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Institutional design and management of a continental research fund in Africa

Insights from an international review of research funding bodies

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List of abbreviations and acronyms

AAS	African Academy of Science
AAU	Association of African Universities
ACE	African (Higher Education) Centres of Excellence programme
AESA	Alliance for Accelerating Excellence in Science in Africa
AESTIF	Africa Education Science Technology Innovation Fund
AFC	African Finance Corporation
AfDB	African Development Bank
AICS	The African Institutional Capacity Initiative
ARISE	African Research Initiative for Scientific Excellence
ASET	applied sciences, engineering, and technology
ASRIC	African Scientific, Research and Innovation Council
AU/C	African Union/Commission
AUDA-NEPAD	African Union Development Agency
BMGF	Bill and Melinda Gates Foundation
CARI	Coalition for African Research and Innovation
CEO	Chief Executive Officer
CESA	Continental Education Strategy for Africa
CONICIT	Consejo nacional para investigaciones científicas y tecnológicas
COVID-19	Corona Virus Disease 19
DELTAS	Developing Excellence in Leadership, Training and Science
DFID	Department for International Development
DG	Director-General
EC	European Commission
ERC	European Research Council
ETaG	Estonian Research Council
EU	European Union
GERD	gross domestic expenditure on research and development
IADB	Inter-American Development Bank
ICIPE	International Centre of Insect Physiology and Ecology
IDRC	International Development Research Centre
LSE	London School of Economics and Political Science
MICITT	Ministry of Science, Technology and Telecommunications of Costa Rica
NIH	National Institutes of Health
NRF Korea	National Research Foundation of Korea
NRF Singapore	National Research Foundation of Singapore
NRF South Africa	National Research Foundation of South Africa
NTSDA	National Science and Technology Development Agency of Thailand
PASET RSIF	Regional Scholarship and Innovation Fund of the Partnership for skills in applied sciences, engineering, and technology
PM	Prime Minister
PWC	Price Waterhouse Coopers
R&D	research and development
REI2025	Research, Innovation and Enterprise 2025
RFB	research funding bodies
RFO	research funding organisation
SCGI	Science Granting Councils Initiative
SIDA	Swedish International Development Agency
SRI	science, research, and innovation
STEM	science, technology, engineering and mathematics
STI	science, technology, and innovation
STISA-2024	Science, Technology, and Innovation Strategy for Africa - 2024
TSRI	Thailand Science, Research, and Innovation
UK-CDR	United Kingdom Collaborative on Development Research
UNESCO	United Nations Educational, Scientific and Cultural Organization

USAID	United States Agency for International Development
WB	World Bank

Background

Funding and delivery mechanisms for research and innovation are vital to developing sustainable research capacity that is necessary for knowledge economies and economic development. African states fund research and innovation through a mix of national research funds or councils (e.g., Burkina Faso, Cote d'Ivoire, Kenya, Mozambique, South Africa, Zimbabwe); innovation funds (e.g., Botswana, Kenya); national science and technology councils (e.g., Malawi, Rwanda, Tanzania, Uganda, Zambia); or through Ministries of Higher Education and/or Scientific Research. Yet, few African governments have met the African Union's target for spending 1% of GDP on research and development [1]. Wenham and colleagues' mapping of available data based on 2017/2018 (or latest year available) found that Botswana, Egypt, Ethiopia, Gabon, Kenya, Morocco, Senegal, South Africa, Tanzania, and Tunisia are spending between 0.5 and 0.8% of GDP on research and development [1].¹

There have been strategies for continent-wide investment and improvement in science, research and technology, such as the African Union's Science, Technology and Innovation Strategy for Africa (STISA-2024) [2] and Health Research and Innovation Strategy for Africa [3]. However, recent research has found regional cooperation efforts to be more oriented towards governance and use of research and lacking financial investment to catalyse success and reduce dependence on external funders, with the risks that brings to the skewing of research priorities [1,4].

[2][2]The African Institutional Capacity Initiative (AICS) is exploring the institutional arrangements for a continental research fund that will catalyse and curate financing from a range of public and private sources to support long-term investment in African research and innovation. Through an international review of research funding bodies, the AICS seeks evidence-based insights and knowledge about how other institutions have approached and developed such arrangements. These would include: organisational structure, governance arrangements, operational frameworks, and grant mechanisms.

The aim of this study was to learn from global best practice and synthesise the implications for a continental research fund in Africa.

Issues in the design and function of RFOs: a review of the literature

Twenty years after the recognition of the 10/90 gap, with less than 10% of funds for health research are spent towards 90% of preventable deaths worldwide in LMICs [5], there remains significant inequity in knowledge production systems. African research institutions are overlooked by global north funders despite a recognition of their ability to identify local issues and gain buy-in to build sustainable partnerships with communities and industry [6]. In a study on research capacity in sub-Saharan Africa, some funders acknowledged that this bias towards global North institutions may partly be driven by "cultural affinity" [6]. Meanwhile, despite significant discussion of the importance of committing domestic research funding to research in Africa, this funding has not materialised [7], which in turn [8] has undermined, rather than promoted, the development of research systems and institutional capacity [9].

¹ The UNESCO Office of Statistics has previously reported from surveys conducted that Malawi met and surpassed this target in 2007 (1.40% of GDP on GERD) and 2010 (1.06% of GDP on GERD). This data comes from surveys jointly funded by NEPAD and the Government of Malawi and conducted by the Ministry of Education, Science and Technology and the National Statistical Office in Malawi. But the authors of the report in 2014 caution in the misinterpretation that this means Malawi is one of the largest investors in research and development on the continent. The reason this indicator is high is because Malawi's GDP is the smallest of other countries with comparable population size; the investment in research and development in real terms is very low [63]. For a critique on the use of global indicators to compare health research and development capacity in African countries, see Mijumbi-Deve *et al.*[49].

The global research ecosystem contributes to this inequity. While there is strong national governance for research funding, there exist very few transnational efforts or governance mechanisms to hold stakeholders to account on their commitments [10]. There is also significant marginalisation of communities and researchers in the global south [11].

Moreover, it is challenging to build research funding organisations (RFOs) with strong governance and effective institutions to manage research funding [12]. A cross-cutting theme in the knowledge base on structures and functions in RFOs is that they should all be tailored to the context in which an RFO operates, including its interaction with the surrounding political, social, and research environments. This means that there is no single recipe for an effective RFO, and that a successful RFO in one context is not transplantable to a different one. In addition, value judgments are involved in all aspects of the establishment and running of RFOs.

Strategy

As with any organisational design, effective governance starts with clear organisational purpose, which can then be supported by effective structures. This is usually a product of a political process and includes policymakers determining the mission of an RFO. Although the relationship between RFOs and policymakers is typically described as a principal-agent relationship [13–15], this conceptualisation confers limited understanding of the role of RFOs. A review of RFOs in three European countries found that a principal-agent relationship did not, by itself, explain RFOs' action, as RFOs (the agents) are often responsive to scientists (their beneficiaries), not just to policymakers (the principals) [16]. This can be explained by RFOs developing their own interests, leading to them resembling scientific, political, or corporate bodies [16,17].

Some guiding principles are ubiquitous, such as the Haldane principle of independence and autonomy, transparency, public benefit, and responsiveness [12,18]. Others vary, such as whether the focus is on overall health improvement or equity; social impact or research excellence [12,18]. But identifying such principles necessarily involves making value judgments. Choosing research excellence, for example, may be at the expense of other potentially valuable principles, such as economic benefit, accessibility, inclusivity, and the social impact of research.

These considerations are particularly important considering dominant narratives on the aims and value of research that have been constructed largely without meaningful participation from the global south, whose researchers and communities may, given the opportunity, promote different priorities. A survey of African researchers and research coordinators reported training future researchers as the most valuable aspect of research excellence, followed by generating new knowledge and effecting social impact [19]. The surveyed individuals identified existing metrics as overlooking the social impact of research [19].

These discussions align with a general shift towards increased emphasis on the social impact of research. In the late 1990s, public funding of research led to a “new social contract” which, in addition to the agencification² of research funding, paid more attention to science addressing social needs [20]. Fulfilling such objectives requires developing suitable evaluation methods and the engagement of relevant stakeholders in RFOs [21,22].

² Agencification has also been noted in the literature as a broader trend in public administration, with semi-autonomous agencies responsible for various tasks like implementation, regulation, or service delivery at arm's length from the government. The legal frameworks for such agencies have implications for their managerial, policy, and scientific autonomy. See: Verhoest, van Thiel, and De Vadder (2021).

Strategic plans

Strategic plans communicate how RFOs plan to achieve and evaluate their core aims. Formulating these generally involves a range of stakeholders including policymakers, researchers, industry representatives, and research institutions. It is uncommon to involve civil society or the general public, despite increasing attention being paid to the importance of their perspectives [12,23]. Most strategic plans are not prescriptive and aim to highlight overarching priorities, although this varies across different RFOs [12,23]. They generally describe the prominent roles of portfolio management and decentralisation of processes, which is used to maximise RFOs' responsiveness [12,22].

Governance

Governance structures aim to translate the values behind the aims of an RFO, and establish an RFO's processes for decision-making, monitoring and evaluation, and interaction with its surrounding environment. The move towards agencification of research funding through RFOs has been driven by principles of New Public Management³ across different settings, wherein corporate governance and performance management practices are incorporated into public administration. However, new agencies remain likely to reproduce existing local structures and cultures, pointing to strong path dependency [24,25].

Translating values

Tensions may arise in the operationalisation of the aims and values of an RFO, which their governance structures will be expected to resolve. For example, funding feasible research with demonstrable potential for translation may conflict with what is generally referred to as "blue sky" research [22]. Striving for research excellence may be in tension with social impact [19]. Even within a priority area, there may be conflicting conceptualisations. While sustainable development and environmental research are similar, the institutional culture in Sweden leads RFOs to mainly disburse sustainable development funds to social sciences and environmental research funds to basic research [26]. In practical terms, choices about criteria for mechanisms, organisational culture, or relevant data have direct consequences for an RFO's operations, and its ability to achieve its aims [27]. Some peer review mechanisms in sub-Saharan Africa, for example, now include consideration of societal impacts [28]. In terms of cultural choices, it has been shown that decentralisation practices were less effective when a change in rules was unaccompanied by a deep cultural change in organisations around how to collaborate [12]. The methods chosen for data collection and analysis, and the specific data collected, imply what matters to an organisation or at least what will be visible to it [29].

Monitoring and evaluation

Evaluation links the aims of an RFO, its strategic plans, and its operations, assessing an organisation's adherence to strategy and whether its operations and strategy feed into its aims. Evaluation can be internal (of the RFO as a whole, or its policies, strategy, funding schemes, or research grants) or external (of the research field or scientific discipline) [30]. Despite the potential breadth of evaluation, most evaluations focus on funding schemes, with very few organisational evaluations [31]. Consequently, there is little empirical evidence on different organisational design features [12]. The application of evaluations also remains limited, with only a minority of RFOs using them to allocate budgets [31].

This has led to suggestions that RFOs would benefit from more scientific and methodologically rigorous approaches to conducting evaluation research (under the umbrella of "research on research") to understand their own processes and the effects of their funding, programmes,

³ New Public Management is a set of principles for governing relationships between governments and publicly-funded agencies. It assumes a low-trust culture and information asymmetry, and introduces checks including market principles, performance monitoring, and performance-based incentives.

and design [18,21,32]. This would require significant investment to support such evaluations, such as appropriate data systems to enable the collection and analysis of the relevant information, as well as engaged leadership and dedicated time [21,33]. It would also require the engagement of a broader set of stakeholders than RFOs currently engage in decision-making or evaluation [21].

Stakeholder engagement and decision-making

The choice of stakeholders to involve in decision-making in RFOs is reflective of the purpose of this involvement; prioritising the relevance, legitimacy, or inclusiveness of research would lead to consulting a different set of stakeholders [34]. As with other governance mechanisms, the choice of relationship between beneficiaries (researchers and/or the general public) and RFOs, and between policymakers and RFOs, will have different implications for the dynamics in relationships between funders and beneficiaries [27]. As already mentioned, the public is rarely involved in RFOs' processes, partly because there is no unified understanding of what public engagement means in the context of RFOs; this leads to RFOs using this in a way that fits their own culture and practice [35]. Yet, there is little evidence on the effect of different public engagement models [34].

Research funding

Disbursing funding is one of the core functions of RFOs and the main mechanism through which RFOs influence science and strengthen research capacity. RFOs align their resources with their scientific, social, and economic priorities. Their funds also increase the cultural and social capital of beneficiaries, which in turn affects the scientific environment [17]. The underdeveloped research ecosystem in Africa is, in part, a consequence of fragmented funding streams, mainly consisting of small and short-term grants, which are insufficient to increase the diverse forms of capital required to support a thriving scientific environment [8]. By contrast, one of the main factors facilitating the development of centres of excellence is their capacity for research flexibility, which is driven by resource flexibility [36].

These influences of RFOs on science ecosystems can be channelled through active or passive measures. Active measures include RFOs funding methods which advance their priorities, or providing training for how to research their priorities [37,38]. Passive measures include integrating such priorities into their criteria for assessment across all initiatives or suggesting these to applicants [37,38]. This influence can extend to the scientific output of beneficiaries of RFOs.

Scientists are generally unfavourable about funding from for-profit organisations (FPOs), with around half of a diverse sample of scientists opposing undertaking research funded by FPOs due to the perceived expectation of financial return [39]. This extends to public and charitable funds which consider financial return, which presents ethical implications around who receives royalties and whether this presents a perverse incentives to commercialise research at the expense of social impact or quality of research [40].

Research translation

RFOs play a role in research translation by specifically targeting funds to promote social or economic value, such as through targeted investments or including social values in assessment criteria [41,42]. This is another underdeveloped area of practice in RFOs, with a diverse range of under-evaluated methods being used by RFOs [43–45]. Most RFOs do not evaluate the translation of their activities into policy and practice at all [32]. This constitutes a missed opportunity for research translation and leads to RFOs funding well-established, rather than the most impactful, areas of research, which may not always align [46].

Nevertheless, investment in research and development has been shown to drive innovation and bring social benefits. The presence of enterprises for researchers to partner with, among other contextual factors influence this [47]. However, this puts researchers in the global south at a disadvantage, since research into problems specific to the global south are underfunded [28] and there is low engagement of researchers in sub-Saharan Africa with policymakers [6]. Another challenge for research translation is the dominance of the concept of research excellence, which may sometimes be in direct conflict with the socio-economic relevance of research, particularly in the global south, since scientific excellence is reflective of global processes which may not align with local needs [48]. The dominance of research excellence also presents barriers to global south researchers. Achieving research excellence generally requires high levels of consistent funding, autonomy, and the capacity to make high-risk investments with the potential for high reward [36]; rarely are these factors present in global south research systems. But in addition to understanding the social, organisational, or other environmental challenges for research excellence in the global south, it is critical to question the transferability of dominant international conceptualisations of research excellence and redefine excellence in context[49,50].

Capacity-building

Despite capacity-building often being suggested as a core function of RFOs [51,52], it is another area that is generally lacking in the empirical literature on RFOs. Some authors suggest that RFOs incentivise researchers to prioritise capacity-building to increase their chances of securing funding [53].

A review of sub-Saharan African RFOs proposed the following list of areas for capacity-building within RFOs, with the last two recommendations focused on the capacity needs in their respective research systems to which RFOs themselves should be committed to strengthening through programmes or collaborations [52]:

- Peer review policies and procedures
- Grant-making procedures and appropriate information systems
- Management of S&T international agreements
- STI policy analysis and research and innovation priority setting
- Basics of R&D management and bibliometrics
- Assess the uptake and impact of publicly funded R&D
- Strengthen local scientific publishing and open access expertise
- Strengthen the capabilities of science councils to utilise new modes of science publishing and dissemination (open access/open science initiatives).

