NRF INSTITUTIONAL REVIEW 2015

FINAL SYNTHESIS REPORT

Review panel

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Detailed reports on the reviews of the NRF clusters can be accessed at:

Research and Innovation Support and Advancement (RISA)
Biodiversity and Environmental Sciences Cluster
Nuclear Sciences Cluster
Astronomy Cluster
Science Engagement Cluster

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LIST OF ACRONYMS

ARC	Agricultural Research Council
CEO	Chief Executive Officer
CoE	Centre of Excellence
CPRR	Competitive Programme for Rated Researchers
DAFF	Department of Agriculture, Forestry and Fisheries
DBE	Department of Basic Education
DEA	Department of Environmental Affairs
DHET	Department of Higher Education and Training
DVCR	Deputy Vice-Chancellor Research
DST	Department of Science and Technology
DTI	Department of Trade and Industry
ESRF	European Science Research Foundation
EU	European Union
HartRAO	Hartebeesthoek Radio Astronomy Observatory
HCD	Human capacity development
iThemba LABS	iThemba Laboratory for Accelerator-based Sciences
MINTEK	Council for Mineral Technology
MRC	Medical Research Council
NEP	National Equipment Programme
NF	National Facility
NRF	National Research Foundation
NSI	National System of Innovation
NZG	National Zoological Gardens
RIBS	Radioactive ion beams
RISA	Research and Innovation Support and Advancement
SA	South Africa
SAAO	South African Astronomical Observatory
SAASTA	South African Agency for Science and Technology Advancement
SARChI	South African Research Chairs Initiative
SARAO	South African Radio Astronomy Observatory
SAEON	South African Environmental Observation Network
SAIAB	South African Institute for Aquatic Biodiversity
SKA	Square Kilometre Array
THRIP	Technology and Human Resources for Industry Programme
WRC	Water Research Commission

EXECUTIVE SUMMARY

This report synthesises the individual review reports of the major operative entities of the National Research Foundation (NRF) in the following five clusters: Research and Innovation Support and Advancement (RISA), Biodiversity and Environmental Sciences Cluster, Nuclear Sciences Cluster, Astronomy Cluster and Science Engagement Cluster.

The report also makes a number of overarching recommendations referring to the strategic integration of activities across the NRF; common structures across the NRF and their efficacy; strategic oversight across the NRF entities; the approach to capacity building and science engagement across the NRF; the appropriateness of the allocation of resources across NRF entities and disciplines; as well as the appropriateness of the NRF having both an agency function and being a research performer through its national research facilities.

The 1996 White Paper on Science and Technology introduced the notion of a 'National System of Innovation' (NSI) into South Africa's formal public policy discourse as "a means by which a country seeks to create, acquire, diffuse and put into practice new knowledge that will help that country and its people achieve their individual and collective goals". Ideally the NSI consists of a co-ordinated, synergistic national network of policy instruments, funding agencies and knowledge-producing institutions contributing to the nation's social and economic advancement. In practice, the innovation landscape in South Africa appears to be relatively fragmented, with a proliferation of agencies.

The remit of the NRF as an independent government agency is described in the National Research Foundation Act (Act No. 23 of 1998). Under the oversight of the Department of Science and Technology (DST), the mandate of the NRF is to promote and support research through funding, human resource development and the provision of the necessary research facilities in order to facilitate the creation of knowledge, innovation and development in all fields of science and technology, including indigenous knowledge, thereby contributing to the improvement of the quality of life of all South Africans.

The synthesis panel recognises the necessity as well as the potential of the NRF (in close collaboration with other national role players) to (re)shape, catalyse and strengthen the National System of Innovation.

To optimise the NRF functions in its current mandate and operational context as well as its potential future role in the National System of Innovation, the panel makes the following overarching recommendations with regard to the (1) role of the NRF in the NSI, and (2) operational, structural and budgetary aspects:

With respect to the role of the NRF in the National System of Innovation, it is recommended that:

- The DST (in consensus with the NRF) should clearly demarcate the domains in which the NRF is to fulfil its mandate in terms of the NRF Act to "promote and

support research through funding, human resource development and the provision of the necessary research facilities".

This is a prerequisite for the NRF to clearly define its future national positioning, required degree of operational autonomy as well as its role to co-ordinate across key role players in the NSI. Such a consensus could also provide valuable input for the current discussions on the revision of the NRF Act.

- The contribution to the transformation agenda is a key deliverable of the NRF. However, the measures should be better aligned and integrated with other components of the education and training system to ensure an integrated approach to transforming the scientific landscape. The key step in this regard should be a reconfiguration and formulation of the co-operation between the NRF and DHET (for example, in the form of joint research appointments – at all levels – between academia and national facilities).

With respect to operational, structural and budgetary aspects of the NRF, it is recommended that:

- A benchmarking study (in relation to other funding agencies both nationally and internationally) should be commissioned to optimise and transparently communicate all the internal operational processes of the NRF, in particular focusing on research and innovation support and advancement.

- The structure of the NRF should be further developed to include a policy advice function (through strategic analysis and fore-sighting) that is informed by a permanent analytical impact assessment capability. A prerequisite for such structural adjustments would be a co-ordinating and convening mandate across the NSI.

- The current science engagement and communication model of the NRF should be reconsidered and broadened in the context of transformation issues, impact analysis and the convening function.

- In the context of the proposed structural changes, the overall governance structure (including NRF board and national facilities) as well as management processes should be re-evaluated.

- Given the current NRF mandate and the associated future expectations, the overall annual budget allocation should be critically reviewed. It is critical that the relationship between the baseline budget and strategic allocations are revised to ensure sufficient funding for the NRF and the national facilities to adequately perform their operational requirements. A zero-based budgeting approach is recommended to ensure the appropriate allocation of resources across NRF entities and disciplines.

1. BACKGROUND

Five years after the previous institutional review in 2010, the National Research Foundation (NRF) has undergone a third review in 2015. The 2015 review was focused on the delivery of the NRF entities against the NRF's mandate and strategic objectives during the past five years (2010–2015) (Terms of Reference, Appendix 1). For the purpose of the review, the entities of the NRF were divided into the following five clusters:

- Biodiversity and Environmental Sciences Cluster:
  - South African Institute for Aquatic Biodiversity (SAIAB)
  - South African Environmental Observation Network (SAEON)
  - National Zoological Gardens of South Africa (NZG)

- Nuclear Sciences Cluster:
  - iThemba Laboratory for Accelerator Based Sciences (iThemba LABS)

- Astronomy Cluster:
  - South African Astronomical Observatory (SAAO)
  - Hartebeesthoek Radio Astronomy Observatory (HartRAO)
  - South African Square Kilometre Array (SKA) project in terms of its human capacity development and science engagement components

- Science Engagement Cluster:
  - South African Agency for Science and Technology Advancement (SAASTA)
  - Science engagement activities of all the NRF entities that were reviewed

- Research and Innovation Support and Advancement (RISA).

Each of these clusters was reviewed by specialist review panels comprising three to four eminent scientists, most of whom were from overseas foundations, research organisations or universities. The synthesis review panel studied the five cluster reports and recommends that these specialist reports and the various recommendations be examined and acted on by the NRF executive and the directors of the entities as appropriate. The synthesis review panel (hereafter referred to as the panel) considered the larger generic issues in these reports as well as certain specific recommendations (which were explored in a series of interviews during the week of 7–11 of December 2015) relevant to the overarching operations of the NRF. It should be noted that the reports were obtained prior to the student protests in South Africa during 2015 and therefore did not consider their impact on the higher education system and the NRF's operational functions.

1.1 Purpose and scope of the review

The panel was constituted to compile a synthesis report on the NRF as a single organisation based on the findings and recommendations of the cluster reviews to address the following:

- Integration of activities across the NRF
- Common structures across the NRF and their efficacy

- Strategic oversight across the NRF entities
- Approach to capacity building and science engagement across the NRF
- Appropriateness of the allocation of resources across NRF entities and disciplines
- Appropriateness of the NRF having both an agency function and being a research performer through its national research facilities
- Any gaps in the national system of innovation (NSI) that the NRF should be addressing in terms of the NRF Act
- NRF's alignment with the Ten-year Innovation Plan of the Department of Science and Technology (DST).

At a briefing meeting with members of the Review Reference Group, the panel was asked to consider the future perspective and role of the NRF within the NSI as well as the pan-African and international research policy and research execution context. In its interaction with NRF board members, the panel concluded that it would be useful to make some comments on the role and positioning of the board as an essential aspect of the governance of the organisation.

1.2 Review process and methodology

In advance of meeting in Pretoria from 7–11 December 2015, the panel received the relevant documentation required for the review (Appendix 2). As reflected in Appendices 3 and 4, the panel had in-depth discussions with the Review Reference Group, NRF executive, Department of Science and Technology, NRF board members, external stakeholders, managing directors of the national facilities and a representative of the Department of Higher Education and Training (DHET). Given the volume of material covered in the various submissions and responses, this report aims to focus on major observations and recommendations rather than re-stating and summarising the details available in this material. However, some specific recommendations have been incorporated in so far as they are relevant to the long-term financial and strategic planning of the NRF.

The point of departure for the synthesis review panel was the analysis and mapping of the NRF in terms of its organisational and stakeholder landscape and positioning in terms of its *current* mandate. The panel is of the opinion that such an analysis will provide the necessary framework for the synthesis report and its recommendations, although recognising that such an approach cannot be fully comprehensive.

The positioning of the NRF within the broader research policy, research development and knowledge production context in South Africa is indicated in Figure 1.

