental Science Education programme usually reaches over 3500 learners a year. The development of SAEON, as well as the recent release of the NRF Vision and Strategic Plan for the coming decade necessitated the need for a formal decadal SAEON strategy by the SAEON management team. Seven critical factors for success for SAEON were identified, after considering the current internal and external environment, the themes of the new NRF Vision (transformation, impact, excellence and sustainability), and the outcomes of the NRF Strategic Plan 2020-25. While much of SAEON's current work activities are considered to already contribute to these, strategic objectives have been formulated to 1) increase workplace diversity, 2) create sustainable human resources, 3) review and if necessary re-align the scientific focus of SAEON-supported research, 4) enhance the impact of the SAEON environmental science education and science engagement programmes, 5) increase and diversify SAEON income , and 6) integrate existing research infrastructure programmes to create an intercontinental, environmental, mega-research infrastructure.

JC PAUW

Managing Director

25 AUGUST 2020

1. BACKGROUND

SAEON was established in 2002, with a grant from the Department of Arts, Culture, Science and Technology (DACST), to create a new unit within the National Research Foundation (NRF) that would focus on environmental change research. The original motivation for SAEON was to provide a platform for environmental research in the form of a national network of long-term research sites. The organisation has grown consistently since and is now of a comparable size to the NRF National Facilities in terms of income and expenditure, infrastructure, staff numbers and research outputs. The growth and development of SAEON has been largely in line with a strategic direction explained in the business plans of its formative years in the early 2000s. A formal, long-term (10 year) strategic plan is now needed due to:

1. The rapid growth of SAEON since its formation, including the award of three large-scale SARIR[1] research infrastructures
2. The recent release of NRF Vision 2030, and the development of an NRF Strategic Plan (2020-2025), with which SAEON must align
3. Changes in the social, political and economic environments
4. SAEON's ambition to be declared a National Facility of the NRF, which requires that our future work be well aligned with the requirements of a National Facility[2]
5. Accelerating deterioration of the natural environment over the last 20 years has increased the public's desire for information on environmental change, and research results that inform decision making.

In response to this, the following decadal strategic plan was developed by the management team of SAEON.

[1] SARIR: South African Research Infrastructure Roadmap

[2] An NRF National Research Facility is "an institution that provides unique and substantial infrastructure capabilities and services for competitive research, innovation and human capital development in science, engineering and technology…" (NRF Amendment Act No 19 0f 2018)

2. The VISION, VALUES and PHILOSOPHY of SAEON

SAEON's vision is to provide

World-class environmental research platforms for a sustainable society

"***World class***" refers to SAEON's aspiration to facilitate and conduct research of excellent quality

"***Environmental***" sets the domain of SAEON research – the ecological and physical processes that sustain all life on earth

"***Research platforms***" are the primary tools SAEON uses to support and conduct world-class research

"***A sustainable society***" is the ultimate goal of all of SAEON's activities – creating the knowledge needed for sustainability of the ecosystems on which society depends and in which all life can flourish

As part of the NRF, SAEON embraces the corporate values of the NRF (NRF Vision 2030):

The philosophical approach of SAEON is that the creation of meaningful environmental knowledge requires collaboration and open sharing of data, capacity development and stakeholder consultation. SAEON has explored a variety of approaches to generating environmental data and creating research outputs, and supports research in a wide range of environmental fields, from organismal ecology to earth system science.

3. SITUATIONAL ANALYSIS

3.1 Current state of SAEON

SAEON facilitates and conducts research through platforms (see Box 1) and these have grown into a diverse array of sites, instruments, infrastructure, datasets, models and staff, widely distributed across both marine and terrestrial environments (Figure 1).

SAEON platforms enable researchers to conduct research that is critical for detecting, understanding and predicting environmental change. These include specialised instrumentation and other research equipment, and data collection at temporal and spatial scales that are not typically possible for higher education institutions. These platforms are very diverse, providing data from terrestrial, freshwater and marine ecosystems, from sites ranging in size from a few hectares to hundreds of square kilometres. Due to the geographical spread of SAEON nodes and sites, collaboration with SAEON can add much value to regional and global-scale research that spans multiple biomes, or includes both terrestrial and marine systems.

Box 1

What are SAEON platforms?

- Long-term research sites, where repeated observations, experimental treatments and related data are permanently maintained.
- Laboratories, *in situ* instruments, vehicles, boats and other equipment needed for conducting environmental research
- Datasets and models relating to environmental change
- Scientific and technical support for researchers
- Data portals for public access to environmental data and decision-support systems

The SAEON platforms are managed by staff located at seven nodes and a national office. Over the past 18 years, SAEON staff have increased from 1 in 2002 to 95 in 2020, and total annual income from R1.3 million to R132 million (in nominal terms). Physical infrastructure includes an office block, a data centre, 31 vehicles, 7 boats, a fixed-wing surveillance aircraft and a variety of field and laboratory instruments. As a unit of the NRF, the Department of Science and Innovation (DSI) is SAEON's primary source of funding. Other national departments – particularly the Department of Environment, Forestry and Fisheries – provide additional sources of funding, and are recipients of SAEON data, information management services and research outputs. SAEON stakeholders include a wide range of government departments and agencies, universities and other research institutions, schools, companies and NGOs.