Landscape of continental initiatives for research funding in Africa: a situation analysis

Overview of initiatives, programmes, and mobilisation efforts

In this section we describe background to several ongoing funding initiatives, joining the dots to show how they are related and facilitating an understanding of where the AICS initiative might locate within the developing ecosystem. These initiatives are:

- [AESA](#) (Alliance for Accelerating Excellence in Science in Africa) (now the Africa Science Foundation)
- [CARI](#) (Coalition for African Research and Innovation)
- AESTIF (Africa Education Science Technology Innovation Fund)
- [SCGI](#) (Science Granting Councils Initiative)
- [ASRIC](#) (African Scientific and Research Innovation Council)
- [ACE](#) Africa Centres of Excellence

We provide substantive background on AESA, CARI and AESTIF, and draw attention to SGCI, ASRIC and ACE.

- Alliance for Accelerating Excellence in Science in Africa (AESA)

AESA was created in 2015 through a partnership of the African Academy of Sciences (AAS), the African Union Development Agency (AUDA-NEPAD), and a number of global partners, specifically Wellcome, the Bill and Melinda Gates Foundation (BMGF), and the UK Department for International Development (DFID – now part of the UK Foreign, Commonwealth and Development Office). Its establishment was supported by a resolution of the summit of African Union Heads of Governments, and it was hosted by the AAS.

As of December 2021, AESA has been re-established as the Africa Science Foundation and is temporarily hosted by PricewaterhouseCoopers (PWC) Kenya. This change was the culmination of a governance crisis that enveloped AESA and the AAS through 2020 and most of 2021.

AESA's stated mission was to *shift the centre of gravity for African science to Africa* through agenda setting, mobilising R&D funding, and managing continent-wide STI programs. Its launch was enabled with initial core set-up funding from Wellcome, BMGF and DFID to establish and resource the systems need for its operations. It covered funding staff, the grants management software and support for development of funding and operating policies. It also covered support for the AAS to establish and grow its supporting operational structure (finance, HR, legal staff etc) and recruit staff to provide more support to its network of AAS fellows. These funders also guaranteed five years of core funding through 2019, which was renewed (in 2019) for an additional five years.

AESA successfully secured grants for a number of pan-African research funding initiatives including DELTAS (Wellcome and DFID funded); Grand Challenges Africa (BMGF-led with investments from the Governments of Sweden and Germany); and Grand Challenges partnerships with African governments (including South Africa and Botswana). It also successfully mobilised resources to support research ecosystem building initiatives across the continent, including strengthening institutional capacity for research management, building financial management capacity, and enhancing public engagement and policy engagement. It successfully mobilised resources for postdoctoral fellowship programmes including

programmes with the US National Institutes for Health (NIH), the European Union, Carnegie Foundation, and the Royal Society. It mobilised resources and deployed them through grants that were handled through robust internationally compatible governance decision making processes. The ambition of AESA was reflected in the scale of its programs. For example, the total budget for Phase 1 of the DELTAS program was US\$100m and the typical budget for each of the 11 funded consortia was approximately US\$8m.

- Coalition for African Research and Innovation (CARI)

The idea behind establishing CARI was seeded at a HIRO's (Heads of International Research Organisations) meeting in 2016, in a session discussing funding of African health sciences research. Deliberations at the session reflected an acknowledgement of the progress being made in funding health sciences in Africa through AESA, while highlighting significant concerns about the sustainability of its funding, which remained primarily mobilised from outside the continent from external funders (mainly Wellcome, BMGF and DFID). At that meeting the concept of AESA 2.0 emerged into an initiative led by NEPAD (now AUDA-NEPAD), the AAS, the AESA funders and now with the addition of the National Institutes of Health (NIH), with the active involvement of the Director, Francis Collins. The initiative was launched at Davos in 2018 with participation from Africa's leadership from Cyril Ramaphosa, then Deputy President of the Republic of South Africa, and currently President of South Africa.

This initiative evolved into the Coalition for African Research Initiative (CARI) and was also based at the AAS. A set-up grant was provided by Wellcome and the BMGF to enable the recruitment of a team, cover running costs, and develop a business plan.

Progress on the CARI initiative has been slow with mixed results. The CARI team successfully secured €25m from the European Union (EU), building on interest from the EU on the prospects of an African entity for the coordination of continental research similar to the European Research Council. Following lengthy engagement with the AAS, the €25m investment was made in a postdoctoral programme (ARISE). The efforts to secure this programme created tensions between the AAS and its funding partners on the overall direction and purpose of CARI, as it appeared to deviate from the goal of creating an Africa led funding mechanism, that would be funded from African public, private and philanthropic sources. Subsequently a decision was reached to have the CARI initiative hosted at the Africa Union Development Agency (AUDA-NEPAD).

As of December 2021, the CARI Secretariat is now hosted at AUDA-NEPAD and an ongoing effort is in place to develop a business case to underpin domestic resource mobilisation from Africa's public sector leadership, as well as Africa's private and philanthropic sectors.

- Africa Education, Science, Technology and Innovation Fund (AESTIF)

The establishment of AESTIF can be traced back to a decision made in 2007 by African Heads of Government to establish a joint fund for both science and education. The African Development Bank (AfDB) was supportive and conducted a feasibility study. The progression of the idea continued albeit at a very slow pace until 2019 when action on taking the idea forward was revived. In 2020 a taskforce was assembled representing AfDB, the African Union Commission (AUC) and AUDA-NEPAD. It was co-chaired by AUDA-NEPAD and AfDB and was active from March 2020 through to 2021. The taskforce recommended the establishment of a joint S&T and Education fund, named the Africa Education Science Technology Innovation Fund (AESTIF). The AfDB expressed willingness to host the fund and a concept note was presented to Ministries of Education and S&T across Africa, following which the process was endorsed. This process is co-managed by the AUC and the AfDB.

The fund is expected to raise US\$1bn for investments into Africa Science, Technology & Innovation over a 10-year horizon, with catalytic funding of US\$120m - US\$200m directly from the AfDB. The AfDB has set a condition that at least two African countries commit at least \$2m - \$5m to the fund, to ensure that a degree of commitment by Africa's political leadership is obtained, prior to AfDB's investment of its own capital in the fund. This condition is expected to be met by the end of 2021 with investment commitments secured from the governments of Ghana and Senegal (US\$5m and US\$2m respectively). The Governments of Botswana and Angola have also indicated interest in investing in the fund, and there has also been some interest from the Government of Japan. As of November 2021, the fund is currently going through the investment approval processes of the Board of the AfDB.

AESTIF is expected to be a fund, not a standalone organisation and will be subject to the governance and management in place at the AfDB for similar funds. Its deployment and utilisation are expected to be anchored on the strategy and sector priorities detailed in the STISA 2024 strategy document as well as the Continental Education Strategy for Africa, (CESA).

- Science Granting Councils Initiative (SGCI)

The Science Granting Councils Initiative (SGCI) in Sub-Saharan Africa aims to strengthen the capacities of science granting councils in sub-Saharan Africa in order to support research and evidence-based policies that will contribute to the continent's economic and social development. The initiative works with scientific grant councils and other stakeholders in science across Eastern, Western and Southern Africa. SGCI's capacity building work focuses across research management, designing and monitoring research programmes, formulating and implementing policies, supporting knowledge exchange with the private sector and establishing partnerships. The initiative operates under the premise that strengthening national science councils will strengthen national research systems vis-a-vis sustainable development. Moreover, it created a platform for SGCs across SSA to network and collaborate through annual fora and meetings.

In the initial phase (2015-2019) CA\$13.9m (~US\$1.16m⁴) was jointly funded by UK's DFID (now FCDO), Canada's International Development Research Centre (IDRC) and South Africa's NRF. In 2018/19, additional funds were committed by SIDA, and Deutsche Forschungsgemeinschaft (German research foundation). SGCI is implemented with technical collaborators in 15 African countries. This [link](#) details the sixteen African science councils supported by SGCI.

- African (Higher Education) Centers of Excellence programme (ACE)

The ACE Project is a World Bank initiative in collaboration with governments of participating countries to support Higher Education institutions in specialising in STEM, Environment, Agriculture, applied Social Science/Education and Health.

Under the ACE programme, loans are made to African governments which then provide grants to the institutions in their countries which have been competitively selected for the programme. A typical ACE receives approximately US\$5m to fund a mix of PhDs and capacity building, similar to the scale of a typical DELTAS grant of approximately US\$5m, though each DELTAS grant is stretched across a consortium. Phase 1 covered West and Central Africa and Phase 2 covered East Africa. The programme is managed through the Association of African Universities (AAU). The program utilises a results-based funding (RBF) framework, wherein each project is funded on the basis of results achieved according to agreed key performance indicators.

⁴ The conversation rate is using a historical rate from December 2019.

The ACE program has links to the RSIF/PASET program, with the same division of the World Bank supporting these initiatives.

- [African Scientific and Research Innovation Council \(ASRIC\)](#)

ASRIC was founded in 2014 by a resolution of the African Union Executive Council following deliberations dating back to the first African Congress for Scientific Research, Technology and Drug Industry in 2004. Its mandate is to “promote research and innovation to address Africa’s socio-economic development challenges.” It aims to involve African scientists, funding agencies, the private sector and civil society in the development of research policy and programmes. It further aims to mobilise research excellence; build a sustainable nexus between policy, and research and innovation; advocate knowledge exchange within the science community; build capacity of and facilitate collaborations between STI councils.

It is a “Specialised Technical Advisory Body” of the African Commission and is governed by the African Union. The funding is stipulated in the founding resolution as coming from the AU budget, in addition to voluntary contribution from member states, development partners, the private sector and, when established the AU STI Fund. It has implemented postgraduate scholarship schemes, audit systems for communicable disease control, and provided a forum for interaction for research communities.

[Implications and lessons for institution building for research in Africa](#)

The preceding review of the landscape of continental initiatives, programs and efforts aimed at mobilising resources into Africa-led research highlights a number of key imperatives that are critical to the ongoing initiative to build viable institutional capacity for accelerating research in Africa. Five such imperatives are summarily described below:

[Addressing fragmentation in Africa research funding](#)

One of the defining characteristics of most of the continent-wide initiatives to improve research funding, including AESA, CARI, AESTIF and PASET, is the objective to achieve a degree of synergy amongst multiple actors already funding research actively on the continent. This is based on widespread consensus that research funding in Africa is highly fragmented, and that continued fragmentation limits the ability to achieve the type of growth and scale that can be truly transformative and curtails prospects of sustainability. While it is important to recognise the structural and geo-political complexities that make an entirely unified research funding paradigm unrealistic, achieving effective levels of coordination within sub-sets of the research ecosystem (e.g., among each of the respective funder segments or sub-segments – private, public and philanthropic, within specific priority disciplines, or on specific research objectives) is a worthwhile objective, and is a key imperative for the continent.

[Entrenching effective governance, and anchoring governance structures on sound principles](#)

Strong and effective governance, anchored on skill and experience rather than stakeholder or geographic representation is critical to building lasting institutional capacity for research funding in Africa. While critical to building any successful regional institution, this is a particularly important consideration in the light of recent experiences on the continent, where issues stemming from governance (design and execution) have stalled progress on promising initiatives such as AESA and CARI and may account for the low level of awareness of the ASRIC initiative.

Taking the example of AESA, established by charter as a semi-autonomous entity within the AAS, under an oversight Board comprising AAS, NEPAD and global funding partners, the

issues that ultimately led to the initiative stalling may be linked to the governance structure design. Its overarching governance arrangements were designed with the intention of enabling overall ownership of the initiative by the AAS and NEPAD, while granting a level of autonomy to AESA, while simultaneously insulating the AAS against the risk of possible failure of AESA. This resulted in a multi-level governance structure with multiple points of potential failure or conflict. For one, the level of authority granted to NEPAD within this structure may have ended up being insufficient despite the crucial importance of NEPAD in facilitating Africa's leadership support. It also created a situation where the AAS, traditionally an academy of science, increasingly absorbed significant scientific grant making and funding responsibilities, treading potential minefields of conflict of interest, and prompting governance questions on the criticality of separating research funding from research execution [54–56]. The experience at AESA highlights why the design of an effective governance structure must be a key priority to solve for in creating viable institutions to transform Africa's research landscape.

Solving for scale of ambition in mobilising capital for research in Africa

Given that Africa has endured decades of under-investment in research, significant resources are needed to transform the research landscape on the continent. For a continental research institution to be impactful, it will need to have the capacity to mobilise transformative capital, in billions of dollars on an annual basis. While this level of resource mobilisation is not expected to happen overnight, the ambition needs to be bold from the start. Note should be taken of the size of funding tickets of the DELTAS and ACE initiatives, as an indication of the scale of funding to aim for. AESA for example, was launched with the ambition that it would be a global funder based in Africa, attracting funds from many funders. Prior to its governance crisis, nearly US\$300m of funding was committed through to 2025. In the context of having a transformative research institution on the continent, this scale is significant and worth paying attention to.

Avoiding scope complexity and ensuring conceptual clarity

Differences in conceptual understanding and lack of clarity amongst key stakeholders have also been key factors that have impacted progress on some of the continental initiatives reviewed. Although there has been no public disagreement on the strategic direction for STI development in Africa as documented in the Science, Technology, and Innovation Strategy for Africa (STISA-2024)[2]_document and within the African Union's Agenda 2063 plan[57], interpretation at the point of execution has not always been easy. With the CARI initiative as an example, from the very beginning there were significant problems and differences of understanding. From the global funding partners' perspective, the goal of CARI was to create an African funding mechanism, that would be funded from African public, private and philanthropic sources. Within other parts of the alliance however, there appeared to be an understanding that CARI's fund raising efforts were to be focused on the programs of the AAS. These differences though seemingly minor have proved intractable thus far.

This factor is also noteworthy considering the emerging designs of the AESTIF, which is being conceived to have a broad mandate to invest in science, technology, innovation and also education, as distinct from a focus on research. Such a scope introduces additional layers of complexity which need to be factored into the design of any organisational or functional instruments required to operationalize such a fund.

Clarity in scope and vision will be critical to entrenching lasting institutional capacity for research in Africa.

Designing for organisational and operational sustainability

Although the issue of over-dependence on external funding partners for research on the continent and the attendant consequences are well-documented, it is important to note that

addressing this imbalance requires securing commitment from Africa's leadership to invest in research, but also critically, ensuring that institutional mechanisms for research funding are designed to be sustainable.

This implies fully considering the role of the private sector in a continental research institution or similar continental research funding mechanisms, as an element of strategic design.

It is important to leverage lessons from continental initiatives that have been successful and have achieved significant scale on sustainable foundations albeit in adjacent domains and apply the lessons on principles of institutional designs to efforts in building lasting institutional capacity for research in Africa.

Methods

The standard terminology used to refer to research funding entities in the scientific literature is “research funding organisations (RFOs)” or “research funding bodies (RFBs)”. Within the literature, RFOs have been categorised in several ways. These generally have to do with the source of funding (public, voluntary/private non-profit, and commercial/industry RFOs [58]), the mandate of the RFO (science-based funding agencies, strategic funding agencies, political funding agencies [17]), or the scale of their funding activities (national, international, EU, private RFOs [59]). We draw from Braun's definition of national funding agencies as “quasi-public organisations financed by the state in order to define and execute a large part of the science policy. Their dependence on political authority differs, but almost all funding agencies have a considerable amount of latitude in determining their strategies.”[17] This distinction is important as it relates to scientific and operational autonomy of RFOs from political structures and their accountability, which is why they are often studied using principal-agent theories and understood as intermediaries between government and research communities or society at large [14,15,17,52].

Landscape mapping

We identified regional, national, or multi-stakeholder funding bodies or initiatives from around the world as case studies for in-depth exploration. The mapping also considered similar multi-stakeholder research funds in Africa to acknowledge previous and existing efforts within the African research ecosystem (e.g., PASET RSIF) to reduce duplication and learn from those experiences where possible. Inclusion criteria for the mapping were to search information about funds which have:

- integrated public and private funds for research and research capacity,
- maintained or strengthened overall investment in research and research capacity,
- funded in lower- and middle- income countries, and
- been operational for at least 5 years.
- increased their expenditure on research and development over time,
- maintained or strengthened overall investment in research and research capacity,
- contributed to a range of scientific disciplines or fields,
- potential for transferability of learning and knowledge from similar contexts of research capacity transition and growth (with attention to multi-country and national RFOs in lower- and middle-income countries and emerging economies that leverage support from development partners and the private (for profit and non-profit) sector).