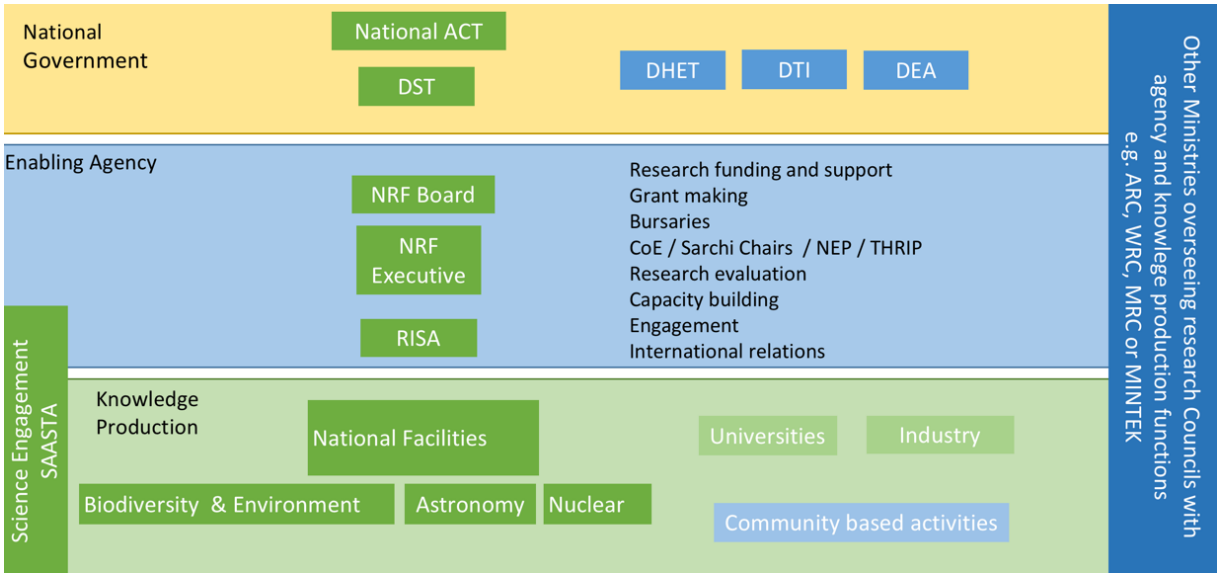


Figure 1: The structure of the NRF within the broader national system of innovation

Note: ARC: Agriculture and Research Council; CoE: Centre of Excellence; DEA: Department of Environmental Affairs; DHET: Department of Higher Education and Training; DST: Department of Science and Technology; DTI: Department of Trade and Industry; MINTEK: Council for Mineral Technology; NRF: National Research Foundation; NEP: National Equipment Programme; RISA: Research and Innovation Support and Advancement; SAASTA: South African Agency for Science and Technology Advancement; SARChI Chairs: South Africa Research Chairs Initiative; THRIP: Technology and Human Resources for Industry Programme; WRC: Water Research Commission

The remit of the NRF as an independent government agency is described in the National Research Foundation Act (Act No. 23 of 1998). Under the oversight of the Department of Science and Technology, the mandate of the NRF is to promote and support research through funding, human resource development and the provision of the necessary research facilities in order to facilitate the creation of knowledge, innovation and development in all fields of science and technology, including indigenous knowledge, thereby contributing to the improvement of the quality of life of all South Africans.

This mandate requires the NRF to operate as an agency within the research support and advancement domain, and also to be present in the knowledge production space through its various national facilities.

In the research support and advancement domain, the NRF performs the following functions through RISA: research funding and support; grant making; awarding of bursaries; managing research programmes including Centres of Excellence (CoEs), the South African Research Chairs Initiative (SARChI), the National Equipment Programme (NEP) and the Technology and Human Resources for Industry Programme (THRIP); research evaluation; capacity building; as well as international relations.

The major beneficiaries of the research support and advancement function of the NRF are South African universities. The Department of Higher Education and Training (DHET) is thus a key stakeholder at the national government level. Certain programmes such as THRIP, which has an innovation and industry focus, are

managed on behalf of the Department of Trade and Industry (DTI). At the national government level another key player, particularly in the Biodiversity and Environmental Sciences Cluster, is the Department of Environmental Affairs (DEA). At the national government level several other ministries support, advance and carry out research activities through their respective research councils, for example, the Medical Research Council (MRC), the Agricultural Research Council (ARC) and the Water Research Commission (WRC).

In the knowledge production space, the NRF not only provides and maintains essential national research infrastructure, but is also involved in knowledge production through the research activities of the national facilities, which are perceived to fulfil the following primary functions:

- Providing research infrastructure to the broader research community
- Generating knowledge through research and engagement with the broader community
- Providing a hub for capacity building for students and professionals so as to produce the next generation of professional researchers
- Expediting collaboration and networking at a national and international level.

The 1996 White Paper on Science and Technology introduced the concept of the national system of innovation (NSI) into South Africa's formal public policy discourse. The White Paper became the cornerstone of government policy on science and technology. In this White Paper,[1] the NSI is conceptualised as 'a means by which a country seeks to create, acquire, diffuse and put into practice new knowledge that will help that country and its people achieve their individual and collective goals'. Ideally the NSI consists of a co-ordinated, synergistic national network of policy instruments, funding agencies and knowledge-producing institutions contributing to the nation's social and economic advancement.

This ambition as originally articulated in the White Paper has recently re-entered the South African national debate through the notion of a single science vote. The present research and innovation support and advancement landscape is perceived to be rather fragmented. In this context, the panel recognises the potential of the NRF, as a national agency in collaboration with other national role players, to fulfil both a catalytic and convening role in realising the NSI.

2. SYNTHESIS OF REVIEW REPORTS

Each of the five clusters was reviewed by a specialist panel. The synthesis review panel studied the five cluster reports and recommends that these specialist reports and the various recommendations be examined and acted on by the NRF executive and the directors of the entities as appropriate. The synthesis review panel considered the larger generic issues in these reports and certain specific recommendations relevant to the overarching operations of the NRF. The essential outcome of each cluster review can be summarised as follows:

[1] Department of Arts, Culture, Science and Technology (1996). White paper on Science and Technology: Preparing for the 21st Century. Pretoria: DACST.

2.1 Research and Innovation Support and Advancement (RISA)

RISA plays a critical role in the NRF enterprise:

- As the grant-making entity of the NRF, it distributes funds for bursaries, research projects, equipment, centres of excellence and research chairs primarily, but not exclusively, to higher education institutions.
- It invests in knowledge, people and infrastructure with the aim of developing the country's diverse human capital, helping researchers to unlock their full potential, and placing strong emphasis on supporting increasing numbers of black researchers as part of the transformation agenda.
- It facilitates national and international partnerships and knowledge networks.
- In close collaboration with the DST, RISA provides science and technology information to assist and guide strategic visioning and decision-making processes in support of science and innovation policies and measures.

The 2015 RISA review panel notes several positive developments towards active engagement and transparency, such as:

- The process of establishing guidelines for reviews and evaluations in line with the European Science Research Foundation (ESRF)
- Inviting researchers who are concerned about the rating process to attend panel meetings as observers
- The decision to establish a feedback forum on NRF activities, including those of RISA, for Deputy Vice-Chancellors: Research (DVCR)
- Including early-career researchers as members of evaluation panels
- Launching a new informative and interactive NRF website
- Contributing to growing the number of rated researchers and the proportion of black researchers
- Improving the electronic services of the grant application systems since 2009.

The following main areas of concern are identified:

- The current peer review system used by RISA does not seem to serve and support optimal capacity building in the sense of achieving greater equity in RISA's distribution of resources.
- Communication with the research communities that RISA serves is not fully satisfactory, and there is a lack of detail, specificity and full transparency in funding allocations.
- There are serious gaps in the monitoring and the subsequent evaluation and analysis of the effect and impact of the grants on building research communities and research cultures at different institutions.
- RISA does not maintain records that would enable it to produce basic aggregate indicators such as data on unsuccessful applications.

A number of stakeholders identified the problem of inadequate attention to monitoring and evaluation as a barrier to greater transparency. Apparent rapid staff turn-over and the associated risk of not being able to retain institutional memory at

different levels is linked to the capacity of the NRF to sustain its current role in the development of South Africa's research landscape and research capacity.

The key findings and recommendations can be synthesised as follows:

Overall RISA strategy

The presentation of the RISA portfolio fails to clarify its contributions to different priorities. There is no indication of its commitment to pursuing either international research partnerships and funding opportunities, or government priorities and the National Development Plan, except in the area of human resource development. At a higher level, the NRF also needs to consider adopting a more demand-driven system as opposed to the current supply-driven approach. Open competition and demand-driven (by the researcher community) programs are core features of research councils internationally. The panel also notes that the balance between researcher-driven research and targeted research is a complex equation for all nations. The imbalance skewed towards targeted research is a matter of concern that the NRF needs to address.

The funding distributed to the research community through RISA has grown significantly over the review period, but this growth has led to a proliferation of calls for proposals and a sense that the opportunities are fragmented.

Key recommendations

- *RISA needs to articulate a clear mission and strategic framework for NRF funding, and communicate how its current portfolio of instruments represents that mission.*

- *RISA needs to develop a strategy through which it can communicate and execute the NRF's contribution to the National Development Plan, as well as its potential further contribution.*

Credibility and transparency of the peer review system, review burden and effectiveness of review panels

Applicants are not always informed about the strengths and weaknesses of their submissions identified through the review process, and unsuccessful applications commonly receive no feedback at all. Compared with international experience, RISA convenes a large number of panels for modest numbers of proposals, and the number of instruments that call for reviews is increasing. Review panels often seem to lack the necessary expertise and experience, and the composition of such panels is perceived as not being fully transparent. While the composition of the rating panels is published on the NRF website, the composition of other review panels is not published.