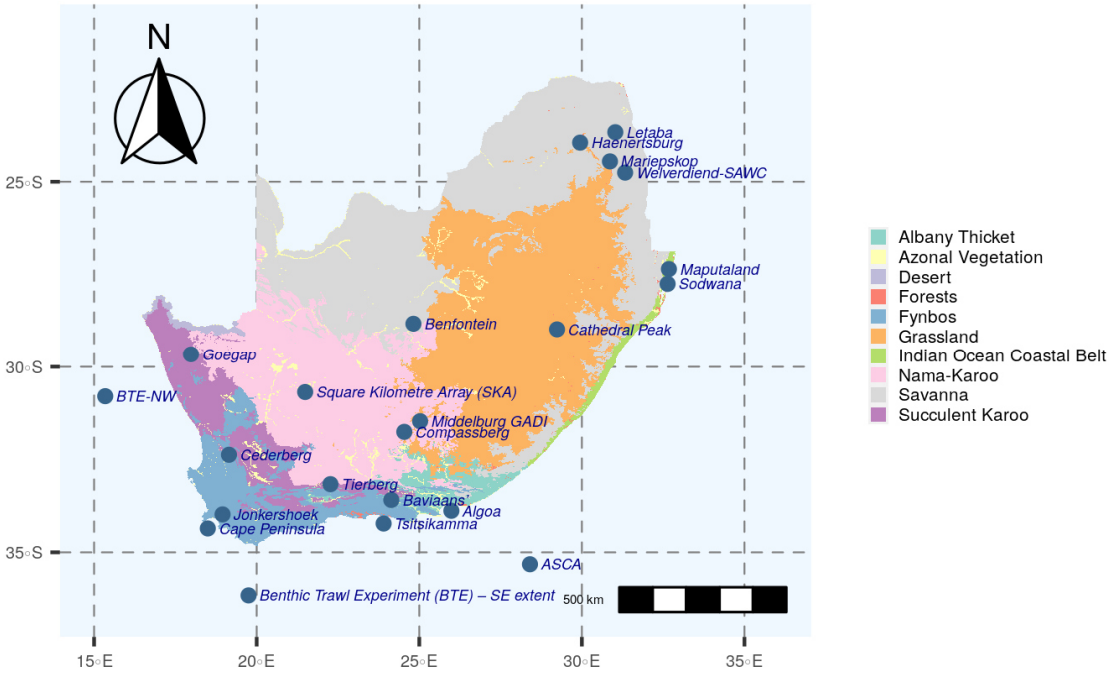


Figure 1. Location of existing SAEON long-term research sites. BTE = Benthic Trawl Experiment, which encompasses a series of marine transects.

Universities, both local and international, are a key stakeholder group, as university researchers and post-graduate students are the primary users of SAEON platforms, and data collected by students are an important part of many SAEON datasets. Many platforms have been developed in collaboration with academic partners.

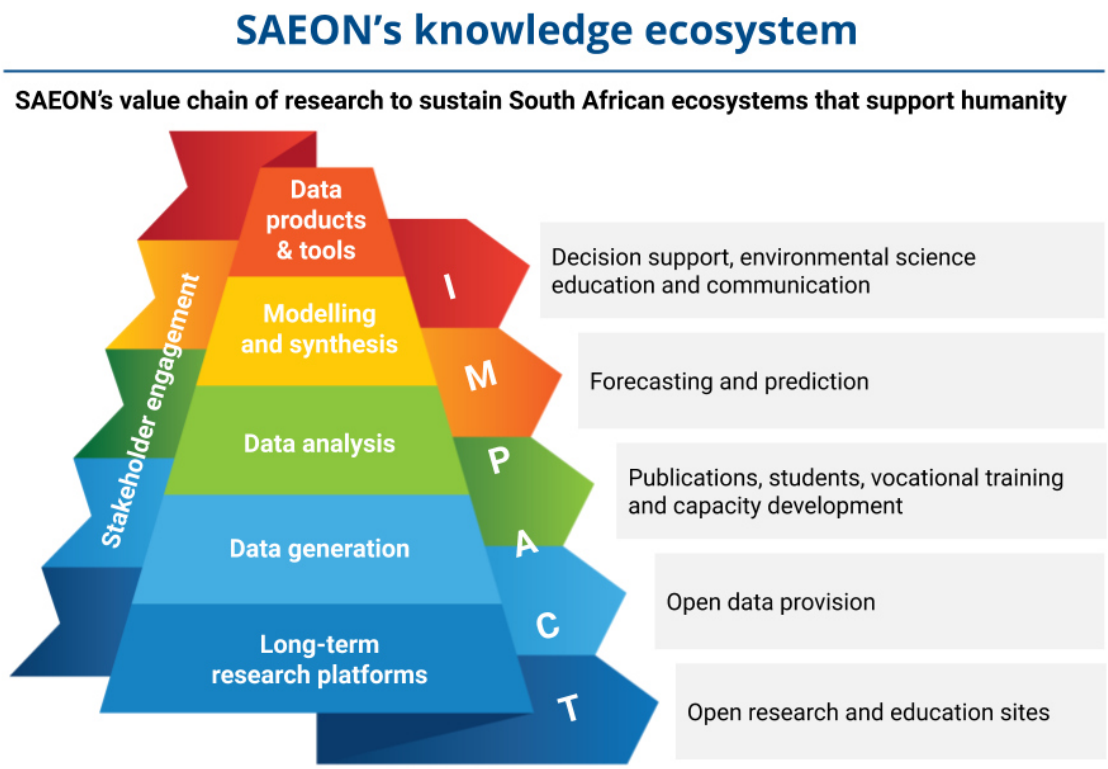
SAEON also collaborates and exchanges data and expertise with other government agencies in the realm of environmental science, including the Department of Water Affairs and Sanitation, the Agricultural Research Council, Cape Nature, the South African National Biodiversity Institute, South African National Parks, the Council for Scientific and Industrial Research, provincial departments (DEDEAT, DEADP, DENC, ECPTA, Ezemvelo KZN Wildlife), municipalities (the City of Cape Town and Port Elizabeth) and other NRF National Facilities.