The search strategy for the mapping involved:

1) Review of the literature:

We carried out a rapid review of the literature to identify key themes and assess the knowledge base on RFOs, with the aim of identifying potential case studies. In addition to key word searches on multidisciplinary databases, we also searched several key journals where this literature is most often found, such as, *Science and Public Policy*, *Research Policy*, and *Research Evaluation*. The search also generated several research and technical reports of interest and relevant to the organisational practices of RFOs [12,22,30,60]. We focused on national, transnational, or regional RFOs, and excluded consideration of programmes, funds, or initiatives related to individual research institutions or other forms of sub-national disaggregation.

2) Review of longitudinal trends:

We reviewed gross domestic expenditure on research and development (GERD) data to assess those with positive R&D expenditure trends in past 10-20 years, using the data from UNESCO's Institute for Statistics which tracks progress on Sustainable Development Goal 9.5 (Scientific Research) and Research and Development (<http://uis.unesco.org/> and <http://data.uis.unesco.org/>). This data allowed us to look at GERD from 2013-2018, as only 2 countries have updated data for 2019. [61,62] Where possible, we identified the breakdown of this investment by the government, private, and university sectors and noting the main research funding mechanisms there. We also reviewed trends in innovation at the institutional and country/regional level with data from the Global Innovation Index.

From the mapping, we compiled a list of RFOs of potential interest as case studies. This list and accompanying data, along with our recommendations, were presented to the APHRC and Thinking Partners at the 2nd milestone meeting to discuss the selection of the RFOs to be explored in the qualitative case studies.

Case study analysis

Following the selection of full, partial and light-touch case studies prioritised with collaborators, for each organisation we undertook in-depth policy review and analysis of the key policies which guided the development of the funding bodies and initiatives to understand the configuration, aims, stakeholders et cetera (see [Appendix 2](#) for list of documentary sources). We conducted interviews remotely with key informants from each case study (senior and middle managers or executives). Informants were current or immediate past employees of the agencies, given that the project is also interested in understanding the trajectories of these bodies, the choices and trade-offs in their development, and a historical, retrospective perspective on influential decisions leading to their activities today. Participants were selected based on their knowledge of the various domains of operations of the funding institutions (i.e., programmes, governance, financing, partnerships, funding delivery, prioritisation, research capacity strengthening, knowledge translation and innovation, researcher retention and development). The interviews with key informants explored three main areas: the strategy and governance of research funding organisation itself, how the research funding organisation funds research and research capacity of individuals and institutions, and key lessons learned that the research funding organisation would share. The interview guide (see [Appendix 1](#)) was adapted to the cases depending on the key areas of interest for learning for the partial and light-touch cases.

The interview data was analysed thematically according to the domains of interest discussed with the Thinking Partners and key themes also identified in the literature. We analysed best practices (including where they do not work well) with respect to the potential new regional funding mechanism for Africa. There was particular focus on areas of best practices in a) organisational arrangements throughout the research life cycle and governance of award

processes, and b) institutional capacity development. Examples of these include but are not limited to:

- alignment of grant-making with organisational purpose;
- governance processes underpinning funding mechanisms;
- degree of independence or influence over funding priorities and where this is situated in governance structure;
- approaches to funding decision-making (e.g., role and composition of committees);
- weighting criteria across a range of considerations (e.g., scientific excellence, equity, leadership);
- approaches to measurement and assessment of national/institutional research capacity;
- approaches to grant funding, disbursement, reporting, oversight and risk management.

Findings

Overview of the organisations in the results

For the cases we analysed, we interviewed 19 key informants in 11 organisations across the regions of Europe, Africa, Asia, and South-East Asia. The organisations fall into a variety of types of RFOs, although most were national public RFOs (see [Table 1](#)). Detailed descriptions of the aims, structures, budgets, and grants and programmes of each of the organisations can be found in [Appendix 3](#).

Table 1: Categories of the cases of Research Funding Organisations and programmes

<i>Type of RFO</i>	<i>Scale of RFO</i>		
	National	Regional / Supranational	Transnational
Public-government	<ul style="list-style-type: none"> - CONICIT - Estonian Research Council - National Research Foundation of Korea - National Research Foundation Singapore - National Research Foundation of South Africa - National Science and Technology Development Agency (Thailand) - Thai Science Research and Innovation 		
Private-philanthropic			
Private-industry			- Africa Finance Corporation
Multistakeholder-public		- European Research Council	
Multistakeholder-public/private	- India Alliance	- PASET RSIF	

We identified 6 key areas for consideration for RFOs from our analysis of the eleven organisations. These areas emerged from our interviews as the core areas that must be addressed when designing and implementing a research funding organisation. Together these areas can construct a framework (see [Figure 1](#)) to explore the fundamental considerations in the establishment of a regional research funding body for African, through a set of questions for each area (see [Table 2](#)).

The answers to these questions are context-specific and influenced by a range of political, social, and scientific factors in research systems, including the organisation and functions of the STI and higher education environments in which RFOs are operating. Thus, our analysis aims to synthesise the various ways that RFOs have responded to these questions and dilemmas in the course of their development, what they have learned in the process, and any key challenges they faced.

Figure 1: Framework for a regional research funding organisation

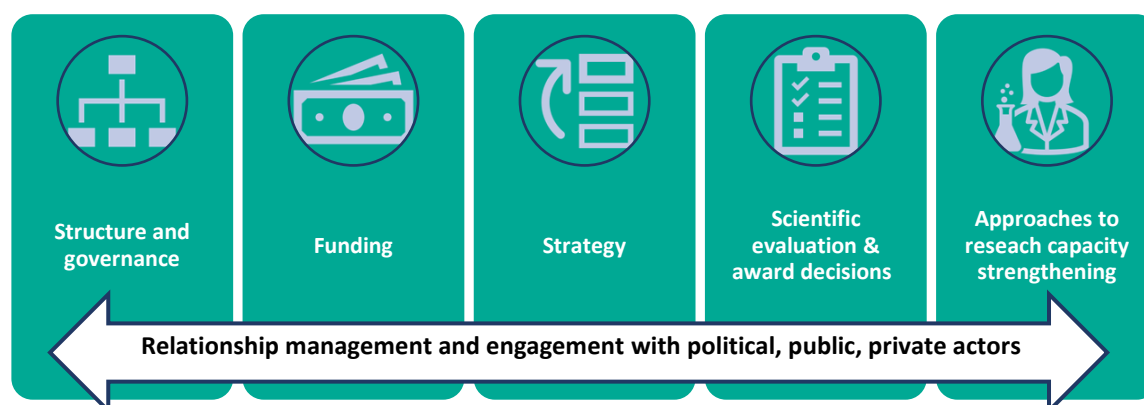


Table 2: Questions for consideration within the framework

Themes in RFO governance and operations	Questions for consideration
Structure and governance	Where is the organisation situated in the public or political administration? How is the organisation structured? What are the lines of accountability? What are the appropriate governance and oversight structures and arrangements?
Funding	What is the funding model? How does this model relate to the RFO's governance? What is the sustainability of this model?
Strategy	What are the overarching aims of the organisation and its funding programmes? Are there research priorities? If yes, how are they established and who decides? How does the organisation incorporate learning into strategic and operational development and change?
Scientific evaluation and grant decision-making	How are the scientific evaluations of proposals organised and conducted? Who is responsible for making decisions about allocating funds to grantees?
Approaches to research capacity strengthening for individuals, institutions, infrastructure	How do you manage issues of equity and inclusivity? What does the organisation do to retain research talent?
Relationship management and engagement	Who are the main stakeholders and partners? How does the RFO involve them?

Whilst we interviewed senior executives and programme managers in regional RFOs, national RFOs, and other types of hybrid (public/private and translational) organisations, the findings are interpreted to respond to the general issues for research funding bodies as well as specific issues that would affect a regional funding organisation (e.g., working with multiple member states and managing research proposals from across various research systems with inequalities in research capacities).

It is important to acknowledge that while these are discrete areas, they are also interconnected. For example, issues related to prioritisation are found in multiple areas. One of the striking findings from our work is the significance for RFOs of engaging and managing

relationships with a variety of key stakeholders as a transversal theme cutting across all of these areas. Within the findings for some areas, specific examples from cases are documented in short boxes to illustrate good or promising practices.

Structure and governance

Key messages and lessons

- Individual champions (from both science and policy sectors), epistemic communities, and politicians have been powerful and effective advocates and leaders in processes to establish RFOs and other research funding initiatives.
- Of particular importance for multistakeholder RFOs (either public or public/private), the ownership of the organisation and overarching strategy needs to be clear. The division of labour and well-defined separate structures or branches for organisational governance, scientific governance, and implementation and award governance can establish a robust separation of political, scientific, and operational and management roles. This contributes to developing trust in the objective and scientific decision-making processes, and protect from bureaucratic or other influences on review of proposals and funding decisions.
- The quality, competence, and integrity of the implementation team and staff is paramount. The working processes need to be transparent, robust and of high international standards.
- The composition of the implementation team should be interdisciplinary and intersectoral. Their insight and expertise will help to manage issues arising in the management of awards and support to beneficiaries. The implementation team needs to have a range of skills including scientific expertise, public administration, finance and management to fulfil its mission effectively.
- The research capacity and systems within states in Africa may first need to be strengthened, as a more bottom-up approach, before a top-down approach of creating something akin to an African Research Council modelled after the European Research Council. The ERC relies on the existence of national research systems. It is not a capacity building institution.

Structure and governance encompass the physical and procedural components of RFOs' operations. This includes the legal status of an organisation, its mandate, lines of accountability, ownership, and internal structures. The diversity of institutional frameworks we found in national RFOs sheds light on the complexity of establishing a regional RFO structure on top of that. Structurally, there are issues to consider beyond a "scaling up" of a national RFO to a regional one, which have consequences for organising governance as well because the relationship of an RFO to the political system and public administration is defined by its authority and accountability structures. The ERC provides the only example of a regional agency that is housed in an institution with the ensemble of states in the EU as a political and economic union, which may be similar to the African Union in some parameters but without necessarily all of the same legal parallels underpinning its foundation and operations as agreed by member states. But key insights from the PASET RSIF also highlight other ways of organising a state-based regional collective for research funding. We explore both of these in more detail below, while also highlighting the lessons about their internal structures and implementation teams.

Institutional design: ownership, accountability, and governance

Generally, national RFOs with public-government status operate under the auspices of a specific Ministry. In some cases, they have been created by law (e.g., NRF Korea, NRF South Africa, CONICIT) and thus are statutory bodies with mandates, roles and responsibilities defined within a legal framework for research and development. However, we also found examples of national RFOs whose position within the broader policy framework for STI have accountability and lines of reporting directly to the Prime Minister's Office. For example, Thailand Science, Research and Innovation (TSRI) is the policy implementation arm for research funding and under the National Higher Education Science Research and Innovation Policy Council (with 11 ministers, and representatives of academic and private sector, chaired by the PM). TSRI serves as the secretariat for the Science, Research and Innovation Committees of 13 members assigned by the cabinet, and is responsible for planning and allocating the budget for science, research and innovation. Similarly, the National Research Foundation (NRF) in Singapore is formed under the PM's office to support the Research, Innovation, and Enterprise Council and the Scientific Advisory Board. However, the Board also has many foreign members from academia and industry.

The National Science and Technology Board (est. in 1991) has its roots in our Ministry of Trade and Industry. When the NRF was formed in 2006 - the intention was for it to be an organisation ... at the centre of government. That's why we are in a Prime Minister's office. There is a recognition that science and technology straddles across multiple ministries. Low Teck Seng, CEO, National Research Foundation Singapore

These two examples highlight how embedding these organisations in high-level whole-of-government structures can enable a highly strategic approach to areas of research funding that focus on economic, national, and other priorities defined in national plans. While other national RFOs can still engage in strategic alignment with supporting goals of national development plans (economic, social, research and innovation, etc.), the approaches of NRF Singapore and TSRI are unique in translating those priorities into specific funding programme areas to guide proposals for research; thus they seek scientific solutions to the most pressing problems for their countries' future as agreed by the government (e.g., climate change and coastal erosion, healthy ageing, technology transfer for agriculture). While these strategic approaches will be discussed in conversation with others below (see: [Strategy](#)), the structured links of these RFOs to cross-government boards also serve as formal and regular mechanisms to support political relationships directly with senior politicians to complement other forms of relationship management discussed further below (see: [Relationship management and engagement](#)).

National RFOs also operate in diverse research funding systems and with a variety of mandates and responsibilities in addition to research funding. Some are the only RFOs in their country (e.g., NRF Korea, ETaG) while others are one of multiple public RFOs, with other funding bodies often targeting different sectors (e.g., NRF Singapore, NRF South Africa, TSRI). The relationships between RFOs within a national jurisdiction vary – operating horizontally in parallel with other RFOs or within a more hierarchical structure. One striking example of the latter is that of the TSRI. There are 9 other research funding bodies in Thailand, which all operate autonomously under different line ministries with their own governance structures, review and allocation processes, which all receive funding through TSRI. The mandates of national RFOs often includes policy advice and implementation, research governance, science communication and public engagement, research translation, and support of research and innovation networking.

However, these structural features have different implications when scaled up to the regional level, precisely because all African states do not have well-established, strong national research systems and research funding organisations.

I think it would be an unmitigated disaster because you then create this body that presumes that they know what nation states need and want. While at the same time, trying to supposedly create something that is unitary for all. I think they would never be able to play that role. But it works if you already have strong national systems, and then you come in and you plug a hole that the national systems are not able to. Molapo Qhobela, immediate past CEO, NRF South Africa

This is why he emphasised, from the perspective of member states, the necessity to first and foremost strengthen research capacity and systems within states, as a more bottom-up approach to strengthening research capacity in Africa rather than a top-down approach of creating something akin to an African Research Council modelled after the European Research Council (ERC). In his opinion, this is one reason that the ERC works well, because it is a complementary value added to national research and funding systems, not a substitution.

Understanding the origin of the ERC, the only regional public RFO in the world, is important from this structural perspective. The ERC is an institution of the European Commission, under the DG for Research and Innovation. The ERC came as a result of over 15 years of advocacy and lobbying by the European scientific community and associations, as well as key allies in the EC. These efforts aimed to establish research in the legal framework of the EC as a competency of the European community and the ability of the EC to fund individual researchers through the ERC, when previously EC funding focused on consortia and collaborative research for specific priority areas. Thus, the Treaty of Lisbon was essential to creating the potential for an ERC. The funding of individual researchers was a critical political battle, with smaller European countries (with populations of 10 million or less) backing the initiative while larger countries appeared more reserved, conservative, indecisive or even uninterested. Eventually, a handful of individual politicians (including one from the UK) played key roles in advancing this proposal successfully.

While the ERC's mission is to fund excellent and ground-breaking science, it also contributes to the politics of strengthening science and research capacity through the diplomatic roles of its President. Since 2014, the President of the ERC changed has been appointed by the EC instead of elected by the Scientific Council (governing body of the ERC), granting the ERC President access to the EC political hierarchy at a very high level. This has had positive implications for advocacy and access to senior EC officials such as the Commission in charge of Research and Innovation, European heads of state, and Members of the European Parliaments, as well as senior civil services in member states. Access at these levels has benefited the ERC's sustainability of its budget, most recently in the face of potential significant cuts due to the COVID-19 pandemic which are discussed further below (see: [Funding](#)). The critical insight from this experience is the value of the continuous informal and formal networking of RFO leadership to a regional RFO, through developing personal relationships with members of scientific and political networks, as a key investment with potential high return in times of crisis when swift actions and high levels of support are needed because trust has been established over time. These relationships, built through a type of ambassadorial role of the President, have also shown to be effective in supporting national research system strengthening by giving local politicians access to advice and support from outside their national political circles (e.g., Denmark, Germany, Poland, Portugal, Slovenia, Sweden).

