

Research excellence in Africa: policies, perceptions and performance

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Executive Summary

Our paper discusses various features of research excellence within Africa, which we frame within the context of government research initiatives, science granting councils and other public sector funding agencies. Our survey, collecting responses from 106 researchers and research coordinators throughout sub-Saharan Africa, highlights the diversity of opinions and preferences with regards to Africa-relevant dimensions of research excellence and related performance indicators. The results of the survey confirm that research excellence is a highly multidimensional concept that ought to be contextualised in order to be responsive and useful to beneficiary communities.

Further analysis shows how some of those dimensions can be operationalised into quantifiable indicators that may suit evidence-based policy discourses on research quality in Africa, as well as research performance assessments by African science granting councils of other research funding agencies. Our indicator case study of ‘top 1% most highly cited research publications’ identifies several niches of international-level research excellence in the African continent, while highlighting the role of (inter)national cooperation.

The final section includes a policy-oriented analysis of our empirical findings and related recommendations for Science Granting Councils in Africa. To gain a better insight and deeper understanding of research excellence in Africa, it is important to take into account the practical challenges faced by researchers, and research funding agencies, to reconcile socioeconomic interests with international notions of excellence and associated research performance indicators. African research excellence should be customized and contextualised in order to be responsive and useful to African needs and circumstances. It is important to take into account the complementarities and tensions that emerge from conceptual and analytical distinctions between ‘African excellence’ and ‘global excellence’.

1. Introduction

1.1. What is ‘research excellence’?

Research excellence (RE) has become a fashionable policy-relevant concept in the world of science funding and assessment. The meaning of RE, and its implementation in research practice and management, is influenced by political considerations but also by the varied social, cultural and organisational environments in which researchers and scholars have to operate. Scientific performance is of course also affected by economic conditions and the availability of human resources. Globally, including the African continent, there has been increasing interest to pursue RE – often geared towards creating an enabling environment to groom and attract high-quality researchers. Such ‘top performers’ are strategically identified by public sector agencies and funding organisations. With demands increasingly outstripping the supply of available resources, thus driving pleas for more selectivity in resource allocation and transparency in decision-making processes, the need for defining, identifying and operationalising RE is becoming increasingly urgent for all stakeholders concerned.

Unfortunately, there is no agreement on what is meant by ‘excellence’ - there never was. Attempts to objectify and operationalize face an entangled web of fuzzy concepts and ambiguous meanings (Tijssen, 2002). Trying to capture the essence of excellence, we sought guidance from one of today’s many online information sources, *Wikipedia*, to find the following descriptions of ‘excellence’ and critical commentary:

- *“a talent or quality which is unusually good, and so surpasses ordinary standards;*
- *a continuously moving target that can be pursued through actions of integrity, being frontrunner in terms of products / services provided that are reliable and safe for the intended users, meeting all obligations and continually learning and improving in all spheres to pursue the moving target;*
- *frequently criticized as a buzzword that tries to convey a good impression often without imparting any concrete information.”*

Another online source, the *Oxford Dictionary*, simply defines RE as *“the quality of being outstanding or extremely good”*.¹

¹ Wikipedia and the Oxford Dictionary were accessed on 11 October 2016.

Stating that someone or something is “*unusually good, and so surpasses ordinary standards*” has three major implications in terms of passing judgement on research proposals, activities or scientific achievements:

- (1) sufficient knowledge of the subject matter to pass a credible, evidence-based value judgements of research quality;
- (2) existence of meaningful “*ordinary standards*” that enable convincing definitions or descriptions of “*unusually good*”;
- (3) widely-acceptable operationalisations and quantification of ‘unusually good’ to identify and describe excellence in terms of ‘exceptionally good performance’ or other dimensions of superiority.

This paper will address these three issues from a perspective of African science in general, more specifically that of the Science Granting Councils (SGCs) of sub-Saharan African countries.

