Introduction

The NRF Executive commissioned an evaluation as a first effort towards demonstrating the value of the socioeconomic impacts resulting from NRF support to the South African higher education sector. The effort is well in line with the current international engagement with better understanding and assessing value for money (VfM) for development, research and other kinds of “difficult to measure” public sector investments.

The NRF wished the evaluation to be treated as an exploration to help the organisation to engage more fully with a useful definition and classification of socioeconomic impact\(^1\), to better understand the pathways to impact resulting from their support mechanisms, and to integrate a systematic focus on impact into grants portfolio management processes. It was intended to be experimental, illustrative, practical and forward-looking in order to inform the NRF’s strategies towards achieving more or better impact, enhance its accountability to multiple stakeholders, and develop credible and reliable methodologies for conducting such evaluations in future. It was not intended to be a full-fledged impact evaluation, or to produce a comprehensive economic valuation of all types of socioeconomic benefits brought about by NRF funding.

The evaluation focused on five funding instruments at different stages of the Human Capacity Excellence Development Pipeline of the NRF investment strategy - three of these funding instruments (CoEs, SARChI and NEP)\(^2\) are strategic investments in support of the needs of some of the best and most experienced scientists in the South African academic sector. The other two focus on the needs of emerging and next generation scientists (Thuthuka and the HCD Scholarships and Fellowships).

Approach

The evaluation focused on socioeconomic impacts, and therefore on identifying, understanding and illustratively valuing changes in the social, cultural, economic and environmental wellbeing of a group, a country, or society at large.

Several formal efforts are on-going to review the role and utility of conventional research metrics and to improve assessment systems. It has become clear that conventional metrics are insufficient to determine the social value and thus the worth of science. Although metrics used for social valuation are themselves inherently problematic, it is important for the sake of national strategy to try to determine the value of research, including in monetary terms as pressure on public funds is causing a major shift towards assessing wider impacts beyond the academic sector, and determining their ‘value for money’ (VfM).

Socioeconomic impact evaluation is a specific type of evaluation that focuses in large part on calculating the ‘social return on investment’ (SROI) of interventions – in this case, of research contributions to development – using a variety of economic valuation methodologies. Over the past few years, social return on investment (SROI) and related approaches have garnered significant attention (and controversy) in efforts to determine the socioeconomic impact of research. At the same time they have expanded possibilities for innovation and improved practice in evaluation, as they have to address both the challenges of defining and identifying research impact and, to the extent possible, the quantification and monetisation of socioeconomic and environmental benefits following these impacts.

In the context of the evaluation, the impacts were considered using a simple classification framework to help illuminate and distinguish between different types of outputs, outcomes and impacts, based on the measure

\(^1\) Any significant changes – positive or negative, expected or unexpected, within and beyond the scholarly environment – to which NRF support contributed and that exhibit socioeconomic benefits.

\(^2\) CoE: Centres of Excellence; SARChI: SA Research Chairs Initiative; NEP: National Equipment Programme
of control grant-holders had over the production and uptake of their work. The framework for understanding outputs, outcomes and impacts spans across three spheres:

- **The ‘sphere of control’**: Largely under the control of the scholarship holder or grant-holder together with his/her research team and partners. This relates to the changes brought about directly as a result of changes in output. These types of knowledge-based outputs and the results of their almost immediate uptake within the academic sector are most frequently the focus of assessment of research performance using metrics.

- **The ‘sphere of influence’**: Influenced by the work of the grant-holder together with his/her team and partners, but not under their control. This relates to the uptake and application of their work – their research findings and their capacity strengthening initiatives – by others both within and outside the scholarly environment, most often in the private sector, in policy-making and implementation, and in institutional or programmatic decision-making.

- **The ‘sphere of interest’**: Of interest to the grant-holder and his/her team and partners as the ‘ultimate’ benefits flowing from their research, but far beyond what they can influence except perhaps in the most indirect way (usually regarded as the impact). This relates to the result of the application of their work by others in policy, technology or practice in order to effect socioeconomic impact, reflected for example in national or global progress, lives saved, quality of life improved, customs and habits of life changed, greater societal cohesiveness, cultural heritage protected, or environmental destruction prevented. They emerge usually, but not exclusively, in the long-term.

**Methodology**

Consideration of the factors determining the evaluation design led to a **theory-based, case-based design using mixed methods, followed by economic valuation**.

The evaluation was comprised of **two broad phases**. Engaging with the underlying logic of the funding instrument (their ‘theories of change’), the impacts within the funding instrument portfolio, and analysis of the nature of and reasons for the impacts, were conceived as ‘Phase 1’ of the evaluation. ‘Phase 2’ consisted of the economic valuation using relevant value creating vectors, including through illustrative case studies. For practical reasons there were some overlaps between the phases.