The Regional Scholarship and Innovation Fund of the Partnership for skills in applied sciences, engineering and technology (PASET RSIF) offers relevant insights for the establishment of a

regional research fund in terms of its structure and ownership. The RSIF is the flagship programme of PASET, which is a platform of African members states. According to those managing the RSIF, one of the main successes of the fund is its ownership by African governments on the governing council and executive board, via ministers and representatives (usually from Ministries of Education or Ministries of STI). PASET was established by the Presidents of Rwanda, Ethiopia, and Senegal in 2013, with Cote d'Ivoire and Kenya joining later when RSIF was established as a programme in 2015 (see [Box 1](#) on what makes countries want to be members). This government leadership means that they can orient the direction of the fund and its priorities to fill gaps on the ground, which they also do by reviewing and approving the calls for proposals to check for broad alignment with priorities.

However, we found that the ownership and accountability of RFOs and research funding initiatives is managed in a variety of ways. PASET is entirely governed by member states, thus using equal representation by states for the governing body. This is a stark contrast to the ERC, which is governed by a Scientific Council, made up of 22 of scientific experts and leading researchers across disciplines and fields. There is no criteria for representation of member states, as the Scientific Council's interest is to have widest possible representation and coverage of areas of knowledge. The Scientific Council members are appointed by the Commissioner and may come from outside of Europe. They set the work programme, calls, instruments, and funding decisions, and approval the panel members for peer review of proposals. This is a unique situation within the EC, as usually the work programme is set by Commissioners. Member states have no influence or authority in the governance of the ERC outside of approving its budget in the European Parliament. There is a programme committee with representatives from all 27 member states which is informed of the ERC's activities and decisions. But unlike programme committees in other EC agencies, they have no governing or strategic authority.

The public-private funding initiatives we explored offered other ways of governing. The India Alliance, a registered public charity, uses a shared governance model with equal membership between senior members of the Wellcome Trust and the

Box 1: Why do countries join PASET as members?

Countries want to be part of this platform to engage with other ministries on issues of higher education and STI from participating countries. They want to share experiences, examples of solutions to similar challenges, and explore joint benefits and achievements through regional collaboration. Since PASET was founded by African states, invitations to join PASET comes directly from other governments.

The minimum contribution to join is US \$2 million. But countries receive good value for their investment because of the high standards of implementation by icipe. This includes the processes for ensuring quality of students' training and managing the fund. Governments have seen the efficiency gains through economies of scale. For example, icipe negotiates reduced tuition rates with the universities that received students with RSIF scholarships. So, the cost of PhD training per capita is less with RSIF than if governments sponsor students themselves.

Training through RSIF has also shown benefits in the creation of networks for researchers. Regional cooperation and mobility are major advantage. Networks are strong outcomes because of their contribution to career development and future work through collaborations.

PASET began with 3 African states in 2013, and the platform now has 9 members. But they fund students from 21 African countries. About 80% of the scholarship and research funding goes to nationals from member states, and 20% goes to nationals from other states.

Government of India on the Board of Trustees, and on special committees like finance and audit. Conversely, the private sector has the majority share in African Finance Corporation (AFC). As an infrastructure finance institution founded by African states, it holds some transferable lessons for multi-stakeholder RFOs where public and private actors may jointly benefit from research funding investments and capacity. The AFC is accountable to commercial interests for infrastructure development, rather than government-defined priorities per se – but these investments are done in partnership with governments to ensure mutual benefit. This is done through continuous interaction of the AFC staff with heads of African states and ministries of finance, as well as local financial institutions to explore what are their priorities and interest and working together on project which align. Building and maintaining relationships with national stakeholders and policy-makers is a primary task of the AFC executive team.

As for national RFOs, we found they either had government-based governing structures, under their line ministry or senior government leadership (i.e. PMs or Deputy PMs chairing the board). Some like NRF Singapore and TSRI used mixed multi-sectoral and multi-stakeholder models of governance in the governing and/or executive board, with strong representation of the public sector (often from several ministries and policy domains), and often including representatives of academia and industry. The implications of the composition of the governance structures and the relationship between strategy and programme implementation and evaluation are discussed further below in terms of choices and processes of prioritisation (see: *Strategy, Scientific evaluation and grant decision-making, Relationship management*).

Implementation teams – high quality staff with diverse skills needed

There was consensus insight from most of the informants about the central importance of the implementation team. The competence and quality of motivated, dedicated staff who operationalise scientific and grant decisions, disburse funding, manage communications, and support the grantees are key to an effective RFO operation. A wide range of skills and attributes are needed to ensure professional, objective and efficient implementation. Staff integrity and quality are key to building trust with stakeholders. Managerial, financial, legal, and communication skills enable the administration, contracting, and information sharing roles. Scientific knowledge and expertise increase awareness of the methodological and disciplinary issues, equipping implementation teams to support evaluation panels and committees in the pre-award phase and in support of grantees in the post-award phase. Scientific expertise was especially emphasised by the ERC as a critical aspect of their implementation teams, where the in-depth knowledge of researchers and PhDs facilitate high-quality support to grantees.

Great ideas need also sound implementation, so they couldn't have 22 scientists also run the operation. [...] We have scientists as scientific officers, so the people who are helping our independent experts doing the evaluation and those doing the scientific monitoring of progress on projects are people with scientific backgrounds in the relevant domains. This facilitates the trust building with the Scientific Council. Angela Liberatore, Head of Department of Scientific Management, ERC Executive Agency

The ERC Executive Agency, the implementation arm of ERC, supports the scientific and strategy arm (the ERC Scientific Council) and provides the data and analysis needed for the Scientific Council to review programmes and consider improvements or changes to them. Most national RFOs implementation teams are in-house. But the RSIF PASET has mandated a third-party organisation, icipe, as the implementation team of the fund. Icipe therefore manages the scientific and the implementation activities, while the strategy remains entirely under the purview of PASET's governing board. Icipe has a wealth of experience in managing

funding initiatives and programmes to international standards in the areas of insect science and innovation, and was motivated by the opportunity to diversify and use these strengths to expand to other areas of impact such as engineering and data science.

You [must] have good people who will manage this in a very open, transparent [way], with a lot of integrity, who are mindful of quality and fairness... [for] the trust from the government, because we deliver on the promises we make. If you look at most of the funding systems in different countries, implementation fails a lot. And once you 'on't have these good systems running, then people get frustrated and the whole thing collapses. So having a strong team behind the implementation is absolutely critical. Julius Ecuru, Manager of BioInnovate Africa, icipe

In the case of the India Alliance, the implementation team in India received significant support from the Wellcome Trust for the first 6 months to set up the internal structures and processes and to train individuals. Whilst the symbiotic relationship between the strategic and implementation arms is a key strength for the ERC, the unique trait of this RFO is that the ownership of the organisation is entirely scientific. Thus, there is no possibility for government influence on strategy or scientific evaluation and grant decision-making. However, in other organisations where ownership is either governmental or multi-stakeholder and the government either leads or is involved in strategy, the separation of the scientific and implementation activities from the strategic governance is key to ensuring the credibility of the organisation (e.g., NRF South Africa, India Alliance, PASET RSIF).

Scientists and professionals need to run programmes without government interference or influence on decisions, and evidence of any bureaucratic or political influence in the scientific evaluation, granting decisions, or other implementation domain will jeopardise trust of the scientific community and other stakeholders. Informants from Costa Rica provided a cautionary tale of a ministry trying to play a technical and implementation role for which it does not have the capacity or mandate, which makes a strong argument for the separation of policy and implementation. A first loan from the IADB supported the strengthening of CONICIT (see [Box 2](#)), but when a second from the IADB was granted to Costa Rica for US\$11 million in innovation and scholarships, it was managed by Ministry of Science, Technology and Telecommunications (MICITT) instead of CONICIT. CONICIT received and reviewed over 300 applications, but all of the funds were not disbursed by the Ministry and the programme did not get implemented as planned. This failure of governance and implementation due to the lack of separation of technical implementation team from political functions caused a major disruption to the research system, leading to many of the research fellows suing the Ministry for lack of good management of the scholarships.

Funding

Key messages and lessons

- Setting up an RFO from idea to implementation takes time. There must be sufficient resources and time built in for establishing the structures, strategy, and relationships to get quality systems in place and operational. The funding needs to reflect and support a long-term vision.
- Public policy analysis and risk assessment analysis are good tools for evaluating needs and potential risks. Doing this in an open and honest way can build trust with government, the research community, and the private sector where involved.
- Delivering on strategic goals and increasing activity incrementally by gradually building on previous success, is an effective way to foster trust, create new champions and advocates for the RFO, and attract the interest of additional member states or funders. Initial programmes that are very targeted and deliberate will help ensure that limited resources are used efficiently.

We found a wide range of annual budgets of RFOs and other research funding initiatives that we investigated, ranging from US\$4.2 million for CONICIT to US\$6.4 billion for NRF Korea. The annual budgets and disbursements according to programmes can be found in [Appendix 3](#). The wide range across these budgets is influenced by the size of the national economy, political support for research funding, number of other RFOs in the country, and funding models. For example, the TSRI has an annual budget of approximate US\$600 million. But 60% of this includes the budgets of all 9 sector-specific RFOs in the country because the TSRI is responsible for allocating their budgets according to the strategic pillars. The other 40% they allocate to competitive block grants to research institutions, universities, and research departments in ministries. Similarly, the NRF Singapore is the main RFO responsible for implementing the Research, Innovation and Enterprise plan (RIE2025) through research funding. As it supports the Research, Innovation, and Enterprise Council and the Scientific Advisory Board in the PM's office (see: [Structure and governance](#)), along with 4 sectoral RFOs, the proportion of the total REI budget (US\$18.55 billion between 2021-2025, or about US\$3.7 billion/year) allocated to or by the NRF is unclear since spending is reported by cross-cutting area (see appended excel sheet). In this section, we look at the various funding models and sources of funds for RFOs, issues with sustainability, and perspectives on the success of what they do with their funds.

Sources of funding and funding models for RFOs

The main source of funds for RFOs are taxpayers through public funding. Several of the RFOs we looked at were entirely funded this way (i.e., ERC, NSTDA, NRF Korea, NRF Singapore, NRF South Africa, TSRI). The large majority of the ETaG budget is funded by public financing from Estonia, but it also receives some European structural funds that support specific programmes, like mobility. The amount of structural funds fluctuates with periods of funding. CONICIT has historically received more external funding than government funding, initially through USAID and then from substantial loans from the Inter-American Development Bank. The initial funding model of CONICIT illustrates how external funding can be useful in the early stages of development of an RFO, where adequate public funding is lacking to establish initial structures and systems (see [Box 2](#)).

Individual high-level champions are key to mobilising and securing funding support for RFOs. We have found this to be a key influential factor in multiple cases. For CONICIT, it was a senior research leader who led and negotiated the process, whereas individual high-level champions from Wellcome and from the Government of India's Department of Biotechnology at the Ministry of Science and Technology played instrumental roles in arguing for this win-win relationship and a new organisation. Their arguments drew from the success of the International Senior Fellowships in Biomedical Research funded by Wellcome in India between 1999 and 2009, and the shared goals of Wellcome and the government around strengthening health sciences research. The senior fellows who had been supported by Wellcome had not only carried out excellent research but also achieved research leadership positions in universities and research institutions rather quickly – which piqued the interest of the government to become a partner in the funding. Once the agreement was established in principle, the Government of India tasked three senior individuals (1 financial expert and 2 research leaders) to work out the details of the financial, legal, and operational arrangements before the proposal could be approved and included in the budget. Both Wellcome and the government contributed equal amounts to the budget for a total US\$21.58 million/year in the first phase.

Whilst PASET RSIF is a multi-stakeholder platform of African states, its funding has come from four main sources: African governments, the

Box 2: The mixed funding model of CONICIT

The idea for CONICIT came from a senior research leader in microbiology who was an expert in Chagas disease who saw the need for a council that could be a technical agency, which advised on science policy and provided instruments to fund basic science and support development of human resources and infrastructure in higher education and research. CONICIT was not originally funded by the government of Costa Rica. Initially, it mainly worked through international collaboration projects with bilateral funding (e.g., IDRC, SIDA). There was very little government support for research funding programmes, exception for some basic operational costs. In the 1980s, cooperation with USAID provided US\$1 million to promote basic and applied projects in the country. In 1990, a US\$34 million loan credit from the Inter-American Development Bank (IADB) came into effect and provided significant resources to improve infrastructure in public universities (where the majority of research was conducted in the country) and train human resources in STI.

The research leader who championed these ideas was instrumental in ensuring that the loan's objectives were aligned with the National Science and Technology Plan. This alignment was beneficial and allowed for CONICIT to develop, in terms of responsibility for managing the funds and prioritising programmes and allocation. The loan helped to set a new course and strategy for STI in the country, with CONICIT as the RFO responsible for this. However, it was operating without a Ministry. The same research leader was appointed minister, but without a portfolio, which meant that he had little influence on budget formulation for STI. Thus, he proposed a law to create the Ministry of Science and Technology.

The case of CONICIT is a unique example where the establishment of an a national RFO precedes the line ministry, mainly due to an individual champion and a strong regional agenda in Central and Latin America. In the 1970s, the international environment involved a movement of several countries in the regions, also led by UNESCO and Organisation of American States, which prioritised the issue of science and technology within national structures of the countries. This environment also enabled the development of CONICIT at that time, due to the interests of funders and the IADB aligning with this regional and national agenda.

World Bank, the Government of Korea, and the European Union through the ACP Innovation Fund. So far, US\$52 million has been raised, with a minimum contribution of US\$2 million from each African government committed to membership on the platform. Three of the countries have requested WB loans to join the initiative through credit, while others pay directly, and some are already replenishing original contributions. The approach of the RSIF to work in a synergistic way with the WB African Higher Education Centres of Excellence (ACE) project created an opportunity for countries to benefit from their investments in these Centres of Excellence. Since icipe first pre-approves the universities to which students receiving its PhD scholarships will be eligible to attend, the universities that were part of ACE in all regions of the continent are automatically eligible to host RSIF awardees.

Informants from both AFC and icipe (the implementing organisation of RSIF PASET) underscored that a good track record for delivering on projects is vital for building trust and bringing in new members. Through exemplars of successful projects in other countries, the attractiveness and incentives of government membership and commitment increase over time. In both cases, countries who have not put government investment in the fund can also benefit from projects, but without any role in the governing structures. This incremental approach to increasing trust through effective implementation has served both organisations well. While informants acknowledged that one critique of this approach may be the lack of wide inclusivity from the start, it does allow for gradual growth in a very focused way to build on successes, which has led to stability and good performance of the organisations by not overcommitting.

Evaluating success of funding and funding models for RFOs

Informants from national RFOs reported a variety of ways their organisations perceived successful budget management and spending to fund research. Many also discussed the challenges of finding appropriate metrics and measures to assess this and that they are still experimenting and exploring to find the most suitable conceptualisation or approach to indicators to evaluate their programmes and achievements with funding. Some, like EtaG and CONICIT, use some efficiency measures such as the proportion of their total budget used for operational costs (that is the cost of managing the organisations) compared to previous years. For example, this is 1.79% for the ETaG and 2.5% for ERC. This was highlighted as a useful metric, because programme funding can fluctuate between fiscal years given policymakers' decisions on budget changes.

Many informants discussed outcome or impact measures. In the case of NSTDA in Thailand, practical outcomes from funding programmes were seen as successful (e.g., dengue vaccine candidates, new varieties of rice and sugar cane). The NRF Korea highlights more traditional R&D performance metrics, such as papers indexed in international scientific journals. Research leadership and career progression are key indicators used by the India Alliance. The number of its fellows now in faculty positions or in key leadership positions at research institutions (within and outside India) represents a key indicator of their success.