1.2. Analytical framework and research questions

There is too much at stake nowadays to rely only on intuition to identify ‘excellence’; we need convincing and transferable evidence on if and how excellence occurs. From a decision-making viewpoint one should distinguish between procedural value (i.e. transparency and fairness of decision-making processes) and evidence value (the type and weight of the evidence needed to justify a decision or recommendation). Focussing mainly on the second of these two values this paper aims to develop a clearer understanding of RE in terms of instrumental issues related comparative value judgements across units of assessment.

As for the African science context, improving the quality of research has become a central objective of science, technology and innovation (STI) policies in many African countries. Like anywhere else worldwide, African research outputs are expected to comply with generally-accepted quality criteria (convincing, competent, relevant, rigorous and applicable). Achieving ‘research excellence’ is not always the top priority. Scarcity of R&D resources and the continent’s socioeconomic challenges are a major obstacle. While the whole continent accounts for 15.5% of the world population, the money available for R&D (research and development) accounts for only 1.3% of global expenditures (UNESCO, 2015, p. 26). One may argue that publishing a research article in internationally in high impact peer-reviewed international scholarly journals, is of lesser relevance than conducting locally relevant research that deals with African socioeconomic problems. Given the state of science in many

African countries, the key ambition is to create sufficient research capacity. This involves the development of individual skills and facilities of its scientists and scholars, but also upgrading general infrastructures such as adequate funding frameworks and quality assessment systems that allow an efficient distribution of scarce funding for research.

Moreover, there are many interpretations of ‘excellence’ and how they could or should be applied within the African context – often accompanied by passionate pleas for Africa-customized notions as for example expressed by Ndofirepi and Cross (2016):

“Excellence, in our view, will only be realised if the African university adopts an African-centred paradigm, providing a space for African peoples to decipher their own experiences on their own terms, philosophies and constructions, instead of being directed through a Eurocentric lens. In their search for world-class university status, African universities are caught up in persistently trying to maintain equilibrium between building a globally competitive university and being nationally responsive. These need not be mutually exclusive goals. After all, fundamentally, the notion of excellence is a concept which works as a grand vision, buttressing broad-minded, strategic decision-making and planning in universities.” (Ndofirepi and Cross (2016)

Nonetheless, African research must also try to transcend the confines of Africa as a geographical space to remain globally competitive. Alignments and conflicts between these global and local objectives, call for a need to closer analysis of quality concepts and performance indicators, especially with regards to defining and capturing Africa-specific dimensions of RE.

Framing the notion of RE within the context of a research performance monitoring, measurement and assessment, our paper touches on three fundamental conceptual and methodological questions in terms of how science is funded and evaluated by African science granting councils (IDRC, 2012a; 2012b):

- can we define RE in a satisfactorily way for all major stakeholders?
- which dimensions of RE are most relevant in terms of the need for unambiguous operationalization?
- to what degree can those operationalizations enable valid comparative measures of RE that distinguish the ‘best’ from the ‘rest’?

This paper addresses the questions from both a global and local (African) perspective. In doing so we focus our attention on:

- analytical frameworks, selection criteria and organisational processes that may help SGCs provide an enabling environment for RE;
- dimensions and sub-dimensions of RE that seem particularly relevant in African research-performing organisations (universities and non-university research centres).

Our study relies on three main sources: (1) a desktop review of existing literature on RE, (2) an online questionnaire and interviews with informants at selected key African universities and research-performing organisations, and (3) existing bibliometric data on the African research publications.²

The next section introduces the public policy background defined by a series of excellence-related initiatives that were launched in Africa over the last 10-15 years. Section 3 describes the key results of our survey to gather African perceptions on RE. Section 4 introduces one of the scarce performance indicators currently available to gauge research excellence across Africa: highly cited research publications produced by African scientists and scholars. The final section presents our general conclusions and suggestions on how to operationalise, measure and assessment of RE within African science.