SAEON's internal stakeholders include platform managers, research scientists, data scientists, research fellows, research technicians, instrument technicians, science engagement managers, programme developers, systems engineers, human resource managers, finance managers, supply chain managers, operations/governance managers and interns.

3.2 The SAEON value proposition

SAEON and SAIAB are the only NRF units that facilitate research on global change, one of five Grand Challenges of the DSI, and SAEON is the only research entity in South Africa that facilitates and integrates such large-scale long-term environmental research at terrestrial and marine sites.

SAEON's approach to creating value from research is summarised in the diagram below. SAEON scientists and technicians, as well as collaborating students and other researchers, utilise SAEON platforms to generate data. This involves the creation and maintenance of large-scale, *in situ* experimental treatments, regular acquisition of field and remote sensing data by SAEON staff and automated instruments, and facilitating access to sites and data by students and other researchers. These data acquired by SAEON and our collaborators are then used for analysis of long-term patterns and processes and the creation of models, publications and archived datasets. These research products then form the basis for policy and other decision-making inputs, as well as decision-support tools. Some of the sites and data are also used for the SAEON Environmental Science Education programme. Administrative staff support all steps of the processes, through human resource, procurement and financial management and ensuring good governance throughout.



By 2020, the number of external researchers making use of SAEON platforms each year had grown to 95, in addition to 71 post-graduate students supported in the form of the provision of scholarships, supervision, assistance with data acquisition and the use of SAEON laboratories, offices, and field instruments.

In addition to facilitating research, SAEON staff conduct their own research, generally in collaboration with platform users and through the supervision of post-graduate students. In this way, SAEON contributes directly to the National System of Innovation, contributing to the production of post-graduate researchers and scientific publications (including journal papers, books, field guides, and videos). SAEON provides good value in this regard, producing a large number of publications compared to the other NRF Facilities, relative to the amount of core funding received (Figure 2).