The NRF Singapore uses the structure of its national strategic approach to research funding to guide the evaluation of its success. It considers whether it is meeting the expectations of stakeholders (particularly ministers and politicians) set out in the strategy. Examples of their success included the rapid design and scale up of COVID-19 diagnostics (due to increases in biomed research and investment since SARS in 2003) and continuing to attract leading technology companies to Singapore (due to high-quality of tech and human resources from investments). But some informants are more critical and cautious of using such metrics because they do not necessarily account for the interactions and relationships between systems (like the research system and the innovation system) that impact the value chain of how knowledge created is translated into economic activity downstream. Nevertheless,

innovation indicators are used to demonstrate success of programmes even when economic impact is not an assessment criterion for funding. For example, the ERC grantees account for 31% of all patents filed by people funded through EC programmes, while it only receives 17% of the budget. While there is certain agreement that a successful funding programme should create knowledge, there is not consensus on the most appropriate measures for that.

Sustainability of funding and funding models for RFOs

Most RFOs shared concerns around the sustainability of funding, with informants from only two of the RFOs reporting no serious sustainability concerns at present. The CEO of the NRF Singapore is not at all concerned with the sustainability of the government's commitment to maintain 1% of GDP investment in STI. Over the past 30 years, the expenditure on R&D in Singapore has steadily increased. But the strong commitment of the current PM to consistent funding that supports STI for Singapore to be competitive and invest in the future is not recent. The predecessor to the NRF (the National Science and Technology Board) was established thanks to the collaboration of two champions at the time – the Chair of the Economic Development Board and the Minister for Trade and Industry, who is now the PM. This emphasises the significance of champions, especially in the long term. Similarly, champions have been critical to the sustainability of funding for the India Alliance. In the first phase of the programme, there were two main individuals in this role. The success and credibility of the programme attracted many more to argue for the renewal of commitments (including the research fellows who had benefited from the awards). The Government of India doubled its commitment for the second phase, making the funding ration 2:1 with Wellcome. This achievement took about 2 years of preparation and negotiation between all the partners. However, the future is ambiguous. Wellcome will not provide funds for a third phase after 2024, and the Government of India has not formally committed. This strong, yet uncertain, situation highlights the need for long-term planning for RFO and research funding initiatives beyond the standard 5-10-year cycles.

The ERC is another RFO that is not very concerned about the sustainability of funds. There is general agreement and strong support from the European Parliament for ERC funding. The budget crisis in 2020 due to the pandemic, with a potential for €500 million in cuts to the Horizon 2020 programme (€220 million of which would have affected the ERC), was averted through direct advocacy to the German and French governments and meetings with Commissioners. But the strong support of scientific research at the European level remains a top priority for many in the EU, although some member states would prefer to put more funds into distributive programmes. While no significant threat (short of a crisis such as the pandemic) appears to challenge this support, there is concern over a potential proposal for an ERC Health, supported by a powerful lobby of medical doctors, which would risk fragmenting existing funds than add new research funds to the mix.

The funding scenarios are less secure in other settings. For example, informants from NRF South Africa and TSRI shared that one of the biggest threats to their funding is the emphasis on short-term performance and impact measures. Multiple informants from TSRI shared that Parliaments want “quick wins”, which due to annual budget agreements, is a major challenge to demonstrating value. As Pongasakorn Tantilipikorn, the Strategic Agenda Team Director for the Medical Division, put it: *“I would not say it's a fight, but we have to defend it [in Parliament], fiercely, almost every year.”* One of the strategies that TSRI uses for this is to show how research, especially technology transfer, is improving the health, lives and productivity of the poorest. Although Thailand has seen a general and steady increase in research funding, the pandemic demonstrated the fragility of such funding in a crisis, with a 25% cut to TSRI budget. NRF South Africa also faces challenges to argue for sufficient

investment. Focusing on short-term impact disincentivises investment in things that require long-term commitment.

And that is one of our biggest dangers, particularly in the global south and in the so-called developing world, where people are expecting instantaneous results. And therefore, by default, we are only going to fund those things that have immediate impact. That's not useful at all.
Molapo Qhobela, former CEO, NRF South Africa

In the case of CONICIT (see [Box 2](#)), partnerships are increasingly essential to its ability to implement and grow programmes. Recent years saw the creation of an Incentive Fund (~US\$100 million/year) and a law committing to US\$1 million/year operating budget for CONICIT. In 2002, another fund was created for financing innovation in small and medium enterprises. This has led to an increase in the ratio of programme to operating funds. This is in addition to the challenges of the international aid agenda turning away from STI and of austerity measures. These difficulties, coupled with the inability to accumulate funds, have particularly affected multi-year programmes. In one instance, the Ministry launched a call without sufficient funds to fulfil obligations to the approved applications, causing great frustration by the research community.

Endowments offer a promising alternative and sustainable funding model. PASET RSIF is implementing one such model, with a general fund and an endowment fund, with the aim of replenishing the former with the latter. Although the structure of this idea has not fully materialised, the growth of the general fund to about US\$55 million in the last three years and a feasibility study carried out by icipe have led to optimism about long-term sustainable funding using this model.

Strategy

Key messages and lessons

- Strategic 5-year planning is key, but it is most useful when embedded in a much longer-term vision (30-50+years).
- Strategy needs to have a sharp focus on what the RFO want to achieve – what is the object of change (beyond focusing on the mechanisms for changes like programmes or grants). We found a variety of strategic practices ranging from alignment with national development or economic goals, multi-stakeholder strategic development based on different sectors' needs, focusing on specific scientific disciplines or areas of knowledge needs or assets, to inclusion of excellent science across all disciplines. Whatever the choice, the organisation needs to have a vision and clear definition of a substantial end goal. Diversification can lead to inefficient use of limited resources.
- Good information systems for monitoring and evaluation processes are fundamental part of strategy to produce data and knowledge about the RFOs achievements and contributions. This is critical to support organisational learning internally and external advocacy to policy makers, the public, and other stakeholders on the value of research and research funding as an investment.
- Learning from international experiences of other RFOs has been a useful approach for RFOs to reflect on their ways of doing things, see how others address similar challenges, and revise or adopt new practices. This can be done in multiple ways through site visits, international collaboration, networks, personal relationships between staff.

The motivation and purpose of many national RFOs extend beyond research funding. Many of them have several mandates which relate to the organisation and levels of integration of the higher education, research, and innovation systems. For example, several national RFOs were founded to reduce fragmentation and consolidate research funding, policy advice, and networking platforms between universities and research institutes. The combination of research funding and public policy advice was common, as was international collaboration. The interpretation of mandates around knowledge translation differed; some consider this a direct RFO function while others consider it an area of funding. The multiple roles and responsibilities were seen by many as a strength that suggests a coherent approach which facilitates achieving its mission, designing research programmes and funding, and engaging with different stakeholders for different activities. One informant from the NSTDA in Thailand finds that this comprehensive approach has worked well for the country. However, the most recent reforms of the Thai STI system separated these responsibilities to reduce conflict of interest, on the premise that an organisation should do one of carrying out research, funding research, or advising/making policy. The recognition of context specificity for national RFOs is thus a caveat when exploring their approaches to strategy development, implementation, and evaluation in terms of relevance for a regional RFO because the relationship to governments is different and multijurisdictional.

NRF South Africa and TSRI in Thailand offer different examples of comparable approaches, based on their different national contexts. In many African countries, research has typically been carried out in national research laboratories and national sectoral agencies, for example for health, agriculture etc. The NRF South Africa therefore mainly aimed to strengthen research within the university sector, leading universities to be more research-driven including in teaching and learning. There has been considerable progress on this objective, since today in South Africa the university sector produces about 80% of research nationally.

Also in the Thai context, most research is carried out by university professors and other public sector researchers. The rationale for transforming the Thai Research Fund into the TSRI was to stimulate university researchers to do more translational research. The merger of the Ministry of Higher Education and Ministry of Science is also to support this underlying thinking and management of the process. The Thai informants explained that their situation differs from others like Korea or Japan, where the majority of researchers working on development and innovation are in the private sector. Despite 80% of Thailand's GERD coming business enterprise sources, the private sector does not invest in deep technology and innovation. This is one reason the Thai government is keen to use its limited resources to focus on the fundamental development and technology transfer.

PASET RSIF presents an interesting case of strategy having been developed by African states to fill a specific gap in applied sciences, engineering and technology (ASET). Governments recognised that much of the research funding available to researchers and capacity strengthening in African countries (including from internal and external funders) is centred on health sciences research. PASET members wished to design a fund that would build skilled scientists and institutions in ASET and support more women in ASET careers (see [Box 3](#) for the motivation and arguments used by PASET to set up RSIF).

Several national RFOs align with the national government strategies for research and development. The existence of a policy and legal framework, such as the Estonian Research Act or the strategic plan for Research, Development, Innovation, Development and Entrepreneurship (2035), with strong government leadership are a key to the success of the national RFO according to the CEO of ETaG. Similarly, the NRF South Africa aligns with government strategy, such as the national development plan. However, when it comes to strategic development for research priorities, these organisations have separate internal processes which are separate from government influence.

Other national RFOs have a more pragmatic, highly structured process to prioritising research funding that corresponds to national strategic and economic priorities. National strategy can be a compass for internal decision-making, as one informant from TSRI explained. The NRF Singapore takes a highly focused approach to strategy that involves collaboration with a range of sectors and government agencies on issues relevant to Singapore's future (see [Box 4](#)). A Scientific Advisory Board, including representation from around the world and across

Box 3: The rationale behind founding PASET RSIF

Three main concerns were at the impetus of RSIF's establishment by the African states of the PASET platform. Their desire to set up a platform for PhD scholarships, research funding, and innovation funding was motivated by the following:

1. African governments were concerned by low numbers of researchers/million in Applied sciences, engineering and technology (ASET). These are important for economic growth and development. Yet disparities exist in research funding for physics, chemistry, or engineering compared to agriculture or health, for example.
2. African governments saw that existing funding is unsustainable. Current mechanisms rely on short term programmes of 1-5 years, and then generally fizzle out without sustainable pathways of funding for research to continue or new research to emerge.
3. African governments acknowledge that individual countries cannot meet regional aspirations working in isolation. Therefore, a regional approach to share experiences and share limited infrastructure is vital to achieving this. For example, RSIF using the concept of Centres of Excellence to select participating universities approved to host the regional PhD students funded by the programme supports institutions of higher learning which have been strengthened through national efforts.

The idea for RSIF was to set a bold vision to fund the training of 10,000 PhDs in Africa, filling a gap in ASET where there was less donor support, through a sustainable funding mechanism founded by governments. By using Centres of Excellence as regional hubs and destinations of PhD students for their training, RSIF aims to implement an efficient approach and economies of scale with potential for significant spill-over effects – for the fields of knowledge, for the careers of scientists, for the universities, and for the African economies. The regional component of working together between countries to achieve this level of training at the continental level is central to the programme.

disciplines, also advises on cutting edge science and feeds into the strategy for specific areas. Their approach to research funding has been driven by two main narratives: one to support competitiveness of Singapore's industries and another to produce scientific knowledge to solve Singapore's concerns and issues for the future. When the NRF Singapore was founded, these included clean water, clean energy, translational clinical medicine, and interactive digital media. Since then, climate change, ageing population, and more recently pandemic preparedness have been added. But within these areas, the NRF funding is selective. Research must be highly relevant to the national narrative for Singapore and produce scientific solutions. For example, rising sea levels are a significant concern for the country in the area of climate change; therefore, NRF Singapore is keen to fund research in the area of coastal protection. They also wish to fund research with the potential to provide solutions and impact change in other countries facing similar issues, small island states in the case of coastal protection for instance. This top-down, targeted approach to competitive research funding differs from other large RFOs. But NRF Singapore considers this necessary to efficiently use funds in a small country that takes a long-term view to guide its strategic investments.

Box 4: NRF Singapore's strategic approach and key narratives for investment

There are two main narratives for investment in research, science and innovation in Singapore. The economic narrative around building industries to make Singapore competitive, which was successful in establishing the National Science and Technology Board (1991), and the national future narrative around using investment in science and technology to provide solutions that are important for Singapore, which has been successful in founding the NRF (2006). Both narratives work in synergy to create strong arguments for the support of science and innovation investment, with a strong pragmatic approach to problem-solving for Singapore's future.

The NRF works closely the economic actors like the Economic Development Board, Infocomm Media Development Authority, building construction authority, urban renewal authority, national environment agencies. These close stakeholder relationships are designed to coordinate with key agencies to understand the country's economic needs from the perspective of industry. The NRF seeks to understand the current state of energy to better plan, ensure a shared vision of the industry's future in Singapore, and provide means for NRF to support research and innovation to "climb the technology ladder with them."

NRF Singapore also works with other social policy areas and government agencies, such as the Ministry of Health, Office of Chief Health Scientists, Water Agency, and the public transport to understand what the national imperatives that we need to address for the future of the country and well-being of the population.

But in many of the things that we funded, water, for example, we found that the economic narrative, and national imperatives are not mutually exclusive. So, we have achieved some level of water resiliency, but we also built for us ourselves a fairly sizable water industry. Low Teck Seng, CEO, National Research Foundation Singapore

Taking a futures perspective – marine science, engineering, space, energy and quantum have been identified as important for Singapore's future, economically and scientifically. All of these efforts, through close stakeholder consultation (including international advisory panels), unite to form the NRF strategy which guides development of programmes for funding from a pragmatic approach to targeted calls for research across broad vertical programmes.

We found other examples of government-mandated investment in specific strategic areas or problems in STI. For instance, the governments of the PASET RSIF determined 5 areas of focus as the top priorities for research funding and training: agriculture and food security, climate change and materials, mining and minerals, energy, and ICT. This helps to align the regional approach (see [Box 3](#)) with national priorities, because it is the governments who define them. But an advisory group also contributes to the revision and renewal of these. Strategic advice also comes from stakeholder engagement and consultation.

Multiple informants emphasised that involving stakeholders in strategic discussions was important for scientific relevance and acceptability. The NTSDA in Thailand sets up an overarching steering committee to work with the relevant academics, government agencies, and private companies for each strategic funding area to give advice on the research and knowledge needs they have for the future (e.g., medicine, agriculture, environment). The steering committees then sets up a programme based on what they determine to be priorities, like emerging infectious diseases. For instance, in the area of medical research, the National

Health Security Office was reluctant to participate but then found the dialogue within the NSTDA oversight committee created opportunities for research calls to help support their work. Similarly, the TSRI and NRF Korea use their government's strategy within a range of top-down methods for structuring the orientation of research funding (i.e., working directly with stakeholders in government sectors, to guide the priorities for strategic funds for research, see: [Relationship management and engagement](#)).

Other RFOs (like the NRF South Africa) signalled that the extent of the government's, or line ministry's, input into operational matters around translating the strategy or going into any detail beyond large, expected outcomes should be avoided. The critical line between government as a stakeholder in strategic involvement and in scientific evaluation or grant decision-making should be firmly drawn and respected (see: [Scientific evaluation and grant decision-making](#)). CONICIT was an outlier among the cases of RFOs in this area, as the development of programmes was more driven by (external) funding than strategy. As of 2015, the Board adopted a more strategic approach to exploring key themes for research, such as the energy transition, in part because there is a substantial amount of international funding for that.

This highly strategic top-down approach based on national priorities contrasts to a more open and bottom-up approach to funding "blue sky" science, such as by the ERC, India Alliance, and to a large extent NRF South Africa and ETaG. Nevertheless, in several strategically driven RFOs like the TSRI or NRF Korea, there is also space and funding to allocate for bottom-up methods and applications for open calls that target more blue-sky or basic science research as fundamental new knowledge creation in a range of fields. But this is a complex balance for countries that have limited resources, well-defined needs, and perhaps disparities in research capacity and expertise in some areas. The NTSDA has alternated between policy driving science and science driving policy, noting that developing areas depend on the quality of researchers and research leadership. This is why every 5-10 years the organisation opens up the priorities and calls to include topics that may appeal to a new pool of applicants, such as those returning from abroad. In this manner, the RFO functioned more as a coordination mechanism, acknowledging that a priority area which is not well capacitated cannot be established with expectations that the country's research environment and capacity catch up. In the same country, TSRI (as the overarching national RFO in Thailand) uses a strategic approach to filling technological skills gaps by supporting tech transfer through its Technology Localization Programme, international research networks, and the Eastern Economic Corridor. The Technology Localization Programme matches researchers in the private sector in Thailand with researchers abroad. For instance, this programme is currently focusing on electronic vehicles as a national priority for industry to improve technology related to batteries and other electronic devices. Thailand's capacity to manufacture AstraZeneca (the only country in Asia with this) was also supported through the government's tech transfer programme.

