National Research Foundation

NRF Framework to Advance the Societal and Knowledge Impact of Research

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BACKGROUND

Over the past twenty years, the National Research Foundation (NRF) has invested in supporting, promoting, and advancing research, human capacity development, research infrastructure development and science engagement across the National System of Innovation (NSI). These investments are expected to generate impacts within the research enterprise, and ultimately for the benefit of society. However, the current NRF systems have not been designed to optimally plan for, assess, or communicate the various and differentiated aspects of impact.

The NRF's Vision 2030 positions the organisation to enable, facilitate and perform excellent research which seeks to extend knowledge frontiers, advance innovation, and address national challenges. To realise this vision the NRF is advancing a research impact agenda.

This Framework outlines how the NRF, through its core mandate areas, can best advance the impact of research. For this purpose, i) a context-relevant definition of impact is provided; ii) high-level impact pathways are outlined within the NRF's areas of control, influence and interest; and iii) types of assessment are explored at a conceptual level. This Framework will be supplemented by implementation and assessment guidelines across the various operational areas of the NRF.

INTERPRETING IMPACT WITHIN THE MANDATE OF THE NRF

Definitions of impact depend on the context within which that impact is being sought and the types of impact being assessed.[i] Broadly, impact in its various dimensions is about a change or marked effect. The Global Research Council (GRC) notes that 'no research is impact-free' but that the impact of research can have different forms[ii] and that these can come in different degrees and at different points in time. They vary in their predictability and measurability. The NRF's emphasis is on how best to advance **research with impact**, through interventions in its mandate areas.

The NRF's mandate is to:
Contribute to national development by —

1. supporting, promoting and advancing research and human capacity development, through funding and the provision of the necessary research infrastructure, in order to facilitate the creation of knowledge, innovation and development in all fields of science and technology, including humanities, social sciences and indigenous knowledge;
2. developing, supporting and maintaining national research facilities;
3. supporting and promoting public awareness of, and engagement with, science; and
4. promoting the development and maintenance of the national science system and support of Government priorities.[iii]

In line with the above, the NRF aims to promote, support, identify and communicate the impact of research within the research enterprise ***(Knowledge Impact)*** and in society ***(Societal Impact)***.

Knowledge impact refers to scientific advances in understanding, interpretation, methods, theory, application, and related advances that bring about positive change within and/or across disciplines and fields.[iv]

Societal impact refers to the value that research adds to society across various spheres, whether social, economic, or environmental. Societal impact reflects the direct or indirect relationship between research, or the research process, and improvement in the quality of people's lives, inclusive of innovation, technological advancements, improved sustainability, and policy developments.[v]

The NRF's decision to emphasise the impact of research is aligned with the NRF's mandate and the 2019 White Paper on Science, Technology and Innovation (WP STI), both of which emphasise the contribution that research can make to national development. Impact is not limited by geographic location, but the NRF's emphasis will be on impact within the South African or African context. The NRF aims to advance the positive contribution of research, while recognising that types of impact and value can change over time.

In line with the above, the NRF has adopted the following definition of the impact that it will pursue through its interventions:

A beneficial change in society or knowledge advancement, brought about as a direct or indirect result of the NRF's research support interventions, whether planned or unintended, immediate or longer-term.

IMPACT PATHWAYS AND THE NRF'S AREAS OF CONTROL

To increase and cultivate the impact of research, it is necessary to plan for impact, to identify potential for research impact in the initial phases of the research process, and to support methodologies that enable impact. Using Theory of Change, and taking into account the desired outcomes and impacts and the inputs and activities to advance these, the NRF has carried out an assessment of the initial inputs into the research process, the desired outcomes and impacts, and the multiple pathways or options to achieve those. Based on this assessment, the following graphical representation of the multiple pathways of impact, within the NRF's mandate areas, was developed.[vi]