2. Research excellence and African science

2.1. African excellence-related policy initiatives

We live in an era where excellence-promoting initiatives have emerged as high-profile policy instruments in the world's more mature economies (OECD, 2014). Their national research systems are increasingly faced with a hypercompetitive environment for ideas, talent and funds. The current focus on excellence provides both a driving force and a policy framework to justify large-scale, long-term funding to designated organisations that (have the capability to) engage in high-quality research. Usually the policy goal is to encourage or foster research that, ultimately, will generate positive socioeconomic impacts and benefits. Similar organisational restructuring processes are now also taking place in the African continent. The following examples indicate that excellence is not only seen as a major marker of performance, but also as a driving force for the forward-looking policies with high levels of political and organisational ambition.

² A brief discussion of the study's preliminary empirical findings, from a generic evaluative context, was published in Tijssen and Kraemer-Mbula (2017). In this paper we present final results of our empirical studies and discuss their wider implications for African science and its funding agencies.

Back in 2002, the Biosciences Eastern and Central Africa Network (BecA) became the first of four sub-regional hubs to be established by New Partnership for Africa's Development (NEPAD), with support from the Canadian government. In 2005, the Science and Technology Consolidated Plan of Action (CPA) (2005–2014) constituted Africa's first attempt to articulate the continent's collective commitment to move towards an innovation-led knowledge economy. The CPA acknowledged science and technology had to be produced and used to solve specific African problems. The pursuit of research excellence was emphasised in the CPA, and resulted in multiple centres of excellence being launched across Africa. Initial efforts were led by the NEPAD, by identifying Centres of Excellence in science and technology for Africa's sustainable development, in water and biosciences, forming new forms of regional and sub-regional networks. Networks of Centres of Excellence were identified in Eastern, Western, Southern and Northern Africa through calls for interest where selected organisations had to demonstrate their sustainability and strong experience in their respective sectors.

In South Africa, the South African Research Chairs Initiative (SARChI) was established in 2006 to increase the number of 'excellent' black and female researchers. The Centres of Excellence funding scheme launched in 2004 currently has a network of 15 research centres, five of which were established in 2014 (UNESCO, 2015).

NEPAD launched a programme in 2006 the Programme for the Support and Development of Regional Centres of Excellence of the West African Economic and Monetary Union (WAEMU/UEMOA). It was implemented as a component of the strategic framework for the African Union to combat poverty and underdevelopment throughout the African continent. The first and second phases (running from 2006-2010 and 2012-2016 respectively) resulted in the identification and support of 20 'centres of excellence' – higher education and research institutions of the UEMOA/WAEMU zone. In 2009 Also NEPAD initiated a program to build regional networks of Centres of Excellence in water sciences in Southern Africa and Western Africa. This programme launched its second phase in 2016.

In 2013 the Pan-African University (PAU) was launched, supported by the African Union, to offer post-graduate training and research network of university nodes in the five AU geographic regions (Western, Eastern, Central, Southern and Northern Africa). The PAU is receiving most support from the European Union and the African Development Bank. It is

expected that the PAU will incorporate 50 centres of excellence under its five academic hubs across Africa.

The African Institute for Mathematical Sciences (AIMS) is a pan-African network of centres of excellence for postgraduate education, research and outreach in mathematical sciences established in 2003. This was followed more recently by the AIMS Next Einstein Initiative, the goal of which is to build 15 centres of excellence across Africa by 2023. The Government of Canada made a US\$ 20 million investment in 2010, through its International Development Research Centre, and numerous governments in Africa and Europe have followed suit (UNESCO, 2015).

In 2014, the African Development Bank (AfDB) approved bilateral loans to develop five centres of excellence in biomedical sciences in East Africa. Also in 2014, the World Bank launched the Africa Centers of Excellence Project in collaboration with West and Central African countries. This project provides funds in the form of loans to 15 centres selected after competitive bidding and external evaluation, in areas of agriculture, health, and science and technology. The aim of this project is to promote regional specialization among participating universities in areas that address specific common regional development challenges, to strengthen the capacities of these universities to deliver high quality training and applied research, and to meet the demand for skills required for Africa's development such as the extractive industries.