Key recommendations

- *RISA should implement a system of returning anonymous verbatim reviews on all full proposals.*

- *RISA should consider increasing the number of reviews per panel member, combining the panel reviews of proposals submitted under related calls, and reviewing annual reports administratively rather than through panels.*

- *RISA should establish standing panels to address regular calls, and incorporate special calls into the workload. A regular schedule should be established for these panels to meet so that a sufficiently expert and diverse group can be assembled through advance travel planning.*

- *RISA needs to consider publishing the composition of all review panels, at least in the aggregate.*

- *RISA also needs to consider publishing the success rates for both rated and non-rated researchers for all its various funding instruments to dispel the perception that only rated researchers receive funding from the NRF.*

Transformation

As the most prominent funding agency for South Africa's scientific community, the NRF plays a vital role in shaping the research environment. RISA is held accountable for attaining targets for the inclusion of women and blacks in each of its programmes. The annual reports indicate that it is meeting those targets overall. The NRF, with RISA at its core, appears to be successfully supporting the national goal of transformation at the individual level. Nonetheless, there are perceptions from some quarters that the actions of the NRF are reinforcing rather than transforming historical patterns of stratification among South African universities. Unless this perception is countered with solid information, it could undermine the motivation of committed researchers to apply for funding. Numerous programmes are focused on capacity development and research excellence. RISA needs to ensure that eligible researchers at all career stages can select from a menu of funding instruments to maintain the mid-career research population. The Thuthuka programme currently provides nine years of funding: three for a doctoral degree, three for post-doctoral training and three for researchers to establish themselves. Awards to Thuthuka grantholders are higher than, for example, in the Competitive Programme for Rated Researchers (CPRR) or the Blue Skies Programme. There are widespread anecdotal perceptions of the success of the Thuthuka and SARChI programmes, but there is insufficient tracking to provide evidence that RISA programmes are delivering the desired outcomes.

Key recommendations

- *RISA should on an annual basis publish funding rates by institutional group, providing clear indications of the volume of applications and size of requests, the success rates of applications, the race and gender of the applicants for both its portfolio of instruments and for large calls, and the percentage of funds requested that are awarded to South African universities and to other institutions, both local and international.*

- *The NRF, through RISA, needs to re-establish a strong programme of building research capacity in historically disadvantaged research-oriented institutions.*

This effort must be appropriately staffed and resourced, and developed in collaboration with DHET.

- *Given that the lack of appropriate supervisory skills in the research workforce was identified as a constraint to improving PhD throughput rates, the NRF (RISA) should consider utilising Centres of Excellence and SARChI Chairs as venues for providing such training to clusters of researchers in disciplines allied to the centres or chairs. Grants to centres and chairs could be top-sliced for this purpose.*

- *While building the next generation of researchers, RISA needs to maintain a balance between research and teaching activities to ensure that the retention of the capacity built not only serves government agencies or private laboratories, but could also be a future pipeline to universities.*

Bursaries

RISA does not provide an annual update of funding and success-rate data for student bursaries, which makes it difficult to evaluate the state of research training at South African universities. There seems to be a problem of late payments of bursaries, leaving bursary recipients without income for a month or more. Bursary amounts vary widely at the same degree level, not only across government agencies, but also between the various bursary sources, including government, grantholder-linked, scarce skills and private bursaries.

Key recommendations

- *RISA should provide an annual list of funding and success rates for student bursaries on the NRF website.*

- *RISA needs to develop a solution to administrative problems so that bursaries are paid on time. An effort should be made to standardise the values of bursaries with other agencies.*

Rating system

The South African system of rating individual researchers is relatively rare in international terms. It has both advantages and disadvantages as part of the current research system. The panel noted the widespread support for the rating system in terms of its integral role in capacity building and in providing various incentives for researchers to become, and remain, active in research and publishing. However, there were also criticisms that the rating system is perceived in some quarters as 'locking out' researchers.

Key recommendation

- *The panel notes that the 2010 review discussed moving away from an individual rating system to a discipline or research group system. The NRF should investigate and formally respond to this earlier recommendation.*

Relationship to other funding instruments

The NRF is ideally placed to develop a more proactive approach to mitigating the negative impact on research innovation and productivity due to the lack of co-ordination and co-operation between different funding instruments. An excellent example of the value of greater co-operation is afforded by the joint DST/NRF initiative to create an interactive database mapping the geographic location of research infrastructure and equipment.

Key recommendation

- *RISA (NRF) should consider focusing more on the possibility of co-ordinating and streamlining efforts to support and expand research capacity through grants to postgraduate students, and in establishing links with industry and international partners. The recommendation of the Ministerial Committee for the Review of Funding of Universities should be noted, namely that the resources of DHET, the NRF and donor funding should be aligned, to give effect to the establishment of Centres of Excellence at under-developed universities.*

Research engagement

Outreach and engagement activities are an important and integral part of science efforts internationally.

Key recommendation

- *RISA should amend its funding architecture so that researchers funded through RISA will have outreach and engagement plans as a clearly identifiable part of their funding package.*

Internal processes

Given the increasing number of student applications and proposals from a growing research community due to the massification of the higher education system, the strain on the NRF system needs to be relieved to ensure an efficient system and reduce the administrative burden experienced by staff.

Key recommendation

- *RISA should work towards simplifying and streamlining data retrieval and reporting. Tools for communicating funding opportunities to potential applicants should be improved through the streamlining of proposal submissions to unrelated calls. The automation of the online system and interfaces needs to be improved and made fully operational and reliable. Honours and masters bursary applications should not require the extensive research proposals expected at the doctoral level. This would also serve to alleviate reviewer fatigue.*

2.2 Biodiversity and Environmental Sciences Cluster

The Biodiversity and Environmental Sciences Cluster review panel considered the following national facilities:

- National Zoological Gardens of South Africa (NZG)
- South African Institute for Aquatic Biodiversity (SAIAB)

- South African Environmental Observation Network (SAEON)

The facilities were considered from the perspective of their function and performance as individual units, but more importantly, common and shared problems as well as synergies and opportunities were examined. The panel made a number of key recommendations following the review:

Social scientists as partners in designing transdisciplinary research

Key recommendation

- *Social scientists should be involved as partners in the co-development and co-design of appropriate transdisciplinary research topics that could strengthen the contribution of the research output of national facilities into socially relevant strategies.*

Synergy and co-operation with government departments

The panel noted clear and substantial opportunities for the national facilities to co-operate with government departments such as DEA, DBE, DHET, DAFF and provincial departments of education, environment and conservation. This would be aided by clear direction from the NRF and support by the DST.

There are multiple role players with mandates for capacity building and outreach in the field of biodiversity and environmental sciences, including DEA, DST, DHET and DAFF and their respective agencies. This is currently perceived by some as a source of tension. This tension could be removed by viewing each player as a strategic partner to the national facilities that could assist in the development and adoption of best practices.

Key recommendation

- *Opportunities should be exploited for synergy and co-operation with government departments such as DEA, DBE, DHET, DAFF and provincial departments of education, environment and conservation.*

Regional influence

Key recommendation

- *The national facilities should have greater regional influence in leading and sharing best practice projects with other African programmes, and be involved with international programmes including the EU-funded Horizon 2020.*

Potential for scientific synergies between national facilities

The potential synergies between national facilities in this cluster include the transfer of best practices in bio-banking, genetic analysis, biodiversity informatics, (big) data management, and archiving/collection management.

Other possible opportunities for synergy include the best practices developed in the various national facilities in aspects of transformation and staff development, training, education outreach and engagement of designated groups. Sharing of best

practices and cross-fertilisation of ideas would substantially enhance the efficacy of national facilities to deliver on their mandates.

Key recommendation

- *The substantial potential for scientific synergies between national facilities in this cluster should be exploited.*

Outreach

Any communication strategy that is developed must recognise the particular needs and preferences of policy-makers, the general public, school learners, students, the media and organised groups.

The value of citizen science in contributing to the knowledge economy is under-estimated. The NRF should lead the way in citizen science through its national facilities with specific activities targeting designated groups.

There is a need for specific additional funding for positions in education outreach, marketing and engagement, which should not be at the expense of research positions.

The national facilities should explore innovative methods to reach out to non-traditional stakeholders in order to contribute to a culture of informal adult learning.

The indicators measuring contributions to policy-making, transformation, outreach and public engagement need to be improved, as the current key performance indicators often fail to recognise key contributions by the national facilities in these areas.

There is a need for specific metrics for the undervalued contributions of the national facilities to community engagement.

Key recommendation

- *A common strategic approach should be developed to outreach this cluster, supported by suitable key performance indicators.*

2.3 Nuclear Sciences Cluster

The Nuclear Sciences Cluster review panel considered the iThemba Laboratory for Accelerator-Based Sciences (iThemba LABS) based at two sites: in the Western Cape (Faure) and Gauteng (on the campus of the University of the Witwatersrand).

The facilities were considered from the perspective of their function and performance as individual units, but more importantly, common and shared problems as well as synergies and opportunities were examined. The panel made a number of key recommendations following the review:

Radioactive ion beams (RIBs)

This is an ambitious and long-term phased project that will help develop skilled manpower across the South African nuclear, isotope and radiation sciences landscape (including accelerator science and radiochemistry) and keep South African nuclear science research abreast of current world developments. The costing of this project in terms of manpower and infrastructure will put pressure on the medium-term financial sustainability of the national facility, but this key, ambitious, carefully considered and 'big science' project is considered necessary for the long-term viability of iThemba LABS as a leading research institute. The NRF is commended for demonstrating its support for the project by providing funding worth R32 million for the RIB demonstrator and for a RIB project feasibility study.

Key recommendation

- *The NRF should intensify its support for the future radioactive ion beams (RIBs) project to be housed at the Western Cape campus of iThemba LABS.*

Joint positions

iThemba LABS has major research universities within the local vicinity of both its Western Cape and Gauteng campuses. More effort should be made to investigate the implementation of joint positions for early-career and future leading scientists with these institutions in a range of areas including nuclear theory, radioactive ion-beam physics, nuclear structure and reaction physics, applied radiation science, radiation biology, isotope science and material science. Relationships with the following university could be considered, for example: the universities of the Western Cape, Stellenbosch, Cape Town and Cape Peninsula University of Technology in the Western Cape; and the universities of Johannesburg, Witwatersrand, Pretoria and Tshwane University of Technology in Gauteng.