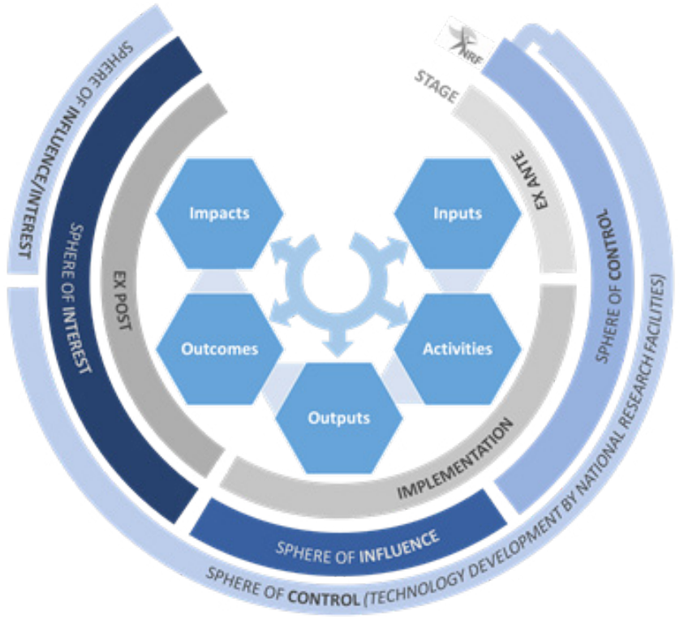

Figure 1: NRF impact pathways and spheres of control

As impact cannot always be predicted, the emphasis is on advancing inputs, activities and outputs that will potentially lead to outcomes and impact with societal benefit. The diagram represents the various and multiple pathways and possible steps that can be followed to advance impact. Impact can result at different points along the pathway (both planned and unintended impact) with the research process itself also producing impacts. Multiple outputs and outcomes can result from specific activities.

The NRF recognises that the nature of research impact implies that it often lies outside of the NRF's sphere of control.[vii] The diagram above indicates where the NRF's primary spheres of control, influence and interest lie and overlap along the impact pathways. In the NRF's core focus areas of supporting and advancing research, it does not generally control how that research is further developed and used outside of the research enterprise, but in the area of technology development and research performance within the in the National Research Facilities this sphere of control extends into the area of outcomes, and on occasion impact.[viii]

The NRF can ensure that potential for impact is considered during the early stages of proposal development and research planning and can encourage the use of mission-oriented, engaged, collaborative, interdisciplinary and inclusive research processes and teams to facilitate impact. Partnerships across the NSI and with society can help to extend the NRF's influence throughout the pathways.

To advance research impact, the NRF will be decisive and intentional about its support for research and research approaches that have the potential for impact. The NRF will include impact assessment that is both *ex-ante* (i.e. planning and proposal review before the research has begun, to identify potential for impact) and *ex-post* (i.e. case studies after the research has been completed), while concomitantly monitoring and evaluating the portfolio of projects in order to maximise impact. The NRF will advance a research-culture shift to encourage awareness of potential impact, and approaches that support impact, throughout the research process.

In interpreting and unpacking the multiple impact pathways for the NRF, it is necessary to consider all areas of its mandate (People, Research, Research Infrastructure and Science Engagement). The pathway descriptors below relate specifically to the NRF's context.

Inputs are NRF resources invested into the knowledge enterprise to support, promote and advance research impact.

Inputs are the investment of financial resources, human resources, infrastructures and research equipment into the sector with the purpose of advancing research and impact. Human resources include those employed by the NRF as well as researchers, postgraduate students and research support staff in other institutions in the NSI.

The strategy and planning documents developed are also inputs aimed at ensuring that the research system contributes to national development and responds to national and NRF priorities.[ix] Significant NRF planning documents include Vision 2030, Strategy 2025 and frameworks on transformation, research excellence, engaged research and impact.[x] Organisational plans, programmes and funding instruments are additional inputs.

Research proposals, and end-user engagement in the development of these proposals, are also an input, as is the *ex-ante* assessment of these proposals based on the matrix of criteria and priorities developed for each funding instrument.

Activities include any actions that directly or indirectly advance new knowledge, new applications of knowledge, innovation or human capacity development.

Activities are those actions supported, initiated or funded by the NRF, whether carried out by researchers and postgraduate students, end-users of research, or research support staff, including those employed at national research facilities, the NRF, universities or elsewhere in the NSI. Activities range from those designed to support or advance research and research impact, to conducting research, engaging with communities and users of research, and supervising postgraduate students.

Activities to support or advance research include granting processes; identifying the need for and providing research infrastructure or equipment; establishing partnerships and networks (at institutional, researcher or community level); reviews and evaluations (of researchers, research and its outcomes/impact, programmes and policies, or institutions); science engagement and engaged-research; and human capacity development (taking transformation imperatives into account). The design and implementation of policies, strategies, plans, programmes and funding instruments are also activities along the impact pathway.