African excellence-related initiatives are designed to recruit researchers, for PhD training, research cooperation, and the improvement or extension of physical infrastructures (MacGregor, 2015; 2016). These organisations are not only expected to create sustainable levels of high-quality research capacity, but also meant to “generate greater impact” and “be role models for other higher education institutions” (MacGregor, 2016). This diverse list of organisational objectives is indicative of the fact that, despite of its wide usage, the concept of excellence is not well understood.

2.2. Observability, quantification and measurement

In the absence of objective and verifiable standards, qualifications such as ‘unusually good’, ‘highest quality’ or ‘excellent’ remain judgement calls with an inevitable degree of subjectivity. Applying meaningful and feasible standards is essential to produce transparent valid judgements: first, to establish the baseline level of performance; secondly the cut-off

points where 'good science' becomes 'excellent'. Which research quality criteria should one select? The choice of appropriate criteria and their weighting is context-dependent and time-dependent concept (Méndez, 2012; Ofir et al., 2016). Secondly, and more importantly, assigning the RE label is the outcome of decision-making and social stratification processes within scientific communities or user communities, where excellence tends to be found at the top of an empirically observed performance distribution or a quality stratification based on scientific community opinions, which are usually focussed on specific features of content as perceived by peers and expert reviewers.

For research efforts, outputs or impacts to be perceived as being excellent they need to be, at the very least: visible and recognizable (to others); attributable (to research contributors and participants); comparable (within a generally accepted frame of reference); categorisable in terms of quality judgement (by external experts or other observers. Any operationalisation of RE will have to meet these basic criteria of 'observability'. But it also depends on the research performance model. Traditional models still predominate when it comes to assessment and evaluation, usually driven by a straightforward 'input/output' approach, where peer review and expert panels cast a judgement weighing one against the other. In practice, a research project or program's success is usually judged by its outputs, while its longer-term impacts and benefits are likely to be ignored, or not observable, given the time-window concerned. Such a crude 'one-dimensional' model does little justice to the research's intent and content – let alone provide a balanced view of RE within local African contexts. A more sophisticated approach is to decompose research objectives, processes and outcomes into several performance-related dimensions each with their own set of analytical sub-dimensions which are amenable for further operationalisation and assessment.

These (sub)dimensions may comprise a wide variety of research-related information, ranging from the quality of allocated resources for research projects all the way to establishing the extent of longer-term impacts of scientific breakthroughs on society. Rather than mechanistic counting of research publication outputs, RE dimensions should also try to capture research 'throughputs' and processes (such as teamwork, international research consortia, and human resources development) or 'impacts' on knowledge users outside science. The process of research itself, and how its products are applied and appreciated, constitute a multidimensional understanding that allows for incorporating feedbacks and views from stakeholders on the value of the research for (end) users.

According to Yule, the range of research quality dimensions should also include utility, accessibility, and quality of outputs geared to end-users (Yule, 2010, p.1). Hence, rather than restricting our view to research inputs and outputs, excellence should also be sought in process of research itself and how its ultimate products are applied and appreciated in everyday African life. Ideally, the assessment should not only involve the opinions from primary actors (i.e. researchers, research managers and funders), but also views from external stakeholders and potential users.

The major advantages of such 'peer review' processes are well-known: integral assessments of performance characteristics and determinants (considering all the activities and the career stage or trajectory of applicants and grantees) within a broader setting of background knowledge about the research area or field (emerging lines, new approaches, circumstances of the researchers, etc.). But important limitations lurk beneath the surface: subjectivity; prejudices and conflicts of interest, and difficulties in selecting the members of the review panels. The great advantage of quantification and measurement is the ability to introduce some degree of objectivity and implement standardization and transparency to assessment procedures of research quality. Metrics can be used to provide comparability and transparency. Focusing on comparative measurement, such as ratings on a 5-points scale, one can apply a scoring guide (referred to here as a metric), to customizable research quality dimensions. The metric contains evaluative criteria of each dimension, quality definitions for those criteria at particular levels of performance, and a scoring strategy to categorize, and perhaps quantify, the available value judgements. The metric should be a valid and meaningful reflection of the quality dimension. Customizable evaluative metrics of value judgements may include qualitative opinions and quantitative measures as they are derived from different types of information sources (such as peer-review judgements or bibliometric data). The measures or are derived from the process of quantification, where a metric is a measure of an entity's research quality dimensions. The 'entity' could be a research grant proposal, individual research activities, grantee's research output, or the citation impact of a specific research publication).