**Inductive and deductive analyses were done by integrating quantitative data and qualitative information from both primary and secondary sources.** Perceptual and factual data and information were both taken as acceptable evidence, as long as triangulation, systematic coding, interpretation and logical reasoning, and appropriate pattern analyses could confirm their credibility. Quantitative and qualitative methods, and the data and information following from their application, were thus treated as of equal importance, informing each other and providing information to help confirm the change logic and economic valuation to the required depth.

**The aspects studied for each of the instruments** were (i) the types of impacts observed per grants portfolio; (ii) the role and contributions of the NRF to the impacts and pathways to impact; and (iii) examples of ‘light touch’ economic valuation as illustration of what can be done. The economic valuations were by no means an attempt to be comprehensive.

**The economic valuation comprised two streams of work.** First, the use of the ‘rates of return to education’ (private and social) approach to represent the impact of NRF funding from a VfM perspective. This analysis was performed on the largest single financing instrument aimed solely at capacity development, the HCD free-standing grants. Second, a valuation of the key net social / economic / environmental impacts of a number of case studies drawn from across the financing instruments was done. The sheer variety of impacts the NRF funding is expected to create makes the development of a valuation analysis akin to SROI an unworkable exercise at the level of financing instrument. A case study approach was thus used to inform the economic
valuation, focusing on analysing successful demonstrations of impact. The cases were selected purely to be illustrative of the spectrum of possible impacts in the various portfolios – in several cases already prominent examples of impact were used to determine what these might have yielded in terms of ‘monetisable’ value.

In the cases of Thuthuka and the HCD Scholarships the evaluation focused on understanding (as well as possible) the difference made by the NRF, by testing the change logic (theory of change) for each using both factual data and perceptual information. The absence of comparison groups was not regarded as a significant weakness, as the team could focus on major value-creating vectors that were not dependent on differences between the grant-holder/bursary holders and a comparison group.

The NEP/NNEP Funding Instrument was not studied in depth as a result of a lack of time and information on impact.

Understanding ‘cause-and-effect’ towards impact was based on counterfactual reasoning, thus using a generative approach to causal inference. Control or comparison groups were not used. In the evaluation, where the illustrative case studies focused on specific research interventions where impact pathways could be readily traced, and on socioeconomic impacts primarily outside the academic sector, counterfactual reasoning was relatively simple.

The pilot evaluation made little systematic use of bibliometrics. The approach paper from the outset confirmed the focus on impacts that have socioeconomic impact, hence those primarily outside the scholarly environment in the ‘sphere of influence’ and ‘sphere of interest’, complementing bibliometric studies.

Major Findings

The exploration of the benefits and impacts resulting from the five funding instruments highlights three broad categories of value added through NRF support: (i) strategic value, (ii) direct and indirect economic value, and (iii) wider social or societal value. It is essential to recognise that the value created through NRF funding is not only that which can be calculated in financial terms. The strategic benefits and many of the societal impacts are not readily monetisable, but are important contributions of the funding instruments.

The evaluation found that the chance of socioeconomic impact is enhanced when eight interconnected factors work in synergy. They can be grouped into two sets of factors that reflect (i) leadership in science and innovation that has very specific attributes and approaches, and (ii) the character and quality of the context for science and innovation in the country (in other words the enabling environment shaped by the NRF and other influential funders). This has been most effectively demonstrated by the Centres of Excellence funding instrument, but is equally applicable in most of the others.

The evaluation showed cases with very significant economic or financial benefits that flowed from research results taken up by users in government and business. A limited number of examples are illustrated below:

- The creation of sustainability guidelines for the wildflower industry, one of the many initiatives of the Centre for Invasion Biology, contributed benefits of R42 million a year to a variety of stakeholders, with the total economic value likely significantly higher.
- A spin-off company from the Centre for Biomedical TB Research – a very small part of what CBTBR has achieved to date - creates R28 million worth of benefits per annum.
- One of three research programmes of SARChI Chair Prof Linus Opara has added an estimated R65 million of direct and indirect benefits to the economy, with a further R90 million estimated until 2018.
- SARChI Chair Prof Kelly Chibale mobilised R100 million, employs tens of people and has the potential to make a major contribution to eradicating a disease that costs Africa US$12 bn per year.