Key recommendation

- *Joint positions should be established for early-career and future leading scientists with academic partner institutions of iThemba LABS.*

Separate entities for research and routine production

The role of large-scale routine isotope production at iThemba LABS (Western Cape) needs to be considered in more detail in terms of possible tension with the research role of the national facility. The isotope-production facility currently generates significant revenue for the laboratory from external sales, but this seems to be at the expense of time spent on fundamental research into high-power targeted development in nuclear science and mechanical engineering, radiochemistry, organic chemistry and radiolabelling of new pharmaceuticals. Since the financial plans for iThemba LABS include a significant planned increase in income from radioisotope production, management might consider splitting the radioisotope-production facility into two separate entities, one based on routine production, and another smaller unit focused on research.

Key recommendation

- *Consider splitting the radioisotope-production facility into two separate entities, one based on routine production, and another smaller unit focused on research.*

2.4 Astronomy Cluster

The Astronomy Cluster review panel considered the following NRF national facilities:

- South African Astronomical Observatory (SAAO)
- Hartebeesthoek Radio Astronomy Observatory (HartRAO)
- South African Square Kilometre Array (SKA) project in terms of its human capacity development and science engagement components

The Astronomy Cluster review panel regards the NRF management and oversight of the major astronomical centres in South Africa as effective and satisfactory. Working closely with the DST, the NRF has been successful in highlighting astronomy as a primary vehicle for human capacity development, technological innovation and education in South Africa. The Square Kilometre Array (SKA) is a bold venture that demonstrates how firm commitment to a complex scientific and technological project can elevate a society.

The panel made a number of key recommendations following the review:

Advisory bodies and co-ordination committees

The emerging activities in big data astronomy are important developments not only for the whole the Astronomy Cluster but also for society, with the potential for broad economic and societal impact. It is recommended that the NRF sub-agency establish a co-ordination committee with representation from all of the big data astronomy activities to facilitate co-operation between them.

Community input to the multi-wavelength strategic plan has been effective and welcomed by stakeholders. The NRF astronomy sub-agency in consultation with the community should consider implementing a mid-layer of advisory bodies that provide input to the Astronomy Advisory Council as a mechanism to provide meaningful community participation. Examples of these bodies may be the Standing Astronomy Grants Panel together with Science Advisory Committees for each facility.

Key recommendation

- *A set of mid-layer advisory bodies and co-ordination committees should be established as a mechanism for providing meaningful user-community feedback and co-ordination.*

Astronomy sub-agency

The NRF astronomy sub-agency manages a wide portfolio of projects, activities and interactions. It is essential that prioritisation of these activities and projects be established at an early stage. It is recommended that this be taken forward in strong consultation with the Astronomy Advisory Council and the proposed advisory bodies and co-ordination committees. The sub-agency structure must clearly focus on co-

ordination issues. The possibility of the potential for conflict with the operational aspects should be avoided through direct delegation from the NRF CEO to the national facility directors in the major operational issues.

Key recommendation

- *The astronomy sub-agency and associated committee structures should continue to be developed.*

South African Radio Astronomy Observatory (SARAO)

A strategic plan for the creation of SARAO should be developed with community input that addresses not only SKA-SA but also the future of HartRAO infrastructures within SARAO.

Key recommendation

- *The South African Radio Astronomy Observatory (SARAO) should be established.*

Human capacity development programme

Strengthening the human capacity development (HCD) programme in the astronomy sub-agency is recommended through (1) continued support for the SKA-SA HCD programme, especially the financially competitive bursary levels, for at least a further five-year period; (2) giving consideration to creating a similar (and appropriately sized) bursary programme targeting those areas of astronomy managed by SAAO; and (3) implementing measures such as creating research fellowships that will serve as a means of bridging between postdoctoral and academic staff positions within universities.

The NRF, DST and other appropriate agencies should co-operate in considering ways to make it easier for established researchers with good track records to transition their research to other areas so as to fully exploit the new investments in South African astronomy. For example, adjustments to the academic rating system should be considered so that researchers are not disadvantaged when changing fields.

Key recommendation

- *The human capacity development programme should be strengthened.*

4m-class telescope

The multi-wavelength strategic plan proposes a new 4m-class telescope strongly linked to the follow-up of MeerKAT and SKA discoveries. The panel recommends that the astronomy sub-agency initiate a detailed scientific study of the value to South African astronomy of this proposal and also investigate cost-effective designs for a targeted instrument with restricted modes of operation.

Key recommendation

- *A detailed scientific study should be initiated to determine the value to South African astronomy of a new 4m-class telescope.*

Space geodesy

The space geodesy work at HartRAO does not fall within the scope of the Astronomy Cluster.

Key recommendation

- *An independent report on the future of the space geodesy work at HartRAO should be commissioned.*

Science engagement activities of the Astronomy Cluster

The science engagement activities of the Astronomy Cluster are of high quality, but are often a series of independent activities that would benefit from greater co-ordination. Modest investment is recommended to strengthen this area further by: (1) convening an annual national conference to bring practitioners together; and (2) considering wider adoption of modern technologies where appropriate, for example, web-based material.

Key recommendation

- *The science engagement activities across all the facilities of the Astronomy Cluster should be co-ordinated.*

2.5 Science Engagement Cluster

The Science Engagement Cluster review panel considered the activities of the South African Agency for Science and Technology Advancement (SAASTA) as well as the science engagement activities of all NRF entities. The panel made a number of key recommendations following the review:

Scope, definition and key metrics of science engagement

The Science Engagement Cluster review panel was intrigued by the renewed emphasis on science engagement within the SAASTA strategy and the apparent confusion about the definition of what science engagement is. In many places, different words are used to describe the idea, but the report and responses to it generally provided nothing more than a listing of actions and activities. The scope and the definition of the term ‘science engagement’ needed to be clarified for two essential reasons. Firstly, because it would help to clarify certain gaps in the roll-out of SAASTA’s overall strategy, and secondly because it would help to align that strategy with the international current concepts. According to the review panel, the absence of a clear definition and the substantiation of definition by a list of actions, as impressive as they are, reflect a vision that is limited to a top-down approach known as the ‘deficit model’. This model represents a form of science engagement process that is limited to delivering more science content to more people in the hope to get larger crowds excited about science, and through this getting more support for the scientific endeavour.

Key recommendation

- *Consensus needs to be reached between the DST and the NRF on the scope and definition of the term ‘science engagement’. A clear description of the key*

metrics for the evaluation of science engagement programmes should also be developed.

Communicating with diverse audiences

Science communication is one of the three-pronged focus areas (along with science education and science engagement) that form SAASTA's strategic approach to science advancement. Within science communication, three further operational areas are delineated: science and the media, science promotion, and science communication capacity building. Science and the media covers aspects of marketing the SAASTA brand and the activities of science communicators in-house, in the academic community and beyond, and in the print and broadcast community. To reach the widest possible audience, it is essential to encourage communication in all official languages.

Key recommendation

- *The numbers of scientists and science communicators that communicate in different South African languages should be increased so as to address more diverse audiences.*

Indigenous knowledge systems

The NRF Act specifically includes attention to indigenous knowledge systems (IKS). It follows that SAASTA is mandated to give attention to IKS in its programmes. However, no evidence of involvement and public sensitisation in the area of IKS was seen in the SAASTA self-assessment report.

Key recommendation

- *The profile and content of indigenous knowledge systems (IKS) should be raised in science engagement programmes.*

3. OVERARCHING RECOMMENDATIONS

The 1996 White Paper on Science and Technology introduced the notion of a 'National System of Innovation' (NSI) into South Africa's formal public policy discourse as "a means by which a country seeks to create, acquire, diffuse and put into practice new knowledge that will help that country and its people achieve their individual and collective goals". Ideally the NSI consists of a co-ordinated, synergistic national network of policy instruments, funding agencies and knowledge-producing institutions contributing to the nation's social and economic advancement. In practice, the innovation landscape in South Africa appears to be relatively fragmented with a proliferation of agencies.

The remit of the NRF as an independent government agency is described in the National Research Foundation Act (Act No 23 of 1998). Under the oversight of the Department of Science and Technology, the mandate of the NRF is to promote and support research through funding, human resource development and the provision of the necessary research facilities in order to facilitate the creation of knowledge, innovation and development in all fields of science and technology, including

indigenous knowledge, thereby contributing to the improvement of the quality of life of all South Africans.

The synthesis panel recognises the necessity as well as the potential of the NRF (in close collaboration with other national role players) to (re)shape, catalyse and strengthen the National System of Innovation.

To optimise the NRF functions in its current mandate and operational context as well as its potential future role in the National System of Innovation, the panel makes the following overarching recommendations with regard to the (1) role of the NRF in the NSI, and (2) operational, structural and budgetary aspects:

With respect to the role of the NRF in the National System of Innovation, it is recommended that:

- The DST (in consensus with the NRF) should clearly demarcate the domains in which the NRF is to fulfil its mandate in terms of the NRF Act to "promote and support research through funding, human resource development and the provision of the necessary research facilities."

  This is a prerequisite for the NRF to clearly define its future national positioning, required degree of operational autonomy as well as its role to co-ordinate across key role players in the NSI. Such a consensus could also provide valuable input for the current discussions on the revision of the NRF Act.

- The contribution to the transformation agenda is a key deliverable of the NRF. However, the measures should be better aligned and integrated with other components of the education and training system to ensure an integrated approach to transforming the scientific landscape. The key step in this regard should be a reconfiguration and formulation of the co-operation between the NRF and DHET (for example in the form of joint research appointments – at all levels – between academia and national facilities).

With respect to operational, structural and budgetary aspects of the NRF, it is recommended that:

- A benchmarking study (in relation to other funding agencies both nationally and internationally) should be commissioned to optimise and transparently communicate all the internal operational processes of the NRF, in particular focusing on research and innovation support and advancement.

- The structure of the NRF should be further developed to include a policy advice function (through strategic analysis and fore-sighting) that is informed by a permanent analytical impact assessment capability. A prerequisite for such structural adjustments would be a co-ordinating and convening mandate across the NSI (see Figure 2).

- The current science engagement and communication model of the NRF should be reconsidered and broadened in the context of transformation issues, impact analysis and the convening function.