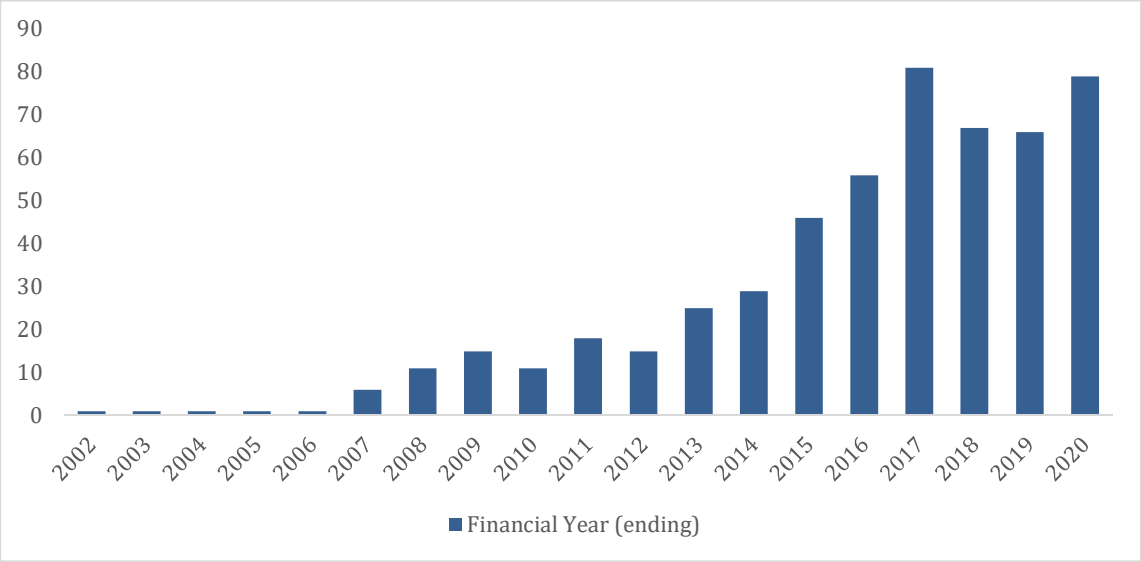


Figure 2. The number of scientific papers published by SAEON staff, students and research associates each year since inception in 2002 (as recorded by Clarivate Analytics' "Web of Science").

The SAEON Environmental Science Education Programme (ESEP) has been an integral part of SAEON since it began and is distinct from more general environmental education programmes. Core funding and a number of permanent positions are dedicated to the programme which is one of the few of its kind, and possibly the largest school-based education programme that focuses specifically on environmental science in Africa. The programme's primary objectives are to support the teaching of environmental science at the secondary school, and to increase public awareness of environmental change. Contemporary scientific research from SAEON's environmental research platforms is integrated into the environmental science education programmes. Educator workshops, science camps for learners, school-based monitoring programmes, teaching material development and science awareness events are entrenched in

SAEON operations and budgets, while many SAEON sites facilitate practical field trips for undergraduate and postgraduate students. Engagement with the general public, through workshops, our digital newsletter (SAEON eNews) and a range of other media, are considered part of the job description of SAEON scientists and technicians. SAEON scientists also make regular contributions to government policies and a variety of resource management plans.

SAEON has developed a pipeline for data from its production to ingestion in data management systems that allow for appropriate curation to support its discovery, interoperability with other systems and the promotion of reproducible science according to the FAIR principles of open science. In addition, SAEON is developing data products that present data in multiple formats to support decision making around, among other topics, the Sustainable Development Goals and Climate Change.

3.3 The External Context

While the allocation of DSI baseline funding to SAEON grew steadily from 2002 to 2016, it has levelled off since then, with no significant growth in real terms (Figure 3). It will be difficult to maintain all the established SAEON platforms even with stable core funding, as future maintenance costs are likely to exceed core funding, due to both inflation and exchange rate fluctuations (the majority of the instruments in operation have to be imported).

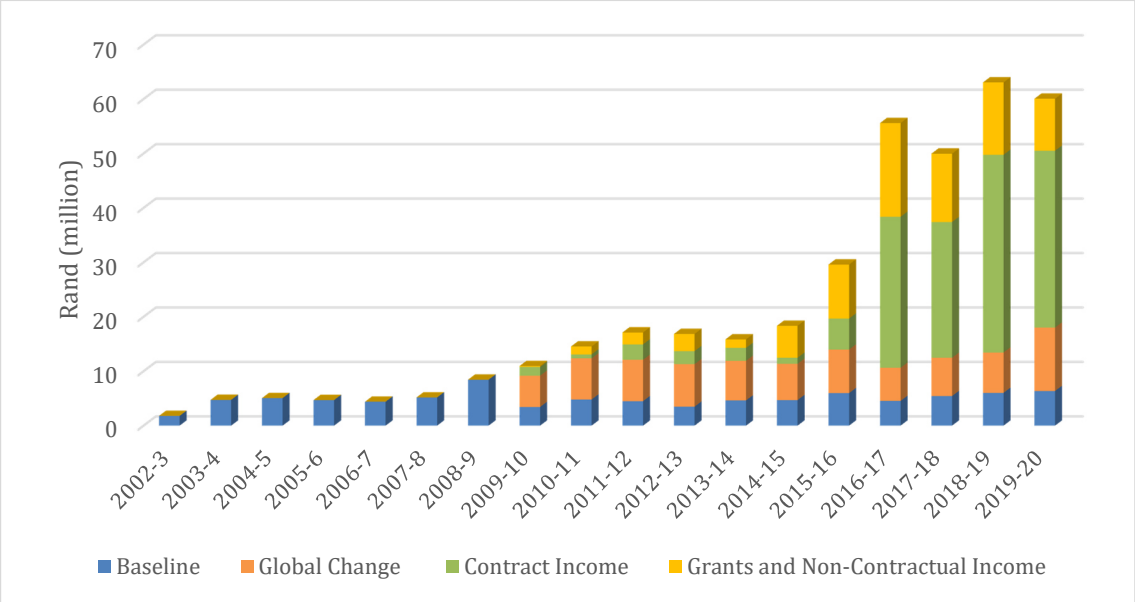


Figure 3. SAEON annual income by source since inception in 2002. Core funding consists of "Baseline" (the MTEF allocation from National Treasury) and "Global Change" (the allocation from DSI's Global Change Grand Challenge programme). Values are adjusted for inflation to 2002 values.