Outputs are the research products, new knowledge, policy briefs and policy proposals, engagement and collaboration, methods, patents and skills produced as a result of the NRF's inputs.

Outputs are the products of the various activities listed above. In terms of the research process, products include, among others, new knowledge, publications, conference papers, policy briefs or proposals, increased engagement and collaboration leading to new research networks (including those with communities, business, government etc.), new methods and processes (whether for use within the research system or outside thereof), patents, and prototypes.

In terms of human capacity development, outputs include a transformed cohort of postgraduate students at various levels, a transformed cohort of researchers (at different career levels) trained in engaged research, technical and professional skills needed for the research enterprise, and other graduates to promote national development.

Science engagement outputs include engaged research processes and networks, events and interactions with the community, media reports on science and research, and learner or community engagement centres established to facilitate community interactions.

Outputs also include functioning and capacitated national facilities and funded and equipped research institutions; funded researchers and research projects; completed policies, strategies and programmes; and concluded review and evaluation processes. Many of these NRF outputs feed back into the pathways loop as inputs, and for this reason do not lead directly to outcomes or impact. This is represented in the circular nature of the pathways in Figure 1, where all parts of the pathway have the possibility to feed into each other.

Outcomes refer to the application or use of outputs by the research enterprise or by society.

Outcomes, whether in the medium or longer term, generally result from outputs being taken up (often by individuals outside of the research sector) to be applied and used more broadly in society. For this reason, without deliberate planning and support interventions, research outputs may not progress to the outcomes and impact stages. Outcomes include the use of research in policy development, product development, innovation, the development of new services or companies, or new methods and processes, all of which have value for society more broadly. Engaged research processes, where end-users are engaged at the proposal development stage and throughout the research process, are more likely to result in research being taken up by the end-users, and therefore in outcomes (and impact).

Outcomes also include cited research and new theories, methods, or methodologies used in other research processes. Outcomes are evident in postgraduates employed (within the NSI, government, or the private sector) resulting in skilled and knowledgeable employees. An excellent and transformed South African researcher cohort is an outcome that the NRF has identified as a priority. The use of the researcher capacity (developed and nurtured within the science system) for national projects and commercial research and development is also an outcome.

Public participation in and support for science and research is an outcome of science engagement activities. It refers to a shift in the public perception of science and research in terms of its value for society and the community's role in the scientific process (towards co-creation). In turn, this results in the public making evidence-informed decisions and participating in engaged research processes.

Multiple outcomes can result from one output, and some outcomes will be evident in the short to medium term, while others will only be evident over the longer-term.

Impact refers to a beneficial change in society or knowledge advancement, brought about as a direct or indirect result of the NRF's research support interventions, whether planned or unintended, immediate or longer-term.

The impact of research can be experienced within the societal (social, economic, environmental) or knowledge domains. Impact can be assessed against the national and international development priorities expressed in the National Development Plan (NDP), Agenda 2063 or the United Nation's Sustainable Development Goals (SDGs). Impact is evident in significant and sustained change in the local or international landscape. For instance, where research informs a policy and that policy brings about improved health, or improved wellbeing, or results in poverty reduction or improved environmental sustainability. Similarly, a scientifically engaged and informed society is brought about through science engagement. Increased employment, job satisfaction, and/or higher earnings are a change brought about through human capacity development. Improved safety and security, and improved living standards are also impacts. Knowledge impact refers to scientific advances that bring about a positive change in understanding, methods, theory or application, within and/or across disciplines and fields.

CONCEPTUALISATION OF IMPACT ASSESSMENT

The NRF's conceptualisation of research impact has informed the impact assessment methods discussed below. Assessment is outlined at a conceptual level, with selected examples provided. As part of the holistic implementation of the impact agenda, detailed consideration of the different 'what', 'how' and 'why' assessment processes will take place throughout the NRF's business units based on their different roles and responsibilities.[xi]

The NRF recognises the importance of information systems in supporting an impact agenda, and is in the process of developing a Research and Development Information Platform (RDIP) with data on the national research enterprise for use across the NSI. The scope of the platform will be determined through thorough consultation with the sector, including a comprehensive needs analysis that will include the identification of available and required data as well as assessment methodologies. This will further inform the NRF's impact assessment.