- In the context of the proposed structural changes, the overall governance structure (including NRF board and national facilities) as well as management processes should be re-evaluated.

- Given the current NRF mandate and the associated future expectations, the overall annual budget allocation should be critically reviewed. It is critical that the relationship between the baseline budget and strategic allocations are revised to ensure sufficient funding for the NRF and the national facilities to adequately perform their operational requirements. A zero-based budgeting approach is recommended to ensure the appropriate allocation of resources across NRF entities and disciplines.

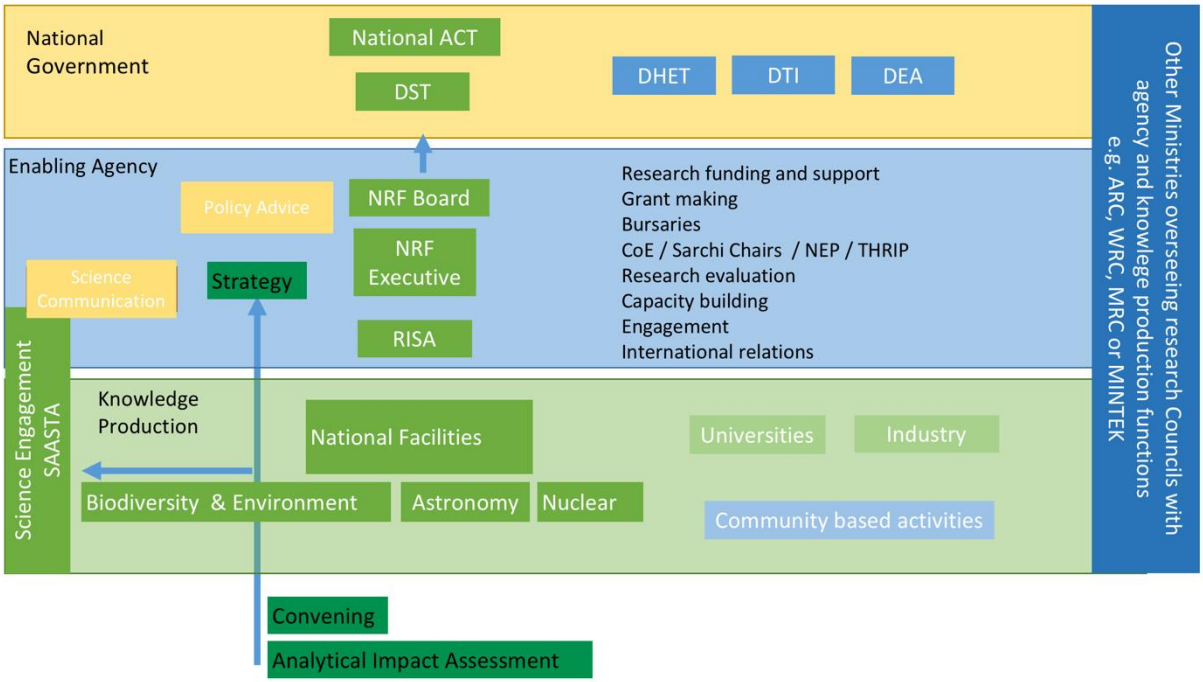


Figure 2 : Proposed future functions of the NRF

4. CONCLUSIONS

The follow-up of the recommendations of the previous review reports has been well documented (e.g. Recommendations from the 2010 NRF Institutional Review). These documents present a message of a strong and systematic approach to further developing the NRF to serve the scientific community. The panel acknowledges this and commends the professional approach and efforts. There has been substantial progress regarding many issues, and some have been resolved. At the same time, however, there are some significant outstanding issues, some of which we have highlighted in the panel's report.

The panel broadly supports the methodology utilised for the 2015 review of the NRF. The panel would prefer in future to have an interaction session with the drafters of the material that was provided to the panel. The involvement of high-level international reviewers was important and contributed to the development of the clusters. However, by having predominantly subject specialists as part of the cluster review panels, a critical strategic view was lacking in some cases. The panel recommends that members of the NRF executive should not be part of the Review Reference Group. The role of executive management and heads of the national facilities in responding to the review reports was not always clear, and these need to be followed up with specific action steps and deadlines to be achieved. The panel recommends an integrated response to review reports in future reviews across all the clusters. Regular reviews of the national facilities should be on-going and feed into the next five-year reviews. The support of an experienced external scribe during the synthesis review was invaluable.

ACKNOWLEDGEMENTS

- The NRF board and executive for their open and willing participation.
- Anke Rädel, David Manamela and Joyce Oliver for excellent support.
- Robyn Arnold for outstanding assistance as external scribe.

APPENDIX 1: TERMS OF REFERENCE FOR THE INSTITUTIONAL REVIEW OF THE NATIONAL RESEARCH FOUNDATION (2015)

1. Assignment title

Institutional Review of the National Research Foundation (NRF) covering the period 2009 to 2015.

2. Background

Science Councils in South Africa are to be reviewed at five-year intervals. The NRF, which was commissioned on 1 April 1999, experienced institutional reviews in 2004 and 2010. The latter review consisted of five in-depth reviews of the NRF entities grouped within the following clusters:

- Nuclear sciences (iThemba Laboratory for Accelerator Based Sciences);
- Astro-geosciences (Hartebeesthoek Radio Astronomy Observatory, Hermanus Magnetic Observatory, South African Astronomical Observatory);
- Research and Innovation Support and Advancement (RISA);
- Biodiversity and environmental sciences (South African Environmental Observation Network, South African Institute for Aquatic Biodiversity, National Zoological Gardens of South Africa); and
- Science advancement (South African Agency for Science and Technology Advancement,
- Science advancement activities of all the NRF entities reviewed).

In addition a group of reviewers was appointed to compile an overarching report synthesising the findings and recommendations of the five review reports covering the individual clusters.

The 2015 NRF Institutional Review will be focused on the delivery of the NRF entities against the NRF's mandate and strategic objectives during the past six years as reflected in the NRF Strategic Plan "NRF Vision 2015". The same methodology applied in the 2010 review will be used for the 2015 review but will exclude the Hermanus Magnetic Observatory which left the fold of the NRF. However, the human capacity development and science engagement components of the Square Kilometre Array since inception will be covered in the 2015 review.

3. Assignment Principal and Review Reference Group

The Assignment Principal is the Board of the NRF. To facilitate matters the CEO of the NRF will act as Assignment Principal for operational matters.

The Review Reference Group (RRG) comprises the Chief Executive Officer of the NRF and five members appointed by the Assignment Principal.

The role of the RRG is to:

- Approve the terms of reference (tor);
- Approve the review plan from the review management service provider;

- Recommend the budget developed by the review management service provider;
- Identify/approve the review panels for the five clusters;
- Consider and suggest suitable interviewees for the review panels;
- Accept the final report from the review panels as well as the overall NRF management response;
- Take responsibility for briefing the working group that will write a synthesis review report on the NRF as a single organisation;
- Provide comments and recommendations on the review process and the extent to which the tor for the review have been addressed;
- Engage the NRF Board (possibly through the NRF CEO) on the outcome of the review and formally request the NRF Board members to take up the findings and recommendations with the Minister of Science and Technology as well as other relevant Government Departments;
- Meet under the direction of the Chair of the RRG, as required.

The Assignment Principal will:

- Appoint the members of the RRG;
- Consider the following before they are forwarded to the Department of Science and Technology (DST) by the Review Technical Committee:
- The final report by the review panels;
- The overall integrated NRF management response to the review reports; as well as
- The comments and recommendations by the RRG on the review process and the extent to which the terms of reference for the review have been addressed.

4. Review management service provider

The Reviews and Evaluation (R&E) Directorate of the NRF will act as the service provider to manage the review process. The responsibilities of the R&E Directorate will be to:

- Develop the tor for the review;
- Develop a budget;
- Prepare the letters of invitation for the approved members of the RRG for the Assignment Principal's signature and distribute them;
- Prepare the letters of invitation for the approved members of the review panels for the Assignment Principal's signature and distribute them;
- Develop a programme for the review;
- Manage, co-ordinate and administer the entire review process, including logistics for the reviewers and the on-site review programme of RISA. (For the other NRF entities please note Item 8.4 of the tor: *All arrangements for the on-site programmes including the logistical arrangements for the interviewees invited to interact with the reviewers will be made by the NRF entity to be reviewed.*)
- Provide support to the review panels;
- Source the necessary documents stipulated in the Appendix with the help of the staff of the NRF entities concerned and make them available to the review panels at least four weeks prior to the commencement of the respective reviews in South Africa;

- Receive the preliminary and final reports by the review panels and submit them to the Assignment Principal for further action;
- Forward the preliminary and final reports by the review panels to the RRG for acceptance;
- Place the final review reports on the NRF website as soon as possible after acceptance of the review reports by the NRF Board.

5. The purpose of the review

The purpose of the review will be to provide:

- A retrospective view on the performance of the NRF with reference to the Strategic Plan "NRF Vision 2015" in terms of its:
    - Mandate;
    - Strategic objectives;
    - Performance (qualitative and quantitative).
- An assessment of the management effectiveness of the NRF in terms of resource allocation in support of strategic objectives;
- An assessment of the investment in the broad thematic areas, i.e. Social sciences, humanities, life sciences, engineering, physical sciences and medical sciences in the case of NRF's Research and Innovation Support and Advancement (RISA);
- Comments on the NRF's contribution to the creation of an enabling environment for effectively delivering on its mandate in the Higher Education sector and its facilities in the broader science system;
- Critical views on first, possible gaps not addressed by the NRF in terms of the NRF Act (Number 23 of 1998) within the National System of Innovation and on secondly, ways to increase science footprints and enhance the quality of science in South Africa;
- Recommendations regarding the future strategic direction and operational execution of the NRF mandate.

6. The scope of the review

The review will cover the past six financial years, i.e. 1 April 2009 up to 31 March 2015 and consider the NRF grouped into the five clusters given below. In addition, the review will generate a synthesised review report on the NRF as a single organisation. In conducting the review the panels should, where possible, take into account the recommendations of previous relevant reviews and assessments of NRF activities.