In contrast to the flat trajectory of core funding, SAEON's total income has continued to grow in recent years through the acquisition of research grants and service contracts, for which SAEON competes with the broader research and consulting community. Two South African Research Infrastructure Roadmap (SARIR) grants awarded to SAEON from DSI, in 2018, were particularly important for recent growth, increasing SAEON income by approximately 20%. These have also expanded SAEON's collaboration with the local and international research community, and created opportunities for leveraging additional research infrastructure projects. The DSI's recent designation of SAEON as host of a Marine and Antarctic Research Infrastructure is expected to create a similar increase over the coming decade.

A number of strategic developments over the past few years are beginning to influence SAEON's income, as well as opportunities for collaboration. These include the current update of the NRF Strategy, as well as the DSI White Paper of 2019 and NRF Amendment Act of 2018. The NRF Corporate Executive has more control over the allocation of DSI funding to SAEON and the NRF Facilities, compared to when SAEON began. The size of the core grant allocated to SAEON by DSI is unlikely to increase in the near future, given the current fiscal environment.

Funding for post-graduate bursaries has become scarcer and attracting students has become more competitive, while the call to train more PhD students has intensified. The need to transform the post-graduate demographic profile is greater than ever.

While the core grant funding outlook of SAEON looks neutral or negative, the demand for research products from SAEON is increasing. The South African government has committed to a range of international treaties and obligations relating to environmental management and generally relies on agencies and contractors to monitor and report on these. SAEON is often requested to assist. Maintaining and growing collaborations with university researchers, and the number of users of SAEON platforms, depends on SAEON maintaining established infrastructure and growing it.

The recent DSI STI White Paper creates pressure for demonstrating innovation, transformation, increased access of the public to science and technology, a high level of research ethics and greater engagement of society in framing challenges and developing research agenda.

The demand for knowledge of environmental change from the general public also continues to increase. The impact of global and local environmental changes on both ecosystems and socio-economic systems is receiving more and more attention in the media, drawing stronger and more wide-spread public responses. For example, environmental issues were, for the first time,

ranked as the most important risks by the members and associates of the World Economic Forum in 2020[3]. The importance of accurate and relevant information on the extent and causes of such impacts has become an important role for SAEON, particularly in light of the call to increase the impact of research by both the DSI and NRF.

Ironically, many of the environmental changes that SAEON is studying may begin to have direct impacts on SAEON operations in the coming decades. More severe storms have already damaged instruments deployed in the oceans and rivers, and wildfires have destroyed instruments at some terrestrial sites. More frequent or severe floods, hailstorms, winds and fires, likely in the coming decades, will increase the cost of maintaining marine and terrestrial instruments.

Weather instruments destroyed by a wildfire at Cathedral Peak

SAEON staff remove a melted antenna from the Langrivier gauging weir hut at Jonkershoek after a wildfire in March 2015

Technological advances continue to provide opportunities for reducing the costs of environmental research. In certain fields, such as remote sensing, numerical modelling, data management ("big data tools") and data sharing, these advances are producing reliable products and services that are now available at little or no cost. However many of these are dependent on *in situ* observations for calibration and validation. In other fields, particularly biogeochemistry and ecology, available technologies remain expensive and are often

[3] 15th edition of the World Economic Forum's Global Risks Report, https://reports.weforum.org/global-risks-report-2020/

unreliable. For marine studies, the fact that observations from space cannot measure phenomena below the sea surface remains a major constraint. The cost of SAEON staff and partners to collaborate over long distances, in the form of video-conferencing and via social media, has decreased considerably and is likely to fall further. These advances also allow for more frequent and less costly engagements with many stakeholders, and reduce SAEON's own impact on the environment.

4. CRITICAL FACTORS FOR SUCCESS

Considering SAEON's internal and external contexts, an assessment of current strengths, weaknesses, opportunities and threats was conducted (summarised in Appendix 1). From this, the following factors were identified as being critical for SAEON to succeed in providing world-class environmental research platforms for a sustainable society over the next 10 years.

1. Maintaining staff with field expertise in long-term environmental research and infrastructures
2. Transformation of SAEON's scientific workforce, in terms of race and gender
3. Growing funding in an increasingly volatile funding environment
4. Maintaining and expanding an established network of diverse collaborations with local and international universities, global environmental observation network organisations, government departments and other institutions responsible for environmental research or management
5. Ensuring all our activities are integrated and focused on attaining our vision
6. Increasing the impact of SAEON research on society
7. Greater access to, and use of, SAEON data by external users

5. STRATEGIC OBJECTIVES

In aspiring to achieve the SAEON Vision, within the boundaries of the broader NRF Vision we recognised the need to both persevere with much of our established principles and processes, as well as create new strategic interventions. The alignment of SAEON's current activities to the new NRF Vision and Strategy is discussed below, followed by six new strategic objectives which have been developed in response to our changing internal and external environment, and our current critical success factors. The alignment of these objectives to the outcomes of NRF Strategic Plan 2020-25 is provided thereafter.