The NRF will rely on assessment that is both *ex-ante* and *ex-post.* In considering impact assessment methods, the NRF drew on international experience and reflected on assessment challenges.[xii] *Ex-ante* assessment will ensure that the NRF's processes, strategies, and policies advance research impact and that the research projects or proposals that it funds are those with potential for impact.

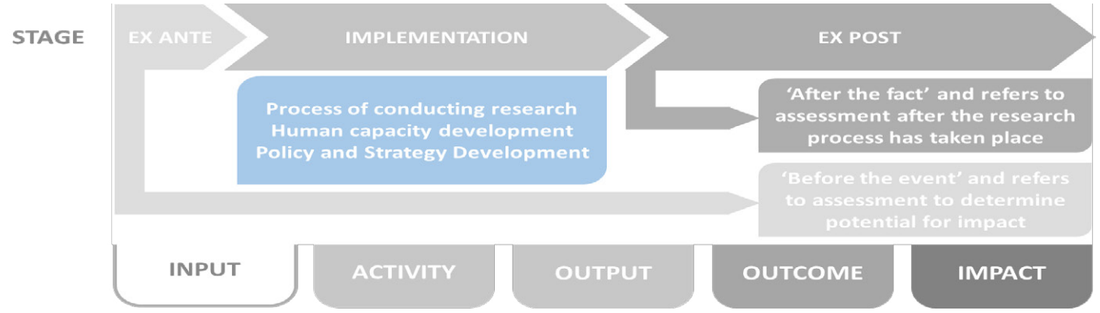

Figure 2: Ex-ante and ex-post assessment

Ex-post, the NRF's focus is on **demonstrating impact** through case studies and relevant indicators, and on the identification and communication of research impact stories. The NRF's *ex-post* impact assessment will identify where the NRF's investments, and the research it has supported or carried out, have contributed to particular outcomes or impacts. Furthermore, the NRF will work with its partners to communicate combined research impact. The NRF's intention is to identify and communicate examples of research impact, rather than to compare, evaluate, or measure either research impact or relative attribution to impact.

The NRF proposes impact assessment throughout the impact pathway, with consistent monitoring and evaluation. This will assist the organisation in learning more about the types of investments and activities that best advance impact. In addition, it will help to demonstrate how the NRF has invested in line with its ambition to advance research impact in pursuit of national development.

In terms of NRF inputs, impact assessment will determine whether the NRF's policies, strategies and plans regarding investment into the research sector align with contributing to national development, national and international priorities, and responding to developmental challenges. We will also assess whether investments (financial, human, infrastructure) are aligned to advance impact.

Ex-ante assessment of research proposals will assess the potential for impact. A suite of funding instruments and programmes will be developed and the requirements and weighting of the various elements or criteria will differ based on purpose and intent. Assessment may include, among others, intended impact (an impact statement), engagement and collaboration (engaged research statement with end-user involvement), and transformation (who is involved in the project).

At the level of activities, assessment will focus on whether the NRF's funding instruments, programmes, processes, incentives etc. are aligned with the research impact agenda, and whether they are implemented taking potential impact into consideration. Through periodic research progress reports, the NRF will determine whether planned engagements, collaborations and partnership activities with end-users occur. Assessment will include analysis of research progress reports and surveys.

Output assessment will include analysis of research outputs (publications, patents, conference papers etc.), taking in account responsible research assessment practices[xiii] and the NRF's holistic interpretation of research excellence.[xiv] Student throughput analysis will take into account the number, demography and quality of graduates. Analysis of collaborations, partnerships, co-creation and engagement with users of research; and indications of community interaction and science communication through articles and media reports will also be assessed. Added investment into the research process as a result of research infrastructures and partnerships could also be assessed.

At the outcome level, a variety of assessment methodologies could be drawn on, including alumni tracking, case studies, bibliometric and altmetric analysis, or surveys. Among other aspects, these would assess the use of research by communities, businesses, and industry, in policy development, and in further research. Alumni tracking could be used to assess progression in academic careers as well as employment and contribution in other sectors, public or private. Science engagement analysis and reporting on the public attitude to science could also be used. Analysis of networks and partnerships in the NSI could indicate effectiveness and coherence within the NSI.

Impact assessment will primarily be through thematic and project case studies and periodic reviews. Case studies could include a variety of qualitative and quantitative methodologies and indicators depending on the specific research project. Thematic case studies could be aligned to the thematic areas of the Research Agenda, the Decadal Plan themes, or against priorities identified in the NDP, Agenda 2063 and SDGs. Periodic reviews include those of the NRF (five-year organisational review), specific programmes or funding instruments, and National Research Facilities. Impact assessment could also include the extent to which the research cohort has transformed, or to which the public is scientifically engaged and informed.