6.1 Biodiversity and Environmental Sciences Cluster:

South African Institute for Aquatic Biodiversity (SAIAB)
South African Environmental Observation Network (SAEON)
National Zoological Gardens of South Africa (NZG)

6.2 Nuclear Sciences Cluster:

iThemba Laboratory for Accelerator Based Sciences (iThemba LABS)

6.3 Astronomy Cluster:

South African Astronomical Observatory (SAAO)
Hartebeesthoek Radio Astronomy Observatory (HartRAO)
South African Square Kilometre Array Project in terms of its human capacity development and science engagement components.

6.4 Science Engagement Cluster:

South African Agency for Science and Technology Advancement (SAASTA)
Science engagement activities of all the NRF entities to be reviewed (see items 6.1 to 6.5)

6.5 Research and Innovation Support and Advancement (RISA)

7. Review dimensions

7.1 The reviewers are requested to determine:

7.1.1 the strengths, weaknesses and impact of the NRF entities in their cluster in terms of their contribution towards the NRF objectives as applicable during the period 2009 to 2015 as stipulated in the “NRF Vision 2015”; and

7.1.2 the extent to which the recommendations of the previous review in 2010 have been addressed.

7.2 In addition, the reviewers are also requested to provide for the NRF entities in their respective cluster:

7.2.1 their critical views on the success of the science engagement endeavours. The findings and recommendations of the cluster reviews will feed into the review of the Science Engagement cluster.;

7.2.2 an assessment of the management effectiveness in terms of resource allocation in support of strategic objectives;

7.2.3 their views on possible gaps not addressed in terms of the NRF Act;

7.2.4 recommendations regarding the future strategic direction and operational execution of the NRF mandate;

7.2.5 any information that could assist the working group members who will be compiling the synthesis report to address their brief (see Item 7.3 below); and

7.2.6 in the case of RISA an assessment of the investment in the broad thematic areas, i.e. social sciences, humanities, life sciences, engineering, physical sciences and medical sciences.

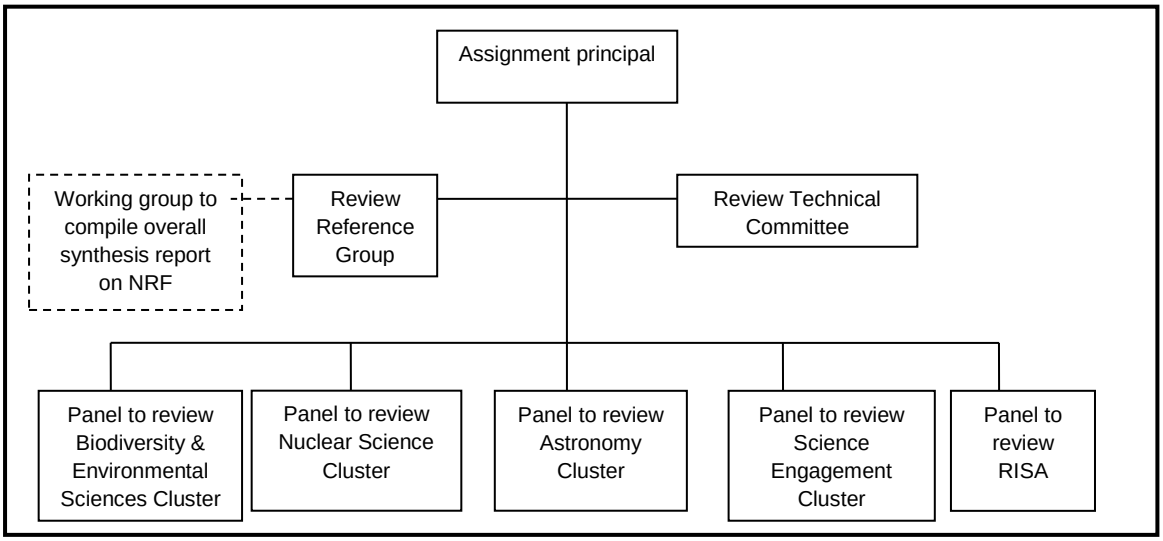
7.3 A separate working group will be requested to compile a synthesis report on the NRF as a single organisation based on the findings and recommendations of the cluster reviews to address the following:

- Integration of activities across the NRF
- Common structures across the NRF and their efficacy
- Strategic oversight across the NRF entities
- Approach for capacity building and science engagement across the NRF
- Appropriateness of allocation of resources across NRF entities/disciplines
- Appropriateness of the NRF as an agency function as well as a research performer through its National Research facilities
- Any gaps that the NRF should be addressing in terms of the NRF Act within the National System of Innovation
- NRF's alignment with the Ten-year Innovation Plan of the Department of Science and Technology.

8. Review structure and process

8.1 A panel consisting of at least two members with appropriate experience and skills to conduct the reviews will be appointed for the review of each of the five clusters. At least one of the reviewers on each panel should be from abroad. Since this review will not be an in-depth review of the scientific activities of the facilities, the reviewers need not be scientific experts in the fields covered by the facilities but should be knowledgeable on the broad areas of their respective cluster.

8.2 A working group comprising at least two experts will be appointed to compile a synthesis review report on the NRF as a single organisation. The latter will be done under the guidance of the RRG. This working group will consolidate the findings and recommendations of the five cluster reviews and will also address Item 7.3 above.



8.3 The reviewers will base their findings on the corporate NRF self-evaluation report as well as other relevant documents. In addition, each panel will be conducting interviews with the management of the entities in their respective clusters

and their most important stakeholders. Each panel will be expected to compile a review report including its findings and recommendations.

8.4 The logistical arrangements for the reviewers will be made by the NRF R&E Directorate staff members. All arrangements for the on-site programmes including the logistical arrangements for the interviewees invited to interact with the reviewers will be made by the NRF entity to be reviewed. NRF R&E Directorate staff will only make arrangements for the on-site programme for the review of RISA and the Synthesis Group.

8.5 The NRF R&E Directorate will draw up a programme for each review in consultation with the RRG and the management of the NRF entity/entities concerned. The panels will have the opportunity to interrogate the proposed programmes and to recommend amendments and additions should the need arise.

8.6 The panels will have the opportunity to interview members of the NRF Board, management of the respective NRF entities in their cluster as well as other relevant stakeholders from government, industry and the Higher Education Sector, recipients of research grants, student beneficiaries, users of the NRF Facilities, users of research supported by the NRF, etc.

8.7 The resource documents for the review listed in the Appendix will be made available to the panels four weeks in advance of the commencement of the reviews.

8.8 The review panels will decide on and pursue their own line of questioning during interviews.

9. Deliverables by

9.1 NRF Corporate Executive

9.1.1. A corporate NRF self-evaluation report addressing the review dimensions listed under Items 7.1 to 7.3 above for transmission to the review panels at least eight weeks prior to the commencement of the first on-site review programme in South Africa. The report should be supported by relevant statistics/figures, focus on outputs and should not exceed 40 pages with Appendices.

9.1.2 A spread sheet/document outlining the progress in the implementation of the recommendations emanating from the 2010 NRF Institutional review incorporating the restructuring of the NRF.

9.1.3 An integrated corporate management response to the review reports on the individual clusters as well as the final review report by the Synthesis Group within four weeks after receipt of the reports.

9.2 Management of the NRF entities to be reviewed

9.2.1 Contributions towards the corporate NRF self-evaluation report compiled by the management of each NRF entity. The reports should address the review dimensions listed under Items 7.1 to 7.2 above and should cover the period 1 April

2009 up to 31 March 2015. Concise information on the funds received by the NRF entity (including all sources in the NRF) and international sources per year for the period under review should also be included. The contributions should be supported by relevant statistics/figures and should focus on outputs.

9.2.2 List of stakeholders

Appointments/discussions with stakeholders will be arranged for the review panels to facilitate their tasks. It would be helpful, if the names could be clustered under the headings NRF Board members, management of the respective NRF entities, stakeholders from government, industry and the Higher Education Sector, recipients of research grants, student beneficiaries, users of the NRF Facilities, and users of research supported by the NRF. It would also be beneficial if the names of the stakeholders are ranked in order of importance on the template to be provided by the R&E Directorate.

9.2.3 List of documents considered to be essential reading for the review panels and other documentation which should be accessible to reviewers during the review. Documents listed on the Appendix to the ToR for the review which are not in the public domain are to be supplied to the R&E Directorate for onward transmission to the review panels six weeks in advance of the commencement of the reviewers' on-site programmes in South Africa.

9.2.4 Names, affiliations and contact details of possible reviewers for consideration including reasons for the suggested names.

9.2.5 Written responses from the management of the NRF entity reviewed to the final review reports within two weeks after receipt of the report. These will be used to prepare the NRF integrated corporate management response.

9.3 Review panels

9.3.1 Verbal feedback on completion of the on-site reviews to members of the NRF Board, the RRG, the NRF Executive/management and senior officials of the DST;

9.3.2 Preliminary reports on completion of the stakeholder interviews;

9.3.3 Final reports within two weeks of completion of the stakeholder interviews. The reports should include:

- An executive summary;
- Background to the review;
- Evaluation questions that were addressed;
- Key findings;
- Recommendations;
- Conclusions;
- Appendices containing, e.g. ToR, persons interviewed.

9.4 Review Reference Group

Comments and recommendations by the RRG on the review process and the extent to which the ToR for the review have been addressed within two weeks after receipt of the final report.

10. Time frame

Preparations for the review will commence in 2014 but the programmes involving the reviewers will take place in the second half of 2015 depending on the availability of suitable reviewers.

11. Budget

The NRF R&E Directorate will submit a budget for the review to the RRG for recommendation and to the NRF Executive for payment.

The ToR may be amended should the need arise.