Over the next decade the NRF intends to position itself as

*"A transformed and agile knowledge organisation that shapes and influences all aspects of the knowledge enterprise with unwavering commitment to **transformation, impact, excellence** and **sustainability**."* (NRF Vision 2030).

The four conceptual themes inherent in this vision (**transformation, impact, excellence** and **sustainability)** formed the basis of our strategic thinking.

THEME 1: Transformation

Transformation is critical for the NRF and SAEON to maintain and grow societal legitimacy in the democratic era, and we are committed to contribute to all four elements of transformation described in the NRF Vision 2030:

1. Transformation of the equity profile of the South African research workforce;
2. Transformation of the knowledge enterprise;
3. Transformation of the relationship between science and society; and the
4. Building of a diverse and fully inclusive learning organisation (ONE NRF).

Much of SAEON's long-standing approach to our human resources and research are already aligned with these aims. We have established a transformation pipeline that includes our school-based Environmental Science Education Programme, collaborations with previously disadvantaged universities and support for students from previously disadvantaged groups. This will continue.

In terms of the relationship between science and society, we have and do engage with a wide range of external stakeholders through various service offerings and outreach activities, but also in the design of our platforms and the dissemination of research results. This must continue, with greater efforts to engage effectively with a broad spectrum of South African society.

Our emphasis on student support, our collaborations with a wide range of universities (local and international) and our long history of staff training demonstrate that SAEON is already a learning organisation that values capacity building. This will continue, but with greater efforts towards increasing and embracing diversity and inclusivity in the workplace.

While the above efforts will continue to make a contribution to transformation within the NRF and the broader research community of South Africa, we acknowledge that more needs to be done to accelerate transformation. Four of our strategic objectives (**Objectives 1, 2, 3** and **4** below) have been developed to drive interventions for increasing the speed and scale of transformation within SAEON.

THEME 2: Impact

NRF Vision 2030 introduces the concept of research impact, also called 'societal impact', as a critical addition to the strategic direction of the NRF. Such impact is defined as 'the demonstrable contribution that excellent research makes to society and the economy'. We recognise that in order to create meaning from our platforms, they must ultimately deliver benefits at local, national and global scales.

Established SAEON platforms already do provide some impact, and many were designed to support global networks that aim to inform and drive planetary-scale policies. Others contribute to national policies, while many SAEON scientists or students have made contributions to local-scale management plans or interventions. Co-generation of research has already been included in some recent projects, and SAEON has invested heavily in the development of demand-driven data management systems to make data and data products accessible to researchers, decision makers, and the general public. We have realised the power of modelling and forecasting to convey the implication of our research results for the future supply of ecosystem services, and have embarked on projects to increase our use of such tools. We have always appreciated the importance of society's capacity to understand, assess, interpret and apply knowledge regarding environmental change. In this regard, we will continue to promote awareness and an understanding of environmental issues, and to inspire the next generation of environmental scientists, through our established education outreach programmes and public engagements.

However, we recognise the need for both the NRF and SAEON to demonstrate a greater impact of our research on society, particularly in this time of constrained funding from national government. Overcoming intense competition for the public's attention, in the modern world of social media and continuous news coverage, also requires that impact receives more attention at the strategic level. **Objective 3** is intended to address this need.

THEME 3: Excellence

NRF Vision 2030 envisages that a National Facility "be a national and world scientific leading research platform; operating research infrastructures producing high quality data and research, while being an enabling facility to support science". To this end, SAEON will continue to provide cutting-edge technology and state-of-the-art instrumentation, and produce high quality data and research. We are aware of the challenge of balancing research and platform management, and will continue to seek the optimal balance. We will also continue with our efforts to realise the value of the substantial datasets SAEON has acquired over the past two decades, and that our platforms continuously generate. This involves continuous innovation of our ICT data

management systems, including data analysis tools and data products. Building on our wide scope of work and integrated character, we will also continue to play a leading role in global environmental research networks and infrastructures.

A number of our strategic interventions are intended to enhance our efforts to attract world-class researchers to our platforms (**Objectives 2, 3** and **6**).

THEME 4: Sustainability

NRF Vision 2030 recognises the need for creating sustainability of both the financial and human resources of its operations. Ensuring that SAEON platforms persist into the future requires sustained funding, maintenance of established infrastructure and satisfied staff and stakeholders. Regarding the latter, SAEON must be perceived as valuable by our funders, our collaborators, and to society in general. We will therefore continue with our effort to have SAEON be recognised as a long-term strategic investment of national importance, which is deeply rooted in society and indispensable for the delivery of high-quality environmental research, human capacity development and environmental decision support. This requires that we persist with our endeavour to have SAEON declared as a National Research Facility, and continue to engage regularly with the NRF, DSI and other funders. Furthermore, we will maintain and grow our engagement with other NRF National Facilities, research institutions, environmental agencies and academic stakeholders, through collaboration and student support. We do however recognise that we can deepen these collaborations, and increase our value to the researcher community, and **Objective 3** is intended to address this.