The study confirmed several important pathways to socioeconomic impact - largely verifying the change logic described in the NRF documents - based on how the majority of grant-holders conduct their work in their ‘sphere of control’. The following success factors were identified, (i) a focus on use-inspired research, (ii) work in areas of national priorities, (iii) implementation of special initiatives to engage, support and further develop
the expertise of a larger and more diverse cohort of students and postdoctoral fellows, and (iv) increasing demonstrations of boundary spanning leadership. These ways of doing have manifested to the greatest degree in the sampled CoE supported initiatives, in large part a result of the way in which the funding instrument has been designed and managed. A good number of examples of change as a result of relevant research findings and effective engagement with stakeholders have been found in their sphere of influence. Following from these, the CoEs and some SARChI Research Chairs offered a few significant examples of (potential, emerging and actual) socioeconomic impacts in the sphere of interest.

The **NRF contributions to the benefits and impacts through the support of research and capacity strengthening were found to be significant.** This was noted, with clear examples, by a large majority of sampled Centres of Excellence and SA Research Chairs Initiative grant-holders. This is further reflected in the Thuthuka and HCD Scholarships and Fellowships. Delivering high level, market-attractive and/or entrepreneurial expertise into the science system has significant value from a national perspective and their socioeconomic impact is further reflected in the work that they produce in turn, and in the attention and investments they garner directly or indirectly from international actors. In the case of Thuthuka, the good initial results and leveraging of resources by many of the emerging researchers as a result of the additional NRF funding will increase their chance of success as the leading scientists of the future.

While the **potential value of postgraduate students’ studies and research outputs and impacts are varied** and numerous, and of value to a wide range of stakeholders, commonality lies in the value, first and foremost, to the students themselves. The value of additional studies is therefore captured through the additional earning potential of students in receipt of higher qualifications. This value in turn has a positive externality of greater income tax receipts for the government.

The total value (private returns to students in the form of higher incomes) and society (in the form of additional income taxation) has been estimated to equate to R1.85 billion for NRF funding for the HCD free-standing scholarships for Master’s, PhD and postdoctoral students supported between 2008-2012. The headline return on investment ratio for these scholarships ranges around a mean of 0.9, with the value for doctoral studies the lowest. Although this appears to imply that for every Rand invested by the NRF into the bursary scheme, less than one Rand of value has been created, very significant societal values of national interest have been excluded.

**The Way Forward**

Several recommendations emphasise the need for the NRF to be realistic and strategic in the approach to value for money studies.

Undoubtedly, the NRF will likely have to concentrate in future on value for money type studies as a result of political and other imperatives. To ensure concrete action it would be useful to give a cadre of thoughtful staff members, grant-holders and policy-makers the responsibility to study the findings and devise effective follow-up strategies. The following key recommendations are made.

1. **Carefully consider the extent to which ‘value for money’ type studies should be a focus - and ensure their credibility:** The field of determining value for money (VfM) is growing in importance around the world, with limited resources and many competing priorities. The NRF has to be strategic about when and how to conduct such studies and how to balance these studies with other NRF review and evaluation activities that are regularly conducted. Since assessing the economic impact of investment in higher education and research is complicated and contested, the purpose, intended use and credibility of such studies have to be clear. Decisions regarding the type and number of studies to conduct should be linked to their potential value to contribute to strategic planning, learning, marketing/advocacy and accountability efforts. Adequate attention must be given to the necessary capacities that must be promoted and embedded within the NRF to enable the desired outcome.
Specifically it should be decided what would be priority studies to conduct. Each funding instrument can make suggestions, or alternatively there can be cross-cutting themes, for example on gender issues, or thematic areas such as climate change or poverty reduction or the building of student and postdoctoral capacities.

The NRF and its various national partners in the national science system are very well positioned to advance VfM studies as a field of work. This effort could be strengthened with actual capacities outside the NRF to conduct such evaluations and special studies on socioeconomic impact. Other universities, science councils etc. have expressed their interest in this type of work, and a concerted effort in building such capacities and monitoring performance, among others, will be more useful if conducted collaboratively. It specifically implies that individuals experienced in this type of work from diverse perspectives should be engaged for joint planning, including how to build such capacities.

In the longer term, the NRF and its partners could consider establishing joint “observatories” for this type of impact evaluation, and take the lead in this strategic endeavour, where expertise can reside and innovations can contribute to global understanding and direction within and of this domain. This will enable the long-term tracking and measuring of the benefits and impacts of research and research capacity strengthening for national interests.

2. Complement expert opinion reviews with more rigorous evaluations, including for determining socioeconomic impact: Most of the NRF evaluative activities are based on expert opinion reviews. This is quite acceptable in the context of higher education, but the inevitable insufficient focus on rigorously collected and analysed evidence can often be detrimental to quality. Reviews and evaluations commissioned by the NRF should ideally be conducted by a team of evaluation and subject specialists. The NRF should also ensure that when funding instruments are designed, what will be monitored and evaluated is part of the planning, and that data – both qualitative and quantitative – are collected and used accordingly.