It is important to realize that quantification processes reduce a variety of multi-dimensional, and sometime ambiguous, value judgements on characteristics of research quality into one or more 'one-dimensional' scales. This information selection and compression process inevitably introduces incompleteness, inaccuracies and biases. Moreover, can also become a

black box, determined by complex computations, which might not necessarily reflect and promote what they were supposed to.

One of the main objectives of metrics is to minimize the risk of unacceptable loss of relevant information. The metric should clarify how the (sub)dimensions of research quality are quantified or measured, and it should explain how and why top ranking categories or scores are defined and operationalised. Provided a sufficiently large number of entities are subjected to the same quantification and measurement process, resulting in a statistically-robust performance distribution, the highest level of achievement may qualify as 'excellent'. This upper tail in a performance distribution might be research proposals that were rated '5' on a five-point scale, or research publications within the top 10% most highly cited worldwide.

3. Survey: perceptions of research excellence in Africa

3.1. Background and prior studies

Unfortunately, the exact meaning of the word ‘excellence’ is left undefined within most African policy initiative. Implicitly, it can be perceived as striving for the highest possible quality given the circumstances. As such, none of the assessments or evaluations of research quality in Africa is done within an institutional or political vacuum, or without implicit (or explicit) notions or perceptions of what quality or excellence entails.

Zooming in from a ‘global excellence’ viewpoint to those features that are of particular relevance to Africa, what do researchers in the ‘global South’ think of RE? More specially, what does excellence in international development research look like and how do different perspectives inform it? A small-scale exploratory study by IDRC study provides some clues (Singh et al., 2013). It is important to note that this survey-based study, conducted among 300 IDRC grantees, does not make a distinction between ‘research quality’ and ‘research excellence’. However, there was wide agreement on the need to evaluate research in terms of excellence, backed by the general belief that without evaluation, poor quality research would lead to unreliable data, misleading conclusions, and incorrect approaches to critical policy formulation. Having agreed on this guiding principle, the respondents exhibited a wide range of perspectives and ideas in discussing the notion of RE. When asked to describe or define relevant dimensions of excellence, the vast majority of the 160 responses showed a preference for ‘scientific merit’ (91%), ‘impact and influence’ (81%) or ‘relevance’ (68%). In other words, a distinction should be made between intrinsic characteristics of the research or the researcher (merit), the final effect of the research outcomes on others (impact), and a value judgement regarding the external usefulness of those outcomes (relevance). Although respondents did not provide clear definitions of either impact or influence they emphasized the important of effects outside science, notably on practice or policy. There was much less consensus on which performance indicators should be selected to cover these three key dimensions. In this respect, most of the 337 respondents suggested performance indicators related to publication and citation counts (136) or peer-review notions of scientific merit, like ‘rigour’ (59) or to ‘changes at the policy and community levels’ (58).

We looked at some of these aspects in details within the context of Africa. Particularly, our study explored those perceptions of research excellence from two points of view: (a) research coordinators in Science Granting Councils and (b) active researchers. Based on an online

survey, these preliminary findings reflect ideas and views that could be found among researchers and research coordinators in various African countries.

3.2. Profiles of researchers and research grants

Science Granting Councils across Africa are under growing pressure to identify high-quality proposals in order to make decisions on the allocation and distribution of the scarce funding available for research. This study collected views from 26 research coordinators of SGCs representing 13 African countries (namely Botswana, Burkina Faso, Ethiopia, Ivory Coast, Malawi, Mozambique, Rwanda, Senegal, South Africa, Tanzania, Uganda, Zambia and Zimbabwe).