We must continue to govern SAEON effectively and maintain our reputation as a reputable and reliable recipient of public funds as envisaged by **Objective 5**. We acknowledge the need for rapid and accurate reporting on expenditure and performance, and compliance with the increasingly complicated financial regulations from National Treasury, and will continue to meet these requirements. We will also continue with our established risk, health and safety management to prevent accidents that could be both costly and damaging to SAEON's reputation.

Recent changes in the funding landscape require that we re-evaluate and diversify our sources of income. We cannot expect that past funding sources will continue indefinitely, nor increase, and **Objectives 5** and **6** have been developed to diversify our funding sources, increase our attractiveness to our current funders, and make more efficient use of income.

Finally, we recognise that we operate in an era of environmental degradation and unsustainable development, and that our own operations impact the environment as much as those of others.

While the research we support is aimed at creating a more sustainable society, we should strive to be a role model organisation, in terms of reducing our negative impacts on the natural environment. This aim is incorporated in **Objective 2**.

STRATEGIC OBJECTIVE 1. Increase workplace diversity

To accelerate **transformation** (NRF Theme 1) of the knowledge workforce and achieve greater diversity, we must recruit more scientific and ICT staff from designated groups, do more to create an organisational culture of inclusivity, and foster the value of diversity in the workplace. This will be achieved by encouraging greater interaction and more exchange of ideas and skills between the various cultures within our organisation. This will not only contribute to the type of transformation envisaged by the NFR Vision 2030, but also increase the quality of our own research, and enable us to engage more effectively with the full spectrum of our external stakeholders. We will also take steps to increase the diversity of our external stakeholders, with greater efforts to facilitate the use of our platforms by previously disadvantaged students and universities, and by supporting the development of emerging scientists into established, world-class scientists, through the use of our platforms.

Measurable outcomes include increased work satisfaction of all our staff, changes to the demographic profile of the SAEON workforce, and the diversity of SAEON platform users.

STRATEGIC OBJECTIVE 2. Create sustainable human resources

Relevant to the NRF Vision 2030 themes of **Transformation, Excellence** and **Sustainability**, and in acknowledgement that retaining skills is a critical success factor, we must increase our ability to attract and retain highly-skilled staff – staff capable of running world-class platforms and collaborating with world-class researchers. Effective staff management and adequate human resource support are critical to maintain this, as is the diverse workplace envisioned under Strategic Objective 1 above. To achieve this, we must:

- Increase our reputation as a trusted source of knowledge on environmental change in South Africa, and a shaper, influencer and stimulator of the national environmental research ecosystem
- Develop our career enrichment opportunities, as SAEON's career path opportunities are limited (due to SAEONs flat structure and the current funding situation)
- Take significant steps to reduce SAEON's negative environmental impacts, as this can have an important influence on staff satisfaction.

Measurable outcomes for this objective are low staff turnover and vacancy rates, high quality research outputs, and reductions of SAEON's own environmental footprint.

STRATEGIC OBJECTIVE 3. Review and if necessary re-align the scientific focus of SAEON-supported research

Achieving the SAEON vision requires that the research we conduct and support is both of high quality and relevant to the most pressing environmental changes occurring in South Africa. As funding and time constraints dictate that we cannot support research on all contemporary environmental changes, it is prudent that we prioritise research that will create the greatest societal impact. And preferably without compromising the quality of our research outputs. This requires focusing our research at societal and planetary boundaries most threatened by environmental change.

The first step to achieving this is to review and prioritise SAEON's current projects. Inviting the broader research community and environmental management agencies to participate in this process will not only strengthen it, but also enhance our collaborations, increase our value to our stakeholders and legitimacy with our funders. Furthermore, a more open science ethic aimed at greater inclusion of relevant authorities, and other decision makers in the realm of environmental management, will lead to greater impact of the results emanating from our platforms. These steps should contribute to **all four themes** of NRF Vision 2030.

Measurable outcomes include an improved relationship between SAEON and South African society, greater collaboration, increased research outputs and greater impact on environmental management.

STRATEGIC OBJECTIVE 4. Enhance the impact of the SAEON Environmental Science Education and Science Engagement Programmes

While the SAEON ESEP is well established, we recognise the need to grow the programme, particularly considering that quality post-graduates from the environmental sciences are needed to achieve our **transformation** objectives. Furthermore, achieving the enhanced societal **impact** envisioned by the STI White Paper and NRF Vision 2030 requires that we increase our reach through engaging society at multiple levels.

We must therefore ensure that our secondary school programme and awareness events continue, (regardless of SAEON's total income) and that we increase our communication of SAEON research results to the general public. Importantly, we will create appropriate opportunities for stakeholder engagement in planning and performing our environmental observation programmes and the interpretation of the resulting data streams.