PRINCIPLES AND ASSUMPTIONS

In developing the NRF's framework to advance the societal and knowledge impact of research, certain principles have been adopted and assumptions made. These have informed the various choices made throughout the framework.

The first principle is that equality, diversity and inclusion (EDI), taking into account race, gender, disability, and intersectionality, and focusing on transformation of the South African research enterprise, is adopted as a critical element and desired outcome of the NRF's research impact agenda.

The second principle is that scientific rigour remains a core criterion of research evaluation, taking into account different understandings by field and discipline.

The third principle is that research impact will be pursued across and within all fields and disciplines and research methods, taking into account different understandings and impacts by field and discipline. Furthermore, the NRF recognises the transformational value of fundamental research and the advancement of knowledge, and support for it remains essential.

The following core assumptions have informed decisions across the framework:

a. Research impact cannot always be predicted and does not necessarily occur within a projected time frame.
b. Knowledge arises out of a variety of social interactions and processes in pursuit of public good and social justice. Engaged and collaborative research, across and between disciplinary boundaries[xv] and with social and business partners, are key enablers of research impact.
c. Impact requires time to be realised, and the nature of research impact can differ over time.

In line with these assumptions, the NRF's focus is on supporting activities with potential for impact within its sphere of control, alongside advancing methodologies that enhance potential for impact. Impact assessment will rely on a triangulation of methods and a multimodal approach, and *ex-post* assessment will only be carried out after enough time has passed for impact to be realised. Assessment will focus on a portfolio of research projects or programmes, and will be augmented by consistent monitoring and evaluation.

CONCLUSION

The NRF's ambition over the next decade is to deliver excellent research with societal and knowledge impact. To advance this ambition, it will invest its resources in such a way as to support and enable research with potential impact. This ambition has led to the decision to adopt an impact agenda to steer the organisation intentionally and decisively towards supporting, promoting and advancing research with impact.

This framework outlines how the NRF can, through interventions within its mandate areas, best advance the societal and knowledge impact of research. Implementing this will result in varied benefits for the NRF, research enterprise and for society.[xvi] The benefits range from gathering and analysing data to better understand and advance research impact, to increased accountability regarding the use of public funds, and highlighting the positive societal value of research. The NRF's expectation is that, by advancing a research impact agenda, the relationship between science and society can be transformed through the co-creation of research, evidence of mutual benefit, and contribution to national development.

ENDNOTES

i. Impact has been incorporated into assessment and research promotion processes in a number of different countries, with varied interpretations of impact and types of assessment and/or reward depending on the country and its aim and context. In developing this framework, the NRF considered a number of documents, approaches and frameworks, including those from the UK, Hong Kong, Ireland, Australia, New Zealand and Canada: www.ref.ac.uk/2014/; www.ref.ac.uk/; https://www.ugc.edu.hk/eng/ugc/activity/research/rae.html; https://www.sfi.ie/funding/award-management/research-impact/;https://www.arc.gov.au/policies-strategies/strategy/research-impact-principles-framework; https://www.mbie.govt.nz/dmsdocument/6983-the-impact-of-research-position-paper-october-2019-pdf; https://www.idrc.ca/en/rqplus. It also drew on *The Soul of a University: Why Excellence is Not Enough* by Chris Brink (2018) and on the discussions and presentations made at the AESIS course on 'Integrating societal impact in a research strategy', November 2019 in Norway and the AESIS 'Implementing Strategy for National Impact Assessment and Stimulation' course in April 2021 (virtual attendance), as well as the November 2020 and June 2021 AESIS Impact Conferences.

ii. GRC (2019), *GRC Statement of Principles: Addressing Expectations of Societal and Economic Impact*, accessed from: https://www.globalresearchcouncil.org/fileadmin/documents/GRC_Publications/GRC_2019_Statement_of_Principles_Expectations_of_Societal_and_Economic_Impact.pdf. The GRC differentiates between 'the advancement of knowledge (scientific impact), the development of societies (societal impact) and fostering innovation (economic impact).' The NRF also drew from Organization for Economic Co-operation and Development - OECD (2002), *Glossary of Key Terms in Evaluation and Results Based Management*, https://www.oecd.org/dac/evaluation/2754804.pdf.