21 out of the 26 respondents (81%) indicated that their organisations do allocate and disburse research grants. In three other cases such mandate was given but the implementation had not started yet at the time of the survey. For instance, Rwanda's National Commission of Science and Technology (NCST) indicated that although it did not constitute one of its functions in the past, a revised mandate approved in 2015 gives that function to the National Commission of Science and Technology – however, they have not yet started disbursing grants. Similarly, all organisations that reported to disburse grants also indicated that they regularly evaluate the research they fund.

The SGCs identified in this study are all national agencies that fulfil national missions. Concerning research activities, the way they define their missions is slightly different. The role of coordination and support of quality research that promotes social and economic progress in their respective countries, tends to be common ground. Their mission often expands to advising government in matters related to research, especially in setting national priority research areas. Supporting technology transfer, dissemination of research, as well as monitoring and evaluation of research, are not always explicit in their mission statement.

Granting mechanisms to the research community takes different shapes and formats, and these organisations fund various research activities, such as: basic research, applied research, innovation & commercialisation of research outputs, technology transfer, research collaboration and research dissemination. Funding mechanisms are also used to support

researchers in various aspects, including: completing their dissertation, travel, organising events, and producing publications for an academic journal.

Most respondents operate as research granting agencies, with standard processes of grant allocation, which includes: launching a call, selection of eligible submissions, peer-review process of selection, decision by the funding council, signature of contracts, research funds disbursement, and monitoring and evaluation. In this respect most of the funding is disbursed on a competitive basis. However, a portion of research is commissioned (rather than supported through competitive research grants). In these cases, SGCs approach individual researchers or specific research institutions in order to solve specific problems of national interest, or to promote new and emerging technologies.

Most of the calls for research grant proposals, and guidelines for submission, do not make specific mention to research excellence, and in the cases when it is mentioned specific parameters to measure excellence are not provided. An exception is the case of UNCSST, where research excellence of the proposal is assessed on the basis of: (1) quality in relation to the highest international standards of scientific excellence in all of the sectors and disciplines that the proposal includes; (2) addition of new knowledge to field; and (3) feasibility of the research methods proposed.

The results emerging from the responses provided by 80 African researchers are summarised in **Annex 1**. 70% of those respondents were recipients of a research grant, and the majority were the primary researcher of the grants obtained, most of them coming from international sources (65%). This is already an indication of the importance that foreign sources of funding have in the Africa research landscape. Moreover, when we look at the amount of the grants, the responses also indicate that international sources of funding are much larger than national sources (above US \$500,000). USAID, Bill & Melinda Gates Foundation, the World Health Organization, EU Commission, SIDA, DANIDA, GIZ, DFID, IDRC and IFAD are some of the most commonly mentioned. Most researchers indicate that their research is regularly evaluated by their funding bodies – and this applies both to foreign and national sources. It is interesting to note here, that our interviews with research coordinators of African SGCs highlighted the different views that international donors and national funding agencies have in terms of the performance parameters and indicators that are relevant and applicable to measure research quality and excellence. In this respect it was noted that some of the

indicators expected from international funding agencies are often non-existent or non-applicable in an African context.

3.3. Perceptions of African excellence

Perceptions of research excellence are examined by aggregating the views from both researchers and research coordinators in SGCs – which provides a total of 106 observations.

When asked “*what criteria would you use to describe an ‘excellent’ researcher?*” respondents place the highest weight on ‘training and supporting future generations of researchers’ – a reflection of the severe shortage of research skills in the continent, and one of the main impediments to the advance of African scientific performance. Creating new knowledge in the field, producing work with great social impact and being well published, follow the list of criteria in terms of perceived relevance. It is important to note that 18 dimensions of excellence are considered as ‘relevant’ or ‘very relevant’, and only three are considered on average by respondents as ‘somewhat relevant’ (i.e. patenting, continuity of work and receiving awards). This gives a strong indication that excellence is seen as a multidimensional concept.