Scientific evaluation and grant decision-making

Key messages and lessons

- Credibility and institutional trust are built through a robust scientific evaluation process, which has been seen to provide benefits to both researchers and science.
- The quality of the reviewers and panel members is essential to this credibility.
- Grants should be kept simple and as flexible as possible to reduce the administrative and bureaucratic burden on researchers and emphasize core criteria.
- RFOs are usually responsible for the final grant decision-making is usually, often relying on input from scientific evaluation provided by national and international experts. Some RFOs also offer block grants to research institutions for them to spend on a range of projects proposed and run by their researchers.

The processes and procedures for scientific decision-making and grant allocation are vital to the credibility and trust of an RFO. Ensuring the rigour, quality, and independence of the scientific evaluation through organisation and management of peer review of the proposals is the core function of an RFO. Informants across RFOs we interviewed underscored the essential ingredient being the quality of the panel members, followed by the competence of the implementation team in preparing, managing, and supporting the review process (see: [Structure and governance](#)). Composing, sustaining, and renewing relevant membership of evaluation panels and committees is a critical responsibility of an RFO. These committees need researchers of high quality, representing the best expertise (in-country and internationally), with appropriate language capacity to review proposals. [Table 3](#) shows a selection of examples of different ways this is done in some of the cases (see [Appendix 3](#) for detailed descriptions of evaluation and governance of allocation decisions). The integrity and independence of the scientific evaluation process was highlighted by a large majority of the informants interviewed as the cornerstone of an RFOs reputation.

This is key to programmes like this, that you develop goodwill based on the transparent systems that you follow. Shahid Jameel, immediate past CEO, India Alliance

We found a mix of the use of international and national experts at different stages of review (see [Table 3](#) and [Appendix 3](#)). In most cases there is a final evaluation committee or panel responsible for making the final decisions based on all of the reviewers reports and ranking, which is occasionally supplemented by interviews with applicants (e.g., NRF Singapore, India Alliance, and ERC for synergy grants). Several RFOs use a mix of evaluation criteria (e.g., NRF Singapore, NRF Korea, NTSDA), which appears to be a corollary of those RFOs with highly structured and strategic targets for funding area. While others rely on a single criterion such as quality or scientific excellence (e.g., ETaG, ERC, India Alliance). The latter aim to fund the best researchers with the best ideas, within a more organic approach to research funding.

The most salient example of this is the ERC, especially given its status as a regional RFO (see [Box 5](#) for details about the ERC scientific evaluation process). The purpose of the ERC is to fund research that makes scientific breakthroughs, whether in basic or applied sciences and across all disciplines. Recruiting the top scientists in all areas of scientific knowledge, the ERC wishes to entice and attract top researchers to submit their proposals. By ensuring that

Box 5: The ERC's focus on excellence

The purpose of the ERC is to fund excellent science and frontier research. For the ERC, this means research that breaks new knowledge boundaries. The evaluation of proposals is conducted using the sole criterion of excellence. When discussing proposals in the panels, panel members are only allowed to examine and comment on the excellence of the idea, the project, and the applicants as individual researchers. The host institution is not evaluated. Any commentary on this is suspended in panel meetings so that it is not a part of decision-making. There is also a strong briefing by the implementation team (Executive Agency) to panel members and measures in place to mitigate and to counter implicit or unconscious bias on gender, geography, or language.

The prestige of an ERC award attracts high quality proposals, and thus researchers from around the world are motivated to serve as panel members (in a generalist capacity on the decision-making panel) and/or reviewers (in a specialist capacity to review proposals). The opportunity to review and discuss high-level projects in their fields presented and experienced as a scientifically satisfying and intellectually stimulating experience in their career. The quality of the panel members is considered by the ERC staff and leadership to be one of its greatest success.

This coherence carries over through the quality of the operational side managed by the ERC Executive Agency, which handles all communication with panels and relays data and analyses on these processes to the Scientific Council. There is an ongoing process of reflection and improvement built into the strategic and implementation collaboration internally. At the end of each grant awarding cycle, the Executive Agency meets with the panel chairs to collect feedback on what worked well or not in the evaluation procedures and any ideas they have for improvement. They also collect feedback from the independent reviewers. This is fed back to the Scientific Council and deliberated upon for relevant lessons to carry into the next cycle. There is a continuous learning and reflection process between the formulation and implementation of the ERC's programme.

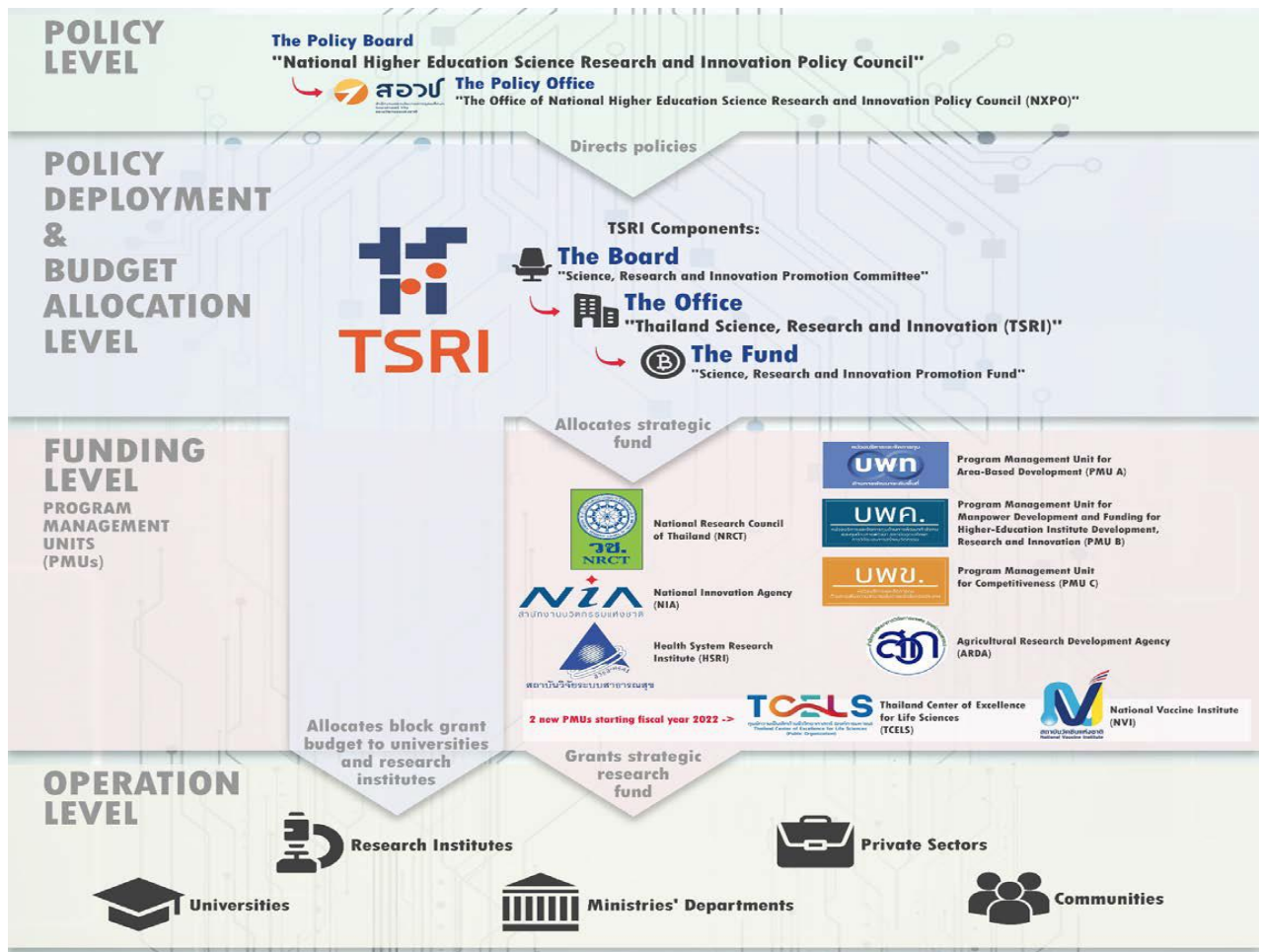
excellent research is submitted for funding, the ERC wishes to entice and attract the best experts to review it. Excellent research is the key motivation for participation on both sides. For this, excellence is the only criterion used to assess proposals. The promise of the ERC to applicants and reviewers is a "best of the best" scenario.

The focus on excellence has trade-offs for equity concerns in the distribution of funds. But the choice to prioritise excellence as a single criterion has been justified by agencies like the ERC and India Alliance as primary objective in search of groundbreaking scientific discoveries. That is not to say that discussions about equity are absent internally. But the choice to select for excellence and the best ideas appears to represent an approach to research systems that prioritises individual researcher's development, over other more systemic considerations.

We found a mix of targeted and open calls across the RFOs, depending on the operationalisation of their strategies (see: [Strategy](#)). Many of the national RFOs also reserve a portion (5-15%) for emerging issues and things that arise in a fiscal year for which calls or programmes may need to be rapidly designed and launched. In terms of a mixed approach to the funding allocation, TSRI provides an example of strategic and open-ended funding, with a focus on block grants to institutions. The TSRI is a unique case in being an overarching

funding allocation body in the Thai system that implements research funding policy (see [Figure 2](#)). The combination of these disbursement mechanism allows for a twinned approach to strengthening researchers and research institutions (see [Box 6](#)).

Figure 2: Thailand's research and STI funding system (Source: TSRI, 2021)



Box 6: TSRI's disbursement mechanisms

TSRI allocates about 60% of the budget to nine funding agencies (Programme Management Units (PMUs) in Figure 2) according to the strategic pillars and areas. Each PMU is autonomous and responsible for its own programmes (calls, evaluation, grant decision-making). However, all PMUs and TSRI share a common information and monitoring system, which has records of all grants and awards in the country and their details. The other 40% of the budget goes to public research institutions in the form of block grants from TSRI. This includes research departments in Ministries. For example, the Department of Fisheries, under the Ministry of Agriculture, conducts research as well. Researchers from the private sector or community are funded by awards from the PMUs. So, TSRI works directly with funding agencies and research institutions, not individual researchers. Researchers in organisations can submit proposals for the strategic fund from PMUs.

The block grants to research institutions are competitive. They are based on an assessment of the research environment and systems in place (not individual project proposals), and the evaluation focus is based on the institution's past performance. The amount they receive depends on their outputs and outcomes from the previous year as an indicator of their capability for the year to come. They submit their plan along with the university group they are in (4 categories in Thailand), and they have to show that they have a good system to select and monitor the projects. Most of what is funded through these is blue sky research, since they are mainly universities, but other institutions, like departments in the ministries, do translation research. The institution itself determines the projects they will use the funds for. The main objective of these grants is to empower and strengthen institutions.

Table 3: Processes of evaluation and decision-making from a selection of cases

RFO	Organisation	Evaluation process	Evaluation criteria	Decision-making
ERC	<p>The Standing Committee on Panels of the Scientific Council is one of three standing committees of the ERC. The Standing Committee on Panels is responsible for the policies and procedures to select ERC evaluation panel members and reviewers for all panels, setting up the database of experts, preparing and approving proposals for panel composition, and ongoing development of norms and rules for panel functioning and ERC peer evaluation system. This committee is chaired by the President of the ERC, and it report to the Scientific Council. ERC Scientific Management Department (in the ERC Executive Agency secretariat) provides operational assistance to this standing committee.</p> <p>The members of the Standing Committee are members of the Scientific Council. The 22 Scientific Council members serve terms of office of 4 years, renewable once. They are appointed by the European Council based on recommendations from an independent Identification Committee.</p>	<p>Proposals are evaluated by selected international peer reviewers who evaluate and score proposals.* Those who pass the quality threshold are ranked.</p> <p>For each call there are 25-27 panels, each covering a sub-section of one of three domains: Social sciences and Humanities, Life sciences, Physical and Engineering Sciences.</p> <p>Each panel has between 11-17 members and a chairperson. Panel members are selected by the Standing Committee on Panels based on criteria, including scientific reputation. Each panel meets twice for a two-step review process for an annual call for proposals. One person may not be a member of two or more panels in the same year. A panellist may be re-appointed for up to a maximum of four times.</p> <p>(*This is the process for evaluating the starting, consolidator, and advanced grants. Process differs for proof of concept and synergy grants).</p>	Excellence	<p>Panels make the final decision. Each ERC panel consists of a chairman and 10-16 members.</p> <p>Depending on the call budget available, a budgetary cut-off applies to the ranking list and only the highest ranked proposals are offered an ERC grant until the call's budget has been used.</p>

ETaG	ETaG invites top researchers to form the Evaluation Committee. The members of the Evaluation Committee are formally appointed by the Minister of Education and Research for a term of 3 years.	1. International experts evaluate proposals, then report 2. Estonian expert groups (7 by disciplines) evaluate and compare reports from international experts, then rank proposals	Quality of proposals	Evaluation committee makes the final decisions on who receives grants (not ETaG employees)
India Alliance	The secretariat selects the members of the committees – based on their experience and recommendations from other committee members. These are ratified by the Board of Trustees.	1. External peer review 2. Interviews by selection committees	Best researchers with the best ideas Vision	Selection committees have full authority for funding decisions on recipients of awards. The work independently with operational support from the secretariat. There is no involvement of the CEO or senior leaders.
NRF Korea		3 types of evaluation methods, determined by project characteristics and size of project: 1. online review 2. panel review 3. presentation review in 4 stages (review of qualifications/eligibility; expert review in panels in each field with industry, academic, or research expertise; review by specialist organisations; programme implementation committee).	Creativity, spirit of challenge, research capability, and track record.	Programme implementation committee generally makes final decisions.
NRF Singapore		1. Evaluation of a concept/white paper proposal by a team of experts from the region (convenience sample) 2. Those selected are invited to submit a full proposal that is sent out for international review 3. International evaluation panel (by programme) – which meets in Singapore for about a week to interview those who submitted	Excellent science Relevance for Singapore Global impact Focus on the quality of ideas for fellowships, and quality of scientist's reputation for investigators.	The International evaluation panel makes final decision. There is no local participation on the panels to avoid conflict of interest.

		proposals (by biomed and physical sciences).		
NSTDA	Secretariat establishes a steering committee for an area of research, and the steering committee appoints the technical committee.	1. Independent review (not international, as most proposals are in Thai)	Track record, idea, visibility/use of research. Overarching focus on quality and performance of research team and its leader. But pragmatic criteria for research with implementation potential. Criteria may also depend on budget (larger budget, broader funding).	Technical committee makes final decision. These committees have a lot of autonomy in terms of their focus, so decisions also vary on composition of committee. Tend to fund the best groups, less focus on novelty.

Approaches to research and innovation capacity strengthening

Key messages and lessons

- Make explicit plans and strategies to attract and retain women in STI, and ensure dedicated funding to support the inclusion and advancement of women in scientific careers.
- Talent retention may be an expensive endeavour, but it is a necessary investment not only to build sustainable research capacity in the sciences, but also to create a critical mass of research leaders – which is essential to support both research and education in across disciplines and fields.
- Good universities are necessary to build up scientific knowledge and research capacity because STI and education work in tandem. Even if this is not the responsibility of the RFO, strategies and funds for improving educational institutions as contributors to excellent science need to be part of an integrated research and innovation strengthening strategy.

Most of the RFOs we examined focused on funding individual researchers or teams of researchers, and fewer included programmes or schemes that focused on institutional capacity or infrastructure (see [Appendix 3](#) for full details on programmes and types of grants for each organisation). Strikingly, for the ERC, institutional research capacity and infrastructure were considered to be outside the mission and core business of the RFO as there are other regional programmes and agencies tasked with those mandates.