APPENDIX 2: DOCUMENTS FOR THE REVIEW PANELS

1. GENERAL (FOR ALL PANELS)

1.1 Essential reading

- NRF Corporate self-evaluation report for 2015 review
- Strategic Plan of the NRF – NRF Vision 2015
- NRF overheads for review
- National Development Plan Vision for 2030 (Executive summary and Chapter covering Education)
- NRF Act (Number 23 of 1998)
- NRF External Survey 2014 - Executive Summary
- NRF Internal Staff Survey 2014 - Executive Summary
- An exploratory evaluation of the Socioeconomic impacts of selected NRF funding instruments, February 2015 (in four Parts)
- Synthesis report on 2010 NRF institutional review
- Management response to the Synthesis report of the second (2010) Institutional review of the National Research Foundation (NRF) of South Africa (confidential)
- Document outlining the progress in the implementation of the recommendations emanating from the 2010 NRF Institutional review incorporating the restructuring of the NRF
- South Africa's National Research and Development Strategy

1.2 Additional reading

- NRF Business Plan 2010/13 (sample)
- NRF Annual Performance Plan 2012 – 2015 (sample)
- NRF Annual Performance Plan 2013/14 – 2015/16 (sample)
- NRF Annual Report 2009/10
- NRF Annual Report 2010/11
- NRF Annual Performance Report 2011/12
- NRF Annual Performance Report 2012/13
- NRF Annual Report 2013/14
- Overview of NRF Funding Opportunities, Grant Management, and the Rating of Researchers, 2013
- NRF Growth Strategy 2008 – 2015: Implementing NRF Vision 2015
- Human Capital and the South African Knowledgebase
- OECD report on the National System of Innovation in South Africa
- Ten-year Innovation Plan of the Department of Science and Technology
- White Paper on Science and Technology, 1997
- NRF KPI (key performance indicator) Report, 2009

2. DOCUMENTS SPECIFIC TO INDIVIDUAL NRF CLUSTERS

2.1 BIODIVERSITY AND ENVIRONMENTAL SCIENCES CLUSTER

Essential reading
Report on 2010 review of NRF Biodiversity and Environmental Cluster

2.1.1 South African Institute for Aquatic Biodiversity (SAIAB)

Essential reading

- SAIAB Management Response to the review of the NRF national facilities in the Biodiversity and Environmental Sciences cluster for the period 2004 – 2009
- SAIAB Self-Assessment Report 2009-2014
- Interim SAIAB Annual Research Report 2014/15
- The African Coelacanth Ecosystem Programme (ACEP) Project Overviews 2013-2014
- Promotional Publications:
    - SAIAB Annual Highlights Report 2009-2010
    - SAIAB Annual Highlights Report 2010-2011
    - SAIAB 2012 Annual Impact Report – Ebb and Flow, Relevance in a Changing Research Landscape
    - Coelacanth 75th Anniversary Report: Building on the South African Coelacanth Legacy 1938-2013

Additional reading

- SAIAB Annual Performance Plan 2015/16 to 2017/18 – includes Science Plan
- SAIAB Fourth Quarterly Progress Report 2010/11
- SAIAB Fourth Quarterly Progress Report 2011/12
- SAIAB Annual Report 2012/13
- SAIAB Fourth Quarterly Progress Report 2013/14
- SAIAB Fourth Quarterly Progress Report 2014/15
- SAIAB Annual Research Report 2010
- SAIAB Annual Research Report 2011
- SAIAB Annual Research Report 2012
- SAIAB Annual Research Report 2013
- SAIAB Quarterly Research nuggets submitted to NRF 2010-2015:
    - 2010-2011
        - Chakona
        - Becker
        - Götz
        - Gouws
    - 2011-2012
        - Weyl
        - James & Mwale
        - Cowley
        - Bills
    - 2012-2013

        - Woodford
        - Gon
        - Whitfield
        - Baliwe
    - 2013-2014
        - Coetzer
        - Cowley
        - Chakona
        - Weyl
    - 2014-2015
        - Mwale & Ntuli
        - Schramm
        - Bills
        - Wasserman
- ACEP Fourth Quarterly Contract Report 2010/11
- ACEP Fourth Quarterly Contract Report 2011/12
- ACEP Fourth Quarterly Contract Report 2012/13
- ACEP Fourth Quarterly Contract Report 2013/14
- ACEP Fourth Quarterly Contract Report 2014/15
- ACEP Brochure 2010
- ACEP Project Overview 2010
- ACEP Annual Report 2011-12 (not for corporate contract reporting)

2.1.2 South African Environmental Observation Network (SAEON)

Essential reading

- Self-evaluation report
- Design of the South African Environmental Observation Network (SAEON), SAEON Technical Steering Committee, 2004
- Broad Participation Enhances Initial Steps towards a South African Ecosystem Observation System (LTER), AS van Jaarsveld and HC Biggs
- South African Environmental Observation Network: vision, design and status, 2007, AS van Jaarsveld et al, 2007
- Third Quarterly Progress Report 2010/11
- Fourth Quarterly Progress Report 2011/12
- Fourth Quarterly Progress Report 2012/13
- Concise Report 2013/14
- Fourth Quarter Report 2014/15

Additional reading

- SAEON Data Systems, and a wider benefit to Stakeholders
- ICT Strategy 2014 to 2016, Wim Hugo, May 2014
- List of publications by SAEON authors (individual publications available on request)
- Summary of contracts generating income or co-funding 2011-2015
- The SAEON Story 2007 – 2011
- Change is in the Air: Ecological trends and their drivers in South Africa

- Understanding Environmental Change in Complex Systems: SAEON Core Science Framework
- Combat Change with Change, JC Pauw
- Observations on Environmental Change in South Africa (in four parts)

2.1.3 National Zoological Gardens of South Africa (NZG)

Essential reading

- NZG self-evaluation report
- A strategy to transform the NZG into a national facility, March 2006
- Agenda 2015: positioning the NZG as a world class research centre, zoological garden and conservation organisation
- Research and Scientific Services Report 2011/12
- Research and Scientific Services Report 2012/13
- Research and Scientific Services Research Report 2013/14
- Research and Scientific Services Research Report 2014/15

Additional reading

- Strategic Plan Science Engagement, April 2015
- Research and Scientific Services Annual Performance Plan 2014/15
- Experience management at the NZG (thesis report on public engagement research at the NZG), MC Allenby, 2014

2.2 NUCLEAR SCIENCES CLUSTER (iThemba Laboratory for Accelerator Based Sciences)

Essential reading

- Report on 2010 review of NRF Nuclear sciences cluster
- Self-assessment report
- 2015/16 – 2017/18 Annual Performance Plan
- iThemba LABS Radiotherapy Workshop Declaration of Intent
- Radioactive-Ion Beam (RIB) Project Executive Summary
- SA-CERN Annual Report 2014-15

Additional reading

- RIB Science Case
- Annual report 2009
- Annual report 2010-11 (final)
- Annual report 2011-12
- Annual report 2012-13
- Annual report 2013-14
- Annual report 2014-15

2.3 ASTRONOMY CLUSTER

Essential reading

- National Strategy for Multi-wavelength Astronomy, May 2015 (confidential)
- PowerPoint presentation on NRF Astronomy sub-Agency (Programme 5) (work in progress)
- Report on the 2010 review of the Astro-Geosciences cluster
- Position paper: A Decadal Strategy for Human Capacity Development in Astronomy and Astrophysics in South Africa, 2011

2.3.1 South African Astronomical Observatory (SAAO)

Essential reading

- Self-assessment report
- SAAO Sustainability, 2 April 2015

2.3.2 Hartebeesthoek Radio Astronomy Observatory (HartRAO)

Essential reading

- Self-assessment report

Additional reading

- Publication list for NRF 5-year review
- HartRAO 4th Quarter report 2014/15

2.3.3 South African Square Kilometre Array project in terms of its human capacity development and science engagement components

- Self-assessment report

2.4 SCIENCE ENGAGEMENT CLUSTER

2.4.1 South African Agency for Science and Technology Advancement (SAASTA)

- Report on the 2010 review of the Science Advancement Cluster
- Annual reports 2009 – 2011
- Annual performance plan 2012- 2016
- Quality Assurance Framework for the network of science centres
- Report into the Johannesburg Observatory & Related Science Centres & Science Outreach Programmes, Totem Media
- Youth into Science Strategy
- SAASTA Business Plan 2013/14
- Unearthing Tomorrow's SET Leaders, The Impact of SAASTA's National Science Olympiad (SAASTA CBT Content)
- SAASTA Brochure

2.4.2 Science engagement activities of other NRF clusters to be reviewed

- Science engagement activities in reports on reviews of NRF clusters, i.e.
  - Nuclear Sciences Cluster
  - Astronomy Cluster
  - Research and Innovation Support and Advancement
  - Biodiversity and Environmental Sciences Cluster
  - Science Engagement Cluster

2.5 RESEARCH AND INNOVATION SUPPORT AND ADVANCEMENT (RISA)

Essential reading

- NRF rating categories survey – Report on a survey, September 2013
- Scaling up the South African Research Enterprise 2011 - 2020
- Report on review of the DST/NRF Centre of Excellence Programme, 2013
- Report on review of the South African Research Chairs Initiative, 2012
- Report on Evaluation of the Impact of NRF-funded Research Investments, 2014
- South African Guide for the Review of Applications for Research Grants and Ratings: Facilitating Quality Research Support, 2014
- Promoting Quality Research: An evaluation of the peer-review system used for grant-making as managed by the South African National Research Foundation, 2009
- Report on Review of Research Information Management System (if available by then)

Additional reading

- THRIP Annual Performance Report 2009/10
- THRIP Annual Performance Report 2010/11
- THRIP Annual Performance Report 2011/12
- THRIP Annual Performance Report 2012/13
- THRIP Implementation and Impact Assessment, Dept of Performance, Monitoring and Evaluation, June 2014
- Report on evaluating the decline in THRIP applications between 2006/07 and 2008/09 and scenarios of possible intervention, Techno Scene, January 2010
- Report on Dept of Science and Technology Review of the South African Nuclear Human Asset & Research Programme, sharppencil Consulting, November 2013