Research coordinators and programme officers at SGCs and other research funding agencies generally select those research proposals that are most likely to represent excellence and generate significant impact. The following question enquires “*which performance indicator(s) should the science council in your country apply to assess a research proposal?*” In response, respondents qualify 10 dimensions as ‘relevant’ or ‘very relevant’. Among the latter, they emphasize the quality of the proposal in terms of methodology and scientific rigour above other aspects, followed by potential of the proposal for social impact and policy influence. Still valued but with lower scores are performance indicators of the researchers (publications and citations), as well as peer-review scores and credentials of the researchers’ organization. These results suggest that researchers may feel that too much weight is given to peer-review scores and ‘bibliometric indicator’ (numbers of publications and citations) in allocating research funding.

Research funders generally want to support research that leaves a positive impact; therefore excellence is also sought in ex-post evaluations. Research evaluations have become not only commonplace in several African countries but also increasingly complex. The results of the

survey suggest that there is still work ahead in developing reliable ways of identifying and supporting the most-impactful research work. Respondents answered the question “*what performance indicator(s) should the science council in your country apply to assess the ‘quality’ of research outputs or impacts?*” The top three suggested indicators are: (1) creating awareness of societal issues, (2) direct benefits to disadvantaged communities and (3) new technological developments. This is an indication of the perceived need for a closer connection between research outputs and end users (communities). However, publications in top international journals also are acknowledged as a relevant indicator of quality of research outputs and impacts. At the bottom of the list are the direct impacts on the researcher or the research team, such as moving to more prestigious positions nationally and abroad, or winning awards.

The respondents were also asked describe an ‘excellent research output’ in their own words, the most common answers have to do with its ability to solve a problem, improve the lives of people (particularly those marginalised or disadvantaged) or change policy. The survey also collected concrete suggestions for new indicators. When asked “what indicators of excellence have been somewhat overlooked in mainstream research evaluation?” many respondents highlighted economic, social and policy impacts. In particular indicators of social impact were highly noted as missing by the research community (see **Table 1**). More detailed responses indicate that gender & age indicators remain disregarded by mainstream evaluation indicators. In this respect it was suggested that the evaluation of research excellence should measure the extent to which the research has led to gender equity and the promotion of young scholars – gender equity constituted a more frequent concern for research coordinators in SGCs than for researchers. Measuring the utilisation of research outputs by the communities of users and primary beneficiaries also constitutes a perceived gap both by researchers and researcher coordinators. Research coordinators in SGCs expressed the need to better measure the commercialisation of research outputs and the impacts in terms of innovation and new technologies emerging from research activities.

Based on the survey responses, any acceptable portfolio of performance ratings or metrics should comprise a mixture of bibliometric indicators and peer-review information. Moreover, our study finds the same blend within research assessments conducted in the ‘global North’, which suggests the existence of generally-held notions of how to identify and assess RE. This does not necessarily mean that operationalisations of RE and associated quality standards can be transposed to the global South without further contextualisation and customization.

Table 1. Indicators of excellence perceived as overlooked in mainstream research evaluation (number of respondents indicated between parentheses)

Researchers	Research coordinators at SGCs
Social and economic impact (11)	
Local relevance (3)	
Policy influence (3)	
Scientific rigour (3)	
Impact across disciplines (2)	
User uptake (2)	User uptake (3)
Mentorship and promotion of young researchers (2)	
Innovation – commercialisation of research outputs (2)	Innovation – commercialisation of research outputs (3)
	Gender equity (3)
	Ethical compliance (2)
	Alignment with national development priorities (2)

Source: Authors' survey (November 2016 -January 2017)

3.4. Challenges to achieve excellence

The results of our survey indicate that the allocation and evaluation of research funding needs to be based on a more multidimensional understanding of research excellence in the context of Africa. SGCs are increasingly turning their attention to funding research that can demonstrate direct economic, social and cultural impacts - by way of gender equity, technology development, commercialisation, and the creation of the next generation of researchers. However, our analysis suggests that there are still many obstacles to the attainment of RE in African science. This section captures some of these challenges from the viewpoints of both researchers and research coordinators at SGCs.