Individuals

Most organisations provide grants to individuals across career stages from post-doc forward. PASET RSIF provides funding to PhD students, and NRF South Africa also provides scholarships to post-graduate students at MSc and PhD levels. Two RFOs had specific programmes or policies to promote gender equity in research and STI. CONICIT has a specific programme for women in STEM and entrepreneurship. ETaG has a policy wherein with two proposals of equal quality, they look at the underrepresented group in the awards for that discipline or field, and award to either a woman or a man depending on the case. They also changed criteria for different programmes that are age-based, to be more inclusive of different ages of applicants who may be at various stages of their research careers. But others, like the India Alliance, have not taken specific action on gender balance although their data show that women and men are equally represented at the post-doc stage and then the number of women awardees declines significantly for intermediate and senior awards. The strategy to only fund the best has remained the key rationale for funding, irrespective of gender or geographical disparities in awards.

Talent retention is a key issue for research systems. RFOs usually wish to use their funding to develop and strengthen research talent, but ensuring that there is an attractive research environment with research career development opportunities may be out of scope of action for an RFO.

And so strategically, it's about supporting and investing in those that have significant proven potential, those that are at the top end of the system, because you want to retain the best in your system, and you want to bring up those that have the greatest potential to grow. Molapo Qhobela, immediate past CEO, NRF South Africa

PASET RSIF and the India Alliance built mobility opportunities into their funding schemes, to encourage networking and external training, but this could not be entirely external. They use a sandwich model. This is particularly useful for PhD students and early career researchers, to have international experiences as well as rooted experiences in their local contexts. The intention is to establish roots and return after a stay abroad. For the India Alliance, this mechanism worked for the most part; people stayed in India and were offered a faculty position where they were or in another institution. Good research environments and flexible funding were reasons for staying. It showed people that they could do good science in India, and they were less likely to leave. Those that did leave went on to top universities overseas, and kept ties with India, including training Indian students in their labs.

A few RFOs have specific programmes for retention. In Thailand, there is a bonding scheme for students who receive a scholarship for studying overseas. They are required to come back to Thailand for a certain amount of time, otherwise, they must pay back the scholarship. But there are frequently issues with this scheme when researchers are bonded to institutions before they graduate, and are tied to inappropriate institutions (e.g., in universities too small for their field of specialisation). CONICIT created a reinsertion fund in 2015, for PhD and post-docs coming back to the country, to support them to do research before getting swept up into teaching responsibilities. Unfortunately, this programme could not merge with the incentive funds because of funding restrictions, but there were a handful of successful projects. Since, the University of Costa Rica has set up its own reintegration programme similar to this one. NRF Singapore also supports a scheme to bring back Singaporean researchers. It is acknowledged as costly investment because researchers want to know that their labs and work will be maintained without interruption. But the return on this investment is two-fold in bringing back research leaders who benefit the system in multiple ways. But Singapore also attracts a lot of international talent in research and STI. About 50% of the researchers in Singapore are foreign, and 50% are local.

Research performing institutions

There were a variety of approaches to institutional capacity strengthening. Some organisations only support individuals and not institutions, such as the NRF South Africa, ETaG, and ERC. The NRF South Africa has taken a concrete stance that the organisation is not in the business of institution building, thus it is out of its scope to help move struggling institutions up the capacity ladder. The ERC has a similar firm position on this, so as not to “dilute the principle of the ERC” and its mission for funding research excellence.

The Scientific Council is very adamant that ERC cannot become a capacity building programme. Angela Liberatore, Head of the Scientific Management Department, ERC Executive Agency

From the perspective of a regional RFO, the ERC supports this position by acknowledging that there are other structures and funds within the EC with programmes for scientific infrastructure and regional support, to help the research ecosystems in various countries. Within Directorate for Research and Innovation, there is a separate programme called research infrastructures, and in collaboration with DG Regions, there is one for regional funds. But it is the countries themselves who decide how these funds are spent based on their national priorities.

The ETaG offered a grant to support institutions and institutional capacity was established, but this programme was discontinued because it was not working very well. ETaG no longer supports institutions because this is primarily done through the Ministry of Education and Research (based on a political goal established for baseline funding as the main instrument for research institutions to have stability, since programmes can vary). There are multiple

programmes to support research institutions from the ministry via structural funds, or development plans for institutional support. This has grown from €5 million/year to €45 million/year now. Research institutions in Estonia are evaluated every 7 years through a rigorous internal and external (international) evaluation. The scores from these evaluations are used to validate the quality of research environment and support from institutions. Grants from ETaG to individual awardees can only be administered by research performing institutions that have received a positive evaluation – thus simplifying the application process, as applicants do not have to provide a separate justification of their support, infrastructure, equipment from an institution.

But approaches to institutional capacity strengthening differed in RFOs located in the global south. For example, with the initial loan that CONICIT received from the IADB (see [Box 2](#)), they focused on building research centres, such as the Marine Research Centre, the Laboratory of Structural Models, and other civil engineering research centres. The idea was that research centres were necessary investments for training human resources. Then under these centres, researchers would be able to work with private small and medium enterprises on innovation, for which they would be eligible for competitive funds for R&D. New grants for building institutional capacity were added in second phase of funding for the India Alliance. For example, proposals could be submitted for team grants (bringing together at least two different institutions) and for clinical and public health research centres (involved in research training).

The PASET RSIF has worked with institutional capacity not through funding, but through its approach and selection process for universities to host its scholarship recipients for their training. Whilst the core business of RSIF is funding PhD students for continuous high-quality training (not building PhD programmes), icipe has used the network of ACE universities funded by the WB as the core network of universities in Africa for RSIF awardees. But they are also working with other universities, which they select competitively (four added in the last call). RSIF also offers research and innovation grants which are open to partner with any other country in Africa, with a focus on strengthening universities as centres of excellence (also selected competitively).

Although several RFOs recognised that the institutional environment is critical to the success of any grant, it appears that their margin and capability to support institutions is often limited. Informants from Thailand and India shared generally funding is concentrated in bigger institutions in urban areas. It can be difficult for researchers who are in smaller institutions, often in rural or remote areas, to successfully complete a grant because they are working alone without a research-intensive environment to support and stimulate them.

Infrastructure

Few RFOs reported investing in research infrastructure. The informant from the NRF Singapore described its funds as based on a pyramid structure: the base and bulk of funding is reserved for individuals, some funds are reserved for groups, and at the top are funds for infrastructure. National labs (e.g., marine lab) and infrastructure are supported centrally, rather than through institutions who are responsible for their own technical equipment (e.g., ocean basin, ultrasonic wind tunnel, synchrotron light sources). Similarly, NRF South Africa invests in large or medium infrastructure, but universities take care of the smaller things. This is reinforced by the alignment to a national macro strategy for the country – to invest in areas with South Africa scientific, geographic, or other strengths (i.e., astronomy, radio, optical), with a specific focus to “make sure that the research is not being done by people who are just parachuted in.” The India Alliance rather uses funding for fellows to contribute to infrastructure

improvements in institutions. Any equipment purchased through the fellowship becomes property of the institution, and thus can benefit other researchers in the environment.

Other RFOs, like the NSTDA, have tried to fund infrastructure before. They found that funding the establishment of infrastructure is not difficult in Thailand, but funding its maintenance is the challenge because it is too expensive. The informant from NSTDA share that, in their experience, you do not always need to invest in infrastructure to support good research. There are outsourcing options, like sending to labs in other countries for testing. This can be done as a paid service, rather than collaboration, and generally leads to better quality work in an established lab than setting something up from scratch.

In the European context, similar to institutional strengthening, we find that infrastructure funds are also separate. The ETaG does not have substantial funds to support infrastructure. There is another agency for that (currently in transition). They currently have €1 million to support infrastructure and use the Estonian Research Infrastructure roadmap for decision-making, with a focus on national scientific infrastructure that supports more than one institution. There are also strategic investments to participate in European infrastructure (i.e., ELIXIR European Life science infrastructure for Biological information).

Relationship management and engagement of academic, political, public, private stakeholders

Key messages and lessons

- Defining the key partners and stakeholders from the beginning is fundamental to support the RFO's strategy, as well as its implementation and evaluation.
- Regular dialogue, consultation, and collaboration with policy-makers, researchers, and research institutions help to foster shared understanding of the research communities' needs and stakeholder wide commitment to strategy.
- Engagement with the private sector has shown to be useful in programmes related to economic priorities, technological transfer, and innovation.
- Visibility and communication about the RFO to the government, parliament, and general public are essential activities within broader advocacy efforts to garner and sustain support.

There was a strong consensus across most informants we interviewed about the importance of working with political, public, and private actors in strategic relationships. RFOs need to define and identify who their key partners and stakeholders are and maintain those relationships. While some stakeholders, like government, may appear to be natural stakeholders, others such as academics, research leaders, research performing institutions (both public and private), and private sector industry were all highlighted as key stakeholders for strategy development, programme design and implementation, and evaluation. The creation and maintenance of these relationships, definition of what considerations and areas require stakeholder input and cooperation, clarification of their roles, and the negotiation and decisions about most effective methods for stakeholders to engage with are decisions that contribute to establishing collaboration with the key groups that either shape RFO policy or benefit from it. In terms of defining appropriate and relevant stakeholders for multi-country

initiatives that involve public and private actors, the informant from the African Finance Corporation highlighted the importance of working with a “coalition of the willing”:

We can't force change. We can only facilitate change when the intent to change is there.
Sanjeev Gupta, Executive Director, Africa Finance Corporation

The mechanisms for creating and maintaining relationships with stakeholders differed across the RFOs we examined. For instance, TSRI holds monthly stakeholder fora with the national funding agencies, and each division director meets with relevant stakeholders for their corresponding pillar – especially when strategic change is on the agenda. CONICIT held multi-stakeholder workshops every five years to collect stakeholder perspectives. But since this has stopped more recently, there has been a lack of accountability concerning how funding programmes are achieving the strategic goals defined by the ministry in the national plan.

Researchers and research institutions

Multiple RFOs emphasised that involving the research community is essential. Researchers are the primary audiences and beneficiaries of RFOs and their funding. Researcher feedback can guide programme and grant development because their input as the users of these is important when thinking about optimising these systems to facilitate research and reduce, or at least streamline, administration and bureaucracy. Several RFOs emphasised that engagement with the scientific community is essential to their mission, and to ensuring ongoing scientific and political support for an RFO. For example, when there were government efforts to close CONICIT and transfer its budget to MICITT, the scientific community defended their separation of roles to ensure objectivity and autonomy of CONICIT's technical role to be separate from the political role of the ministry.

At the core, RFOs need to receive proposals from researchers, and RFOs should, in theory, be responsive to researchers funding needs. While this seems obvious, RFOs need compelling goals as well as trust from the scientific community to attract researchers and entice their interest to submit proposals.

All this could be done only because there was a supportive scientific community. It was always there. We had to rely on it, we had to mobilise people to call for their help, and so on. All the time, that's what I've been doing, day after day. Because all of this doesn't make sense if you cannot explicitly show the support of the community. Jean-Pierre Bourguignon, immediate Past President, ERC

RFOs engage with researchers to understand whether the research funding system is working well and performing from their perspective and to support dialogue and broader conversations and reflection about the national research funding system and programme development. The case of ETaG offers good examples of best practice for this (see [Box 7](#)).

The engagement with the research community can also generate proposals for new areas of research or programmes. For example, TSRI invites members of the research community to draft White Papers on key topics where more research is needed that are fed into the RFO's strategic development process. Also, through its ongoing relationships with the research community, the NSTDA fostered opportunities for developing new areas of research and funding to support that (i.e., working with virologists to develop a dengue vaccine candidate). These relationships with the research community are linked to a sense of ownership of the RFO. As the immediate past CEO of the NRF South Africa stated: *There has to be ownership by the people who we are working for, that this system is working for them. You need to be able to work with people that are going to be direct recipients.*

Box 7: ETaG's stakeholder engagement with researchers

The ETaG has established several mechanisms for engaging researchers as a key stakeholder in the development and management of research funding. Since 2016 the RFO holds an annual conference with researchers called *About Science*. It has become very popular and is well-attended because it provides an informal opportunity for researchers to talk about important issues and changes in the research system. The format uses networking and working groups to collect and discuss information about the needs of researchers, which can be useful to support ETaG in fulfilling its role. This process of open dialogue also helps to overcome challenges of frequent changes to the system because it is a venue where researchers can make suggestions and share their perspectives. This has already led to modifications to reduce the bureaucracy in the grants management system, which are improvements that are appreciated by the research community. Some lessons emergent from this process are that researchers want consistency, flexibility, and simplicity. Grant systems and programmes that frequently change are difficult for researchers to navigate.

At the same time, ETaG carried out a review and revision of the grant system with stakeholder input by researchers and research institutions to develop principles to guide decisions about what role grants should pay, what size grants should be, how funds should be distributed. A conceptual framework on the grant systems was produced through stakeholder consensus. As of September 2021, 5 years after initiating this, stakeholders were invited back to discuss what was achieved and further potential improvements.

Business and private enterprise

The relationships with the private sector and industry appear to be more informal than formal among the RFOs analysed. Indeed, relationships with the private sector were reported by several RFOs (e.g., NRF Singapore, TSRI) in particular related to strategy. But few reported relationships related to programmes and grants. For example, industry participation and funding matching is involved in the vertical programme funds for NRF Singapore (i.e., advanced manufacturing and engineering, health and human potential, urban sustainability and solutions, and smart nation and digital). Industry partners also define standards as criteria for the evaluation of these funds.

CONICIT, however, offers a specific example of a programme designed to promote innovation and support relationships between research institutes and business. The Propyme fund is run jointly with the MICITT and the Ministry of Economy, Industry and Commerce as part of the governing body. This has been critical to build alliances with the private sector. The Propyme programme brought universities and other government sectors together to define the strategies that would guide the projects of the programme, and the CONICIT board ratified these. It provides 80-20 funding and has been critical to building alliances with the private sector. CONICIT has also outsourced US\$180 million to a foundation with an entrepreneurship programme in *Green Tech* across different sectors of the economy to design a programme for female entrepreneurship in STEM. This grew from a data-driven effort that showed the gap between number of women entrepreneurs in STEM in Costa Rica and disproportionately high number of proposals submitted from men. Propyme has been very successful, with overwhelming response of high-quality proposals being submitted. The informants from CONICIT emphasised that the key is to build alliances with other foundations to create an overall umbrella for funding activities. Also, the success of the Propyme programme is linked to the Incentives programme because you need to have strong human resources and talent in universities to produce and submit the project proposals. Based on the success of this, the CONICIT Board is now moving in the direction of more ambitious financing that can create start-ups and innovation to attract funds like venture capital through the National Development Banking system.

Government

As mentioned above, government stakeholders are among the most natural and obvious stakeholders for RFOs. In previous sections, we have shown the influence of government in the overall context for RFOs in terms of their structure, funding, and strategy. But some RFOs also shared ways that they cultivate relationships with government and political actors in other areas, such as awareness raising and valuing research among policy makers. ETaG holds an annual conference for members of the Estonian Parliament. The conference addresses issues around the value of research for society. It has helped policy-makers understand the importance of research for improving welfare of citizens and the role of research in solving global challenges and national problems. These discussions led to an agreement between the heads of all political parties, the heads of research organisations, and the heads of major firms, in which the government agrees to 1% of GDP expenditure on R&D, research institutions commit to help better society, and firms commit to use research results.

For this report, however, we focus on the regional or multistakeholder organisations' relationships with government because these can differ from relationships to the state actors from within the same jurisdiction. The ERC's relationships between national research funding entities in their member countries are mainly around communication, information sharing, and awareness raising to stimulate interest and knowledge about ERC in member states. As discussed previously in this report, member states have no authority or oversight in the governance of the ERC (see: [Structure and governance](#)). The formal and informal mechanisms for ERC's relationships with member states include:

- A network of national contact points (usually located at national RFOs, or research ministries, or national research councils, depending on the country);
- Information sessions in Brussels;
- Programme committee feedback;
- Personal relationships and communications with the ERC President.