It will be important to determine how the NRF can interrogate and adjust its own framework of engagement to reflect a better understanding of, and management for socioeconomic impact. Major improvements can be made with relatively low investment, as additional strategies will complement the already established nature and diversity of data collected by the organisation, with due recognition not to overburden scientists.

3. Manage portfolios in order to understand and enable impact: The NRF has to have a stronger portfolio management approach for each of its funding instruments. A number of approaches to do this are proposed in the report, including working in practice with the change logic or theory of change of the funding instrument, working more intensively with the data in hand, defining and classifying impact per funding instrument and defining success for each instrument (and managing accordingly). In alignment, it will be important to determine the focus among scientists/ grantees/ scholarship holders on working towards socioeconomic impact in a manner that embeds it in the culture of research. In particular the NRF must direct how research leaders – both current and emerging – should think about socioeconomic impact to bring the best benefit to the country. In the South African context it is important to emphasise the notion of “use-inspired basic research” (based on Pasteur’s quadrant). Emphasising this to a greater extent means that NRF staff should be able to promote the ideas, frameworks etc. in a consistent and constant manner in their engagements with stakeholders.

The NRF can therefore facilitate a supportive environment to invest in appropriate strategies and incentives to encourage grant-holders to understand better, work towards, and track socioeconomic benefits and impacts, rather than pursue impact only in the scholarly environment. Managing for success through a focus on the factors that enhance impact should be given due attention in designing and implementing the various funding instruments.
4. **Ensure that the factors influencing the road to impact are considered during funding instrument design and implementation, including the important role of boundary spanning leadership:** The evaluation identified a number of factors - both within and outside the scholarly environment - that influence the achievement of impacts. It also identified the influence of the NRF towards impact in each of the funding instruments. It will be important to be cognisant of these factors, and to promote those most likely to make a difference.

Boundary spanning leadership is of particular importance. It has been proven to be critical for success in science and innovation, and for acquisition and diffusion of local knowledge internationally and vice versa. It is particularly prominent for innovation, which requires collaboration across all five boundary dimensions - vertical, horizontal, stakeholder, demographic and geographic. The ability to cross these boundaries enables a bridge to innovative and transformative solutions. It needs to be rewarded and supported, and hence measured in a manner that benefits national priorities and strategies. Measuring success in this aspect with the appropriate depth needs to be done with nuance in order to be useful for strategic decision-making.

At present data in the NRF are not organised or analysed appropriately for this purpose. NRF could consider initiating an evidence-rich study to investigate this aspect in much greater depth in order to help structure incentives and conditions towards socioeconomic impact.

5. **Promote concerted attention to the sustainability and resilience of the science and innovation system and its results:** One of the most important management challenges in both the NRF and grant-holder institutions remains how to effectively sustain positive and useful ideas and results that can lead to real impact, emitting from the research supported by the funding instruments amidst ever-evolving contexts and new ways of doing.

The NRF funding (in partnership with institutional support) buys time and provides scientists with the freedom and infrastructure to pursue interests within limited and realistic conditions, and to exert ‘boundary spanning leadership’ to a much greater extent. If this type of support falls away, it will be hard to replace from sources other than public funding. This affects the sustainability of the difference made by these funding instruments, as well as the resilience of the science system as a whole. If the grant-holders exit the NRF funding cycles, their legacies will continue primarily through the people they mentored and delivered into the science system. It is therefore imperative for sustainability, and for the increasing resilience of the science system in South Africa, to make sure that the kinds and attributes of people delivered by such leading scientists are what will cultivate new leaders, and in future sustain a knowledge-based economy and society.

**Conclusion**

For NRF to contribute in an informed manner to the resilience of the science system (or national system of innovation), it might need to find innovative ways - together with its partner institutions - to understand to greater depth whether these upcoming scientists are sufficiently empowered with the technical and entrepreneurial capabilities, and the market-attractiveness, demanded by a resilient science system in order to yield dividends from NRF investments for the future. Not only that, but continuous attention will be needed to shaping these scientists’ ‘ecosystem’ or enabling environment (whether social, cultural, policy, institutional or economic) so that they can continue with, and emulate the legacies of their mentors.

It therefore remains essential that the DST, NRF and other national stakeholders work in a coherent manner to (i) promote the uptake of research of quality, and (ii) cultivate confident, market-appropriate, entrepreneurial leaders for the future. The impacts of the NRF funding instruments are successive, from building capacities to contributing to socioeconomic impact on a local, national, regional or global scale. The NRF together with DST have to a large extent been successful in establishing and managing initiatives that - although not yet fully realised, already have many elements that contribute to such a system, while also adding socioeconomic and strategic value to national interests.