Respondents indicated that certain features of the research environments in which they work necessitate a contextualized interpretation of RE. They highlighted that:

- The time available for research is too limited. Given the shortage of qualified people, African scholars often work in environments where teaching takes priority over research. Heavy teaching loads tend to result in fewer qualified staff being assigned to research activities and less time dedicated to research. It is generally agreed that this limitation influences the interpretation of research excellence, and it shapes donor preferences for certain countries.

- Research infrastructures are also less developed and hierarchical in their design. Limited access, outdated infrastructure and scarcity put serious barriers to achieving research excellence in the continent.
- The engagement and collaboration of African researchers with various stakeholders is considered a key factor in shaping the relevance and ‘local excellence’ of research. In this respect, several respondents highlighted that action-based research and participatory research in Africa may require different parameters when it comes to identifying or measuring research excellence.
- The goals of the research were seen as central to the interpretation of research excellence; especially research of national relevance and geared towards solving societal issues.

Table 2. Perceived challenges to achieve research excellence in Africa

Researchers	Research coordinators in SGCs
Insufficient funding (34)	Insufficient funding (10)
Poor research infrastructure & equipment (11)	Poor research infrastructure and equipment (11)
Heavy teaching loads/ lack of incentives to research/ insufficient time (6)	Heavy teaching loads (3)
Lack of human resources/ low research capabilities (5)	Limited human and institutional capacity (4)
Poor access to top rated journals (5)	Poor access to top rated journals (1)
Weak collaborations/networks of researchers (2)	Weak collaborations/networks of researchers (2)
Weak collaborations with stakeholders/ users (2)	
Inadequate legislations (2)	Inadequate legislations (2)
Poor ethical based culture (1)	
Lack of support to researchers (1)	
Over reliance on publications (1)	
Low remuneration of researchers (1)	
Own ability to generate ideas (1)	
Insufficient mentorship of young researchers (1)	
Lack of administrative support to researchers (1)	
	Insufficient gender transformation (1)
	Poor monitoring and evaluation of funded projects (1)
	Lack of commercialisation of research outputs (1)

Source: Authors’ survey (November 2016 -January 2017)

Keeping this in mind, respondents identified specific challenges, which are summarised in **Table 2**. The two largest obstacles to achieving RE are, according to both researchers and SGC research coordinators: insufficient funding; poor research infrastructure and equipment constitute. In this respect it was mentioned that private sector participation in research and innovation funding remains very limited, and that further efforts should be done to strengthen

public-private partnerships. The lack of a critical mass of qualified researchers also constitutes a main obstacle, linked to the fact that, owing their heavy teaching loads, most African scholars lack time and incentives to actively engage in research. African researchers also indicated that they experience difficulties in accessing top-rated journals to publish their research outputs – due to their thematic focus on Africa or language barriers.

4. Indicator case study: highly cited research publications

4.1. Quantitative indicators of excellence

While peer review remains a key element in the *ex ante* (before the fact) opinion-based case-by-case process of selecting excellent research proposals, *ex post* (after the fact) evaluation processes of research outputs have come to rely more and more on quantitative data and standardized routines.³ Quantitative data tend to provide greater clarity and consistency compared to opinion-based judgements like conventional peer review. This pervasive shift towards quantification of research output and its impacts has ushered in a range of ‘easy’ bibliometrics, usually dealing with aggregates of research publications, to identify high-quality science and prolific researchers. Deriving measures of research quality from those publication outputs has become widely available to all stakeholders, in large part owing to commercial software packages and evaluation tools such as Elseviers’ *SciVal* or Thomson Reuters’⁴ *InCites*, but also freely available web-based information on *Google Scholar*. Rather than of going through a more costly and time-consuming process of checking the actual content of the publications themselves, these sources provide instant analysis and readily available metrics such as the H-index.

However, the lack of consensus, as mentioned in the previous section, on which performance indicators are most relevant within the African context, presents a major issues on to how develop widely-acceptable quantitative indicators for large-scale implementation. At this point in time only very few quantitative indicators seem to be feasible. Just one option is now readily applicable to