3. DOCUMENTS SPECIFIC TO COMPILATION OF SYNTHESIS REPORT ON NRF AS A SINGLE ORGNISATION

Essential reading

- Management response to the Synthesis report of the second (2010) Institutional review of the National Research Foundation (NRF) of South Africa (confidential)
  [also listed under 1.1 above]
- Reports on 2015 reviews of five NRF clusters, i.e.
  - Nuclear sciences cluster
  - Astronomy cluster
  - Research and Innovation Support and Advancement
  - Biodiversity and environmental sciences cluster
  - Science Engagement cluster
- Management responses to the above reports by the entities in each cluster
- Strategic Plan 2015 - 2020

APPENDIX 3: PROGRAMME FOR THE SYNTHESIS REVIEW PANEL

Sunday, 6 December 2015	
	Arrival of panel members in Pretoria
18:00 – 20:00	Informal get-together of panel members at Stephnie's Restaurant, Shop 7, Lynnwood Bridge Retail, c/o Daventry & Lynnwood Road, Lynnwood, Pretoria, tel. (012) 348 8943 To be joined by: Dr Dorsamy (Gansen) Pillay, Deputy CEO: Research and Innovation Support and Advancement Ms Joyce Olivier, Director, Reviews and Evaluation (R&E) Ms Anke Rädel, Professional Officer: R&E
Accommodation:	*City Lodge, Cnr. Lynnwood and Daventry Roads, Lynnwood Ridge, Pretoria,* *tel. +27 12 471 0300, e-mail cllynnwood.resv@citylodge.co.za* *https://www.c.co.za/cl14.php*

Monday, 7 December 2015	
Venue:	***Sydney Brenner Meeting Room, NRF***
08:30 – 10:00	**Welcome and briefing of reviewers by representative(s) of Review Reference Group (RRG)** Dr Beverley Damonse, NRF Acting CEO (ex officio) Mr Geoff Rothschild, formerly: Head: Government and International Affairs, Johannesburg Stock Exchange Prof Errol Tyobeka, Rector, Polytechnic of Namibia **Members of Review Technical Committee** Dr Rocky Skeef, Executive Director: R&E, NRF Ms Joyce Olivier, Director: R&E, NRF Mr David Manamela, Professional Officer: R&E Ms Anke Rädel, Professional Officer: R&E
10:00 – 10:30	Refreshments
10:30 – 11:00	Discussion of programme with staff of NRF Reviews and Evaluation Directorate
11:00 – 12:00	Session for panel members to prepare their strategy and allocation of tasks among themselves
12:00 – 13:00	Representatives of **Department of Science and Technology** Dr Thomas auf der Heyde, Deputy Director-General: Research Development and Support
13:00 – 14:00	Lunch

14:00 – 15:00	Representatives of **NRF Board** Ms Gail Campbell, CEO, Zenex Foundation Prof Murray Leibbrandt, Economics Dept and Pro Vice-Chancellor, Poverty and Inequality Initiative, SALDRU, University of Cape Town (connection by teleconference failed) Prof Loyiso Nongxa (Chair), Faculty of Science, University of the Witwatersrand (by videoconference)
15:00 – 15:15	Refreshments
15:15 – 16:15	Representatives of **NRF Corporate Executive** Dr Beverley Damonse, Acting CEO and Group Executive: Science Engagement and Corporate Relations Prof Nithaya Chetty, Deputy CEO: Astronomy Dr Dorsamy (Gansen) Pillay, Deputy CEO: Research and Innovation Support and Advancement Mr Bishen Singh, Group Executive: Finance and Business Systems Mr Patrick Thompson, Group Executive: HR and Legal Services

Accommodation: *City Lodge, Pretoria*

Tuesday, 8 December 2015

08:30 – 09:30	Sample of **external stakeholders** Prof Narend Baijnath, CEO, Council on Higher Education Dr Ashley Naidoo, Chief Director: Oceans and Coasts Research, Dept of Environmental Affairs (by teleconference) Dr Di Parker, Deputy Director-General: University Education, Dept of Higher Education and Training Prof Crain Soudien, CEO, Human Sciences Research Council
09:30 – 10:00	Refreshments
10:00 – 11:00	Sample of **external stakeholders** (contd) Ms Carmel Mbizvo , Head: Biodiversity Science & Policy Advice Dr Tshilidzi Marwala, Deputy Vice-Chancellor: Research, Innovation, Post Graduate Studies & Library, University of Johannesburg Dr Linda Mtwisha, Senior Director: Strategic Initiatives and Administration, University of Johannesburg Dr Edgar Nesamvuni, Acting Deputy Vice-Chancellor: Research, Tshwane University of Technology Prof Daya Reddy, Chair, Academy of Science of South Africa [only able to join from 10:30 – 11:00]
11:00 – 13:00	Sample of **Managing Directors of NRF facilities**

11:00 – 11:30	Dr Jabu Nukeri, Managing Director, South African Agency for Science and Technology Advancement
11:30 – 12:00	Dr Kobus Lawrie, Acting Managing Director, iThemba Laboratory for Accelerator Based Science (by teleconference)
12:30 - 13:00	Dr Clifford Nxomani, Managing Director, National Zoological Gardens of South Africa
13:00 – 14:00	Lunch
14:00 – 17:30	Sample **of Managing Directors of NRF facilities/NRF Executive Directors**
14:00 – 14:30	Dr Andrew Kaniki, Executive Director: Knowledge Fields Development
14:30 - 15:00	Refreshments
15:00 – 15:30	Dr Rob Adam, Director Designate, Square Kilometre Array (by teleconference)
17:00 – 17:30	Dr Romilla Maharaj, Executive Director: Human and Infrastructure Capacity Development (at City Lodge)

Accommodation: *City Lodge, Pretoria*

Wednesday, 9 December 2015

08:30 – 09:30	Preparation of synthesis report
09:30 – 10:00	Refreshments
10:00 – 10:45	Representatives of **NRF Board** (contd) Prof Mala [Ratnamala] Singh, Professor Extraordinaire in the Centre for Higher Education Research, Teaching and Learning at Rhodes University
10:45 – 13:00	Preparation of synthesis report
13:00 – 14:00	Lunch
Afternoon	Preparation of synthesis report

Accommodation: *City Lodge, Pretoria*

Thursday, 10 December 2015

Thursday, 10 December 2015

08:30 – 13:00	Preparation of synthesis report
13:00 – 14:00	Lunch

14:00 – 16:00 Finalisation of synthesis report

Accommodation: *City Lodge, Pretoria*

Friday, 11 December 2015

08:30 – 10:30 Preparation of presentation

10:30 – 11:00 Refreshments

11:00 – 12:00 *Venue:* ***NRF Albert Luthuli Auditorium***

Verbal feedback to members of the:

- Review Reference Group
- NRF Board
- NRF Executive/Management
- Department of Science and Technology

12:00 – 13:00 Venue: ***Sydney Brenner Meeting Room, NRF***

Debriefing session with members of NRF Board and Review Reference Group

APPENDIX 4: STAKEHOLDERS INTERVIEWED BY THE SYNTHESIS REVIEW PANEL

Department of Science and Technology

Dr Thomas auf der Heyde, Deputy Director-General: Research Development and Support

NRF Board

Ms Gail Campbell, CEO, Zenex Foundation
Prof Loyiso Nongxa (Chair), Faculty of Science, University of the Witwatersrand (by videoconference)
Prof Mala [Ratnamala] Singh, Professor Extraordinaire in the Centre for Higher Education Research, Teaching and Learning at Rhodes University

External stakeholders

Prof Narend Baijnath, CEO, Council on Higher Education
Dr Tshilidzi Marwala, Deputy Vice-Chancellor: Research, Innovation, Post Graduate Studies & Library, University of Johannesburg
Ms Carmel Mbizvo, Head: Biodiversity Science & Policy Advice, South African National Biodiversity Institute
Dr Linda Mtwisha, Senior Director: Strategic Initiatives and Administration, University of Johannesburg
Dr Ashley Naidoo, Chief Director: Oceans and Coasts Research, Dept of Environmental Affairs (by teleconference)
Dr Edgar Nesamvuni, Acting Deputy Vice-Chancellor: Research, Tshwane University of Technology
Dr Di Parker, Deputy Director-General: University Education, Dept of Higher Education and Training
Prof Daya Reddy, Chair, Academy of Science of South Africa
Prof Crain Soudien, CEO, Human Sciences Research Council

NRF Corporate Executive

Dr Beverley Damonse, Acting CEO and Group Executive: Science Engagement and Corporate Relations
Prof Nithaya Chetty, Deputy CEO: Astronomy
Dr Dorsamy (Gansen) Pillay, Deputy CEO: Research and Innovation Support and Advancement
Mr Bishen Singh, Group Executive: Finance and Business Systems
Mr Patrick Thompson, Group Executive: HR and Legal Services

Managing Directors of NRF facilities

Dr Rob Adam, Director Designate, Square Kilometre Array (by teleconference)
Dr Jabu Nukeri, Managing Director, South African Agency for Science and Technology Advancement
Dr Kobus Lawrie, Acting Managing Director, iThemba Laboratory for Accelerator Based Science (by teleconference)
Dr Clifford Nxomani, Managing Director, National Zoological Gardens of South Africa

NRF Executive Directors

Dr Andrew Kaniki, Executive Director: Knowledge Fields Development

Dr Romilla Maharaj, Executive Director: Human and Infrastructure Capacity Development

Members of Review Reference Group
Dr Beverley Damonse, NRF Acting CEO (ex officio)
Mr Geoff Rothschild, formerly: Head: Government and International Affairs, Johannesburg Stock Exchange
Prof Errol Tyobeka, Rector, Polytechnic of Namibia

Members of Review Technical Committee
Mr David Manamela, Professional Officer: Reviews and Evaluation (R&E), NRF
Ms Joyce Olivier, Director: R&E, NRF
Ms Anke Rädel, Professional Officer: R&E, NRF
Dr Rocky Skeef, Executive Director: R&E, NRF