iii. National Research Foundation Amendment Act, 2018 (as amended).

iv. In developing its understanding of knowledge and societal impact, the NRF drew on international frameworks as explained above as well as https://www.vitae.ac.uk/doing-research/leadership-development-for-principal-investigators-pis/intellectual-leadership/demonstrating-research-impact.

v. The NRF's understanding of societal impact 'includes, but is not limited to, an effect on, change or benefit to: the activity, attitude, awareness, behaviour, capacity, opportunity, performance, policy, practice, process or understanding; of an audience, beneficiary, community, constituency, organisation or individuals; in any geographic location' as per the REF2019, REF 2019/01: Guidance on submissions, pp. 7, 68, accessed from: https://www.ref.ac.uk/media/1092/ref-2019_01-guidance-on-submissions.pdf.

vi. The impact pathway has been used by a number of organisations and science granting councils. In developing and interpreting the impact pathway for the NRF we drew on international literature (among others): UNESCO (2008) *Results-based programming, budgeting, management, monitoring and reporting (RBM) approach as applied at UNESCO: guiding principles* from https://unesdoc.unesco.org/ark:/48223/pf0000177568; OECD (2002) *Glossary of key terms in evaluation and results-based management*; New Zealand Ministry of Business, Innovation and Employment (2019) *The Impact of Research. Position paper* (https://www.mbie.govt.nz/dmsdocument/6983-the-impact-of-research-position-paper-october-2019-pdf) and presentations made at the AESIS courses and conferences discussed above.

vii. The discussion and identification of areas of control, influence and interest was influenced by (among others): International Development Research Centre - IDRC (2016) *Research Quality Plus. A holistic approach to evaluating research* (https://www.idrc.ca/sites/default/files/sp/Documents%20EN/Research-Quality-Plus-A-Holistic-Approach-to-Evaluating-Research.pdf).

viii. As part of supporting research, the organisation provides research infrastructure through the NRF's National Research Facilities. Technology development occurs as part of the development, commissioning, testing and use of the infrastructure.

ix. Key legislation includes the 2019 *White Paper on STI*, the 2013 *White Paper for Post-School Education and Training* (PSET), the *National Development Plan 2030*, and the NRF Act (1998, as amended).

x. The NRF has developed, or is in the process of developing, Frameworks on Transformation, Research Excellence, and Engaged Research, all of which support and feed into this Impact Framework. The NRF's Research Agenda will bring all of these together.

xi. The impact agenda draws on thinking more about the 'why' of research, and less about the 'what', in line with the ideas of Simon Sinek (https://simonsinek.com/).

xii. In developing the NRF's research impact assessment methodologies (and in understanding challenges around attribution, time lags, and the counter-factual argument) we drew on, among others: New Zealand MBIE (2019) *The Impact of Research. Position paper*; European Science Foundation (2012) T*he challenges of impact assessment. Working Group: Impact Assessment* (http://archives.esf.org/index.php?eID=tx_nawsecuredl&u=0&g=0&t=1604143909&hash=1545672c71408801356a10dbd1c796ce3827e0e5&file=/fileadmin/be_user/CEO_Unit/MO_FORA/MOFORUM_Eval_PFR__II_/Publications/WG2_new.pdf).

xiii. Responsible research assessment practices draw on the *Declaration on Research Assessment* (DORA, https://sfdora.org/) and the *Leiden Manifesto* (http://www.leidenmanifesto.org/) in line with the views advanced by the GRC (https://www.globalresearchcouncil.org/news/responsible-research-assessment/).

xiv. The NRF's research excellence framework advances a holistic interpretation of excellence, where research excellence is at the heart, or intersection of international competitiveness, knowledge advancement, societal benefit and transformation. The NRF's Transformation Framework unpacks the organisation's comprehensive interpretation of transformation.

xv. http://www.transdisciplinarity.ch/en/td-net/Transdisziplinarit-t/mainColumnParagraphs/00/text_files/file/document/AddressingSocietalChallenges_FINAL.pdf.

xvi. In developing this section the NRF has drawn on the concept of the 4 As as explained: https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-018-0281-5 and the 6As as discussed at the AESIS 'Implementing Strategy for National Impact Assessment and Stimulation' course, virtual attendance, April 2021.

www.nrf.ac.za