Often, national RFOs will fund proposals from their countries that met the ERC threshold in review but did not receive an award due to lack of funding. ETaG confirmed that they regularly offer grants for at least one year to candidates that were over threshold but did not receive a grant from ERC.

But from the perspective of participation of scientific communities from member states in ERC, the involvement is unequal. Generally, Central and Eastern European countries have not been very successful because they submit a smaller number of applications, and the success rate tends to be lower than Western and Northern European countries with some exceptions, like Slovenia. But scientists from France also do not submit a lot of applications to the ERC. France contributes 18% of ERC's budget, but applications from France constitute 11% of all applications received and are very low in some fields like the social sciences and humanities. In comparison, The Netherlands has one fourth the population of France. But looking at the grants in social science and humanities, Netherland has four times more grants than France. So, the ratio is 1:16. Usually Germany, France, and the Netherlands receive the most grants. But The Netherlands has been particularly successful in terms of grants per capita. The Netherlands receives the most, with about 60 ERC grants per million, followed by Denmark, Sweden, Austria, Belgium and Luxembourg. Germany is 10th and France 11th.

Although there is widespread support for ERC from member states, including their members of the European Parliament (see: [Structure and governance, Funding](#)), some countries may also wish that there was a policy for more equally distributed funding instead of the sole criteria being scientific excellence and ideas for frontier research. The Scientific Council has multiple working groups to discuss issues on widening participation, for example on gender, and

follows up with countries who are not doing so well in terms of the competition. But this type of engagement by ERC with member states is mostly carried out through awareness raising activities with countries, increasing information campaigns, explaining how to be competitive and what the peer review system is like. However, there are also special programmes, such as the fellowship programme, which support mobility for researchers to be hosted by an ERC team to learn more and understand the process of how ERC funding and projects work. According to informants from ERC, this seems to be working because those who have participated seem to be more successful even though the level of participation in this programme has not seen high numbers.

Implications and discussion

The practices and experiences of RFOs in the findings highlight a number of issues for reflection by actors exploring the establishment of a continental research body in Africa. The results from this project do not provide prescriptive recipes for which combination of ingredients should be assembled for the most effective institutional design and governance for a regional RFO aiming to strengthen research capacity in Africa. We suggest rather that considering these options and lessons alongside the implications drawn from a situational analysis of the landscape of continental initiatives for research funding in Africa can support an in-depth discussion on key questions posed within the framework we propose.

One of the limitations of these results stems from the different levels of operation of the organisations analysed. Key issues of structure, relationship management, funding, governance do not lend themselves to “scaling up” from a national to a regional RFO case because of the distinct relationships and embeddedness of these public agencies with the political, social, technical, and economic context of the jurisdictions in which they operate. Practices highlighted from the ERC and from PASET RSIF provide useful lessons for the types of regional cooperation considerations that arise when regional research funding is organised within formal institutions of a political and economic bloc inscribed in a legal framework (former) or through a third-party professional implementation agency with strategic governance by a collective body of partner governments (latter). Each of these provides different options to address about the structure, funding, and strategy such as:

- Will the organisation be housed under the auspices of an existing or new regional political institution or is established through a separate implementing agency?
- Will the organisation be funded by governments, donors, or both?
- Will the organisation be governed by scientists, professionals, or by a mix of government, science, and industry?

Answers to the above have implications for the ownership of an RFO. The trajectories and choices of many of the organisations we analysed have their starting points in government action and decision either alone (NRF Singapore, NRF Korea, TSRI, ETaG) or in cooperation (PASET RSIF), but external partners can also influence these (e.g., India Alliance). The support of the scientific community was also shown as an important factor in creating demand and support to establish an RFO (CONICIT, ERC), to develop its strategy (ERC, ETaG, NRF Singapore, TSRI), but also vital to support the processes of scientific review and evaluation (all RFOs).

The integrity, rigour and quality of the scientific evaluation process and grant decision-making are aspects that come through transversally across the findings as essential cornerstones of

the design of an RFO. This is a key finding, because it is an area that is not emphasised in other frameworks on governance of research funding organisations in the literature [27]. One of the key lessons that stands out is around the engagement of the research community who will be the target beneficiaries, which is critical to the life of an RFO. While other stakeholders (like government and the private sector) may be engaging in funding and strategy, the findings point to the importance of building the relationship between the RFO and the research community it serves as early as possible in the process.

Consideration of these experiences against lessons from the African context such as potential danger of duplication and fragmentation and the need to solve for adequate scale of funding and clarity of scope may require mapping to visualise how efforts may be consolidated (when there is a clear argument for it) under a common banner and governance structure that is African led and owned, and accountable to member states. We see from other countries that a significant amount of funding is needed to dedicate to clear goals, and the less money available, the less broad and more specific the goals need to be to be achievable. Important goal clarification around whether an organisation is funding research or building capacity may be fundamental, especially given findings which showed few examples of RFO support for institutional capacity development or infrastructure strengthening, as compared to a large majority of their funding going to individual researchers for projects. For example, PASET RSIF focused on sciences but not health, having identified ASET as neglected areas for investment in research capacity in Africa.

The findings also raised some new questions about how to build research capacity – from the ground up within countries, or top down for the continent/region. The example of the ERC raises questions about whether regional funding is desirable at continental level before scientific and research system capacity is in place in all member states of the organisation. One direction for future research may be to approach the questions from a perspective of regional analysis: what have been the regional approaches to strengthening research capacity in South-East Asia, Latin America, Asia? Why haven't other regions adopted regional research councils similar to the ERC?

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Appendices

Appendix 1 – Interview guide

We will explore themes in our interviews with key informants under **three main blocks of questions** about: **1)** the research funding organisation itself, **2)** how the research funding organisation funds research and research capacity of individuals and institutions, and **3)** key lessons learned that the research funding organisation would share with others. Each block has an overarching question to convey the essence of what we are trying to learn from these organisations. Under each of these are key themes and questions to develop further discussions or seek more information where needed. Key informants will not be asked all questions systematically. Some cases (and informants) will be targeted for specific elements of their work (either for their institutional design, fund-raising or governance practices, or their grant-making activities and decision-making).

The **purpose of the interviews** is to seek advice (not description), lessons, and practices from research funding organisations that would be valuable to a group setting up a continental research funding body in Africa. As regional and supranational research funding bodies are scarce, the project will also seek transferable learning from national research funding organisations and other bodies that can provide relevant lessons and insight. The information collected from these interviews will be used to help understand a) how to set up a research funding body that leverages funding from multiple governments (and some private sources) and b) how to fund research, institutional research capacity, and research infrastructure through diverse grant mechanisms.

Descriptive data for case studies related to the organisation and its funding programmes **will be collected mainly from documents in the public domain before interviews**, and only followed up if needed with informants in the interview for details that are unavailable publicly.

Information about the research funding organisation itself and context	<u>Background details on research funding organisation</u> <ul style="list-style-type: none"> • Institutional (legal) status • High-level organisational structure • Remit and scope • Organisational funding, budget and amounts disbursed per year • Types of grants, average grant size, range of grant sizes • What is the policy and/or legislative framework for research and development in your country (or region)?
Information about the research funding organisation's grants and programmes	<u>Geography, target audience, sector and scope</u> <ul style="list-style-type: none"> • What countries? • What subjects/disciplines? • Which career stages if funding individuals? • Requirements for cross-institutional or cross-country collaboration if any?

Opening question may cover several key points in the descriptive details above from which we can follow up if needed:

Tell me about your organisation, what it does and why it does things this way.

Block 1 - About the research funding organisation

Overarching question: *How does your research funding organisation secure its funds, gain trust, maintain its relevance, and ensure its sustainability?*

Theme	Questions
1. Organisational funding and strategy (development, implementation, coherence with national, regional, and/or organisational vision and priorities) and political support for research funding	<p><u>History of development</u></p> <ul style="list-style-type: none"> • What led to the establishment of your organisation? Who led this process and why? <p><u>Strategy and operations</u></p> <ul style="list-style-type: none"> • Tell me about the way your organisation’s strategy is developed, decided, and implemented. • How does your organisation assess its value and achievement of its mission (i.e., performance monitoring, or impact evaluation of the realisation of its mission)? • In what ways does your organisation influence the research environment⁵ nationally/regionally/globally and in what ways does the research environment influence your organisation? <p><u>The organisation’s funding</u></p> <ul style="list-style-type: none"> • How does your organisation attract support and sustain resources (from government, private, endowment, or other)? Why do they support your organisation? <ul style="list-style-type: none"> ○ Are there concerns with sustainability of your funding? Is it susceptible to the political climate? ○ If government funded, what convinced the government to put money into this? What were the arguments? Who decides the amount? What guarantees this funding? • What does your organisation plan to achieve with its funding? <p><u>Research policy/politics environment</u></p> <ul style="list-style-type: none"> • How is political support to fund research in your country/region?

Block 2 - About the research funding organisation’s grants and mechanisms to fund research, capacity, infrastructure

Overarching question: *Why does your research funding organisation work the way it does?*

Theme	Questions
2. Funding programmes and mechanisms (for things like research, mobility, capacity, knowledge use, collaboration, commercialisation, and inter-disciplinary work)	<ul style="list-style-type: none"> • What are your mechanisms for disbursing⁶ funds? • If your funding programmes have changed over time, why and how have they changed (or why not)? What influenced your organisation to make these changes? <ul style="list-style-type: none"> ○ What have been the main challenges and decisions in adapting old ones or introducing new ones? • What ambition, strategies, or mechanisms are in place to support capacity development of research institutions, knowledge translation, innovation, collaboration, networking, and/or inter-disciplinarity? <ul style="list-style-type: none"> ➤ We are particularly interested in hearing about what you are doing to strengthen research infrastructure and research institutions and why your organisation does it.

⁵ The research environment refers to: ‘shared values, assumptions, beliefs, rituals and other forms of behaviour whose central focus is the acceptance and recognition of research practice and output as valued, worthwhile and pre-eminent activity.’ (Evans 2007, quoted in Ajjawi *et al.* 2018; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6120529/>).

⁶ We define disbursement mechanisms as *any means through which resources/funding are channeled to achieve the objectives of the research funding organisation*, which might include programs they fund or support as well as grants they make.

2.1 <i>Impact evaluation of programmes</i>	<ul style="list-style-type: none"> • What makes your funding programmes effective, or what makes you think you are effective funders? • How do you monitor, evaluate, and measure impact of your awards? 	
3. Governance of funding allocation and decision-making (across portfolio of funding programmes and instruments, and within funding programmes and instruments); and financial governance	<p><u>Governance of funding allocation</u></p> <ul style="list-style-type: none"> • How do you identify and decide what programmes or priority themes to fund? • What is the evaluation and review process for grant applications? Why do you do it this way? <p><u>Decision-making on funding awards</u></p> <ul style="list-style-type: none"> • What are the main criteria used to make decisions about awarding funds? <ul style="list-style-type: none"> ◦ How are these weighted in your decision-making? • How do you recognise potential or strength in capacity of research institutions you fund? What are their key characteristics? • Do you fund the same people - or are you a risk taker? Why? <p><u>Financial and risk management</u></p> <ul style="list-style-type: none"> • Policies and practice to strengthen financial management of grants by grant-holders? • How do you approach due diligence? How does your organisation manage it (internal/outsourced)? 	
4. Research capacity building – 3i's: infrastructure, institutions, individuals.	<p>Your funding support may be directed towards national infrastructure, institutions or to individual researchers. You may be nudging the research ecosystem in line with national or international culture, current trends in funding, research capacity goals, etc. We are interested to learn about your organisational systems to support research infrastructure and institutions as well as compensation and retention of researchers.</p>	
4.1	<i>National research infrastructure</i>	<ul style="list-style-type: none"> • Why and how does your organisation support the development of national scientific research infrastructure?
4.2	<i>Research institutions</i>	<ul style="list-style-type: none"> • Why and how does your organisation support institutions? <ul style="list-style-type: none"> ◦ What specific funding instruments do you use to support research institutions?
4.3	<i>Individuals</i>	<ul style="list-style-type: none"> • Why and how does your organisation support the retention of research talent within your country (or your region)? <ul style="list-style-type: none"> ◦ How do you deal with challenges of “brain circulation” or “brain drain”? What has influenced your stance and mechanisms to encourage mobility/return of researchers? • Policies and practice to encourage or mandate diversity and inclusion in how grants are awarded?

Block 3: Lessons learned by the research funding organisation

Overarching question: *What do you think are the key lessons you have learned as a research funding organisation?*

- Do you have important advice that you would pass onto a new research funding organisation, particularly in a setting like Africa where resources are constrained and where there may be weak and/or mixed levels of research capacity and infrastructure?

Appendix 2 – List of reference documents used for documentary data collection

Name of RFO	Reference Documents	Website
Africa Finance Corporation (AFC)	→ AFC Annual Report and Financial Statements 2019	https://www.africafc.org/
CONCICT		http://www.conicit.go.cr/
Estonian Research Council (ETaG)	<ul style="list-style-type: none"> → Estonian Research 2019 (ETaG's report on the Estonian Research System) → ETaG Infrastructure Road Map 2019 → ETaG Science Communication Strategy 2020-2035 → ETaG Gender Equality Plan → Estonia's Research Revival (news article in Nature, vol 565, 24 Jan 2019; pp. 416-418) → ETaG Development Plan 2027 	https://www.etag.ee/en/Estonian-research-council/
European Research Council (ERC)	<ul style="list-style-type: none"> → ERC Work Programme 2022 → Annual Report on the ERC Activities and Achievements in 2020 	https://erc.europa.eu/
India Alliance	<ul style="list-style-type: none"> → Financial Statements 2020, India Alliance → About India Alliance 2020 	https://www.indiaalliance.org/
National Research Foundation (NRF) Korea	<ul style="list-style-type: none"> → Introduction of National Research Foundation of Korea (PPT provided by informant) → NRF Bylaws 	https://www.nrf.re.kr/eng/index
National Research Foundation (NRF) Singapore	<ul style="list-style-type: none"> → Research Innovation and Enterprise 2020 Plan → National Research Fund Guide (2016) → NRF Annual Report (2016) → National Research Fund Act (2006) 	https://www.nrf.gov.sg/
National Research Foundation (NRF) South Africa	<ul style="list-style-type: none"> → NRF Strategic Plan 2020-2025 → NRF Annual Report 2019-2020 	https://www.nrf.ac.za/
National Science and Technology Development Agency (NSTDA)	<ul style="list-style-type: none"> → NSTDA brochure 2019 → NSTDA Annual Report 2020/2021 	https://www.nstda.or.th/en/
Regional Scholarship and Innovation Fund - Partnership for skills in applied sciences, engineering and technology	<ul style="list-style-type: none"> → RSIF Research and Innovation Grants Manual and Procedures 2019 → Project Appraisal Document on a Proposed IDA Grant World Bank Document to icipe (US\$15 million) for RSIF, 2018 	https://www.rsif-paset.org/
Thai Research Fund (TRF)	<ul style="list-style-type: none"> → TRF International Collaboration, 2014 (PPT) → TRF, Funder Presentation (PPT) → TRF Brochure 	https://www.trf.or.th/eng/
Thailand Science Research Innovation (TSRI)	<ul style="list-style-type: none"> → TSRI Introduction Booklet → Brief Introduction to TSRI (PPT provided by informant) 	https://www.tsri.or.th/

Appendix 3 – Description of cases and country profiles

A separate excel file contains two sheets.

1. Description of RFOs

This tab contains a description of each of the cases by type of RFO, overview of organisation's history and structure, main aims, funding and budget, governance of grant decision-making, programmes, and support to the research ecosystem. This data mainly comes from websites and documents of RFOs, but some additional information from key informant interviews has complemented this.

2. Country profiles

This tab contains information for each of the countries in which a national RFO case was studied, including data on income group; region; policy and legal framework for R&D or STI; R&D national level data; and data on national research capacity, productivity, and innovation. Data sources noted at the bottom of the spreadsheet.