Measurable outcomes will be the proportion of participants in SAEON ESEP activities who enrol in environmental science degrees, and the number and quality of SAEON engagements with the general public, including the co-creation of research agendas.

STRATEGIC OBJECTIVE 5. Increase and diversify SAEON income

In alignment with the NRF Vision 2030 themes of both **Excellence** and **Sustainability**, this objective aims to ensure that SAEON's existing platforms endure as relevant and valued research foci in the long-term. As our core funding is unlikely to increase in the foreseeable future, alternative sources of funding need to be sourced, not only for growth but also for maintaining existing platforms. In addition we need to utilise our income more efficiently, in terms of the amounts spent on outputs relative to administration.

To achieve, this we commit to compliance with regulations while we position ourselves to secure any increases in core funding that may become available, as well as generating even more income through contractual services and grants. The latter often requires utilisation of short-term grants in a way that they contribute to the maintenance of long-term platforms. Reviewing and prioritising existing projects will also lead to more efficient use of income, as will optimising use of information technologies to reduce our operational costs. More effective ways of managing staff performance may be required to keep staff motivated and focused, in the context of uncertain funding and limited career path opportunities.

Measurable outcomes will be a return to growth of SAEON's total income, audit findings and the persistence of our established platforms.

STRATEGIC OBJECTIVE 6. Integrate existing research infrastructure programmes to create an intercontinental, environmental, mega-research infrastructure

SAEON is currently implementing two SARIR research infrastructures (EFTEON and SMCRI), with a third for marine and Antarctic research awarded and to be implemented from 2020 onwards.

The eventual integration of these into a single platform provides the organisational **transformation** opportunity to create an environmental research infrastructure of unparalleled size and scope. Similar research infrastructures of this size, incorporating a multitude of terrestrial and marine sites, have not been developed elsewhere in the world due to institutional legacies and boundaries. The combination of the three infrastructures would integrate research sites from the Limpopo River in the north to the SANAE 1V Base in Antarctica in the south, 6 000 km apart, and will fully exploit South Africa's geographic advantage. This demonstration of **excellence** will be highly attractive to the international earth system science community, and international funders.

The first steps towards achieving this aspirational objective are to successfully establish the three individual SARIR research infrastructures and create an integrated administrative system for them. This will be followed by the creation of high-level stakeholder advisory structures, and securing research funding for users of the mega-research infrastructure.

Alignment with NRF Strategic Outcomes

The following table indicates which of the above strategic objectives will contribute to each of the four outcomes of the NRF Strategic Plan 2020-25.

NRF Strategic Plan Outcome	SAEON Strategic Objective
Outcome 1: A transformed (internationally competitive and sustainable) research workforce	**Strategic objective 1.** Increase workplace diversity
Outcome 2: Enhanced impact of the research enterprise	**Strategic objective 3.** Review and if necessary re-align the scientific focus of SAEON-supported research **Strategic objective 5:** Increase and diversify SAEON income **Strategic objective 6.** Integrate existing research infrastructure programmes to create an intercontinental, environmental, mega-research infrastructure
Outcome 3: Enhanced impact of science engagement (SE)	**Strategic objective 4.** Enhance the impact of the SAEON environmental science education and science engagement programmes
Outcome 4: A transformed organisation that lives its culture and values.	**Strategic objective 1.** Increase workplace diversity **Strategic objective 2.** Create sustainable human resources

Appendix 1: SWOT Analysis

An internal assessment of the strengths, weakness, opportunities and threats to SAEON, under current circumstances is summarised below.

STRENGTHS	**WEAKNESSES**
• Expertise in long-term environmental research • A geographically diverse network of long-term research sites, representative of the major ecosystem types of South Africa, including marine and terrestrial systems. • Well established and diverse collaborations, including strong ties with a number of local universities and government departments and agencies • A reputation for good governance • An entrenched and effective environmental science education programme • Continuous government recognition since inception, and stable core funding	• Geographical separation of offices and staff hinders internal collaboration and skills transfers • Limited demographic transformation of scientific staff • Flat organisational structure with limited opportunities for career path development
OPPORTUNITIES	**THREATS**
• Growing public concern about the impacts of global climate change, and calls for information on contemporary environmental change • Strong demand for long-term environmental data from other government agencies and the international research community • The need for field sites and instrumentation for training university student • Established research in areas that are globally unique, and attractive to international researchers • One of only a few employers of graduates seeking a career in environmental research • Growing scientific networks and initiatives, from national to regional to global, seeking data and expertise on environmental change	• Stakeholder expectations exceeding what can be achieved with available resources • Lack of growth of core funding, and reductions in grant funding resulting from global financial recession • Uncertainty in future funding due to lack of National Facility status • Long time frames for procurement and staff appointments constrain agility • Structural changes in funding regimes for post-graduate students and interns. • Access to long-term research sites, research vessels, external datasets owned by others • Loss of SAEON instruments and gaps in data collection resulting from theft, vandalism, extreme weather and fire • Human capacity shortages, particularly at offices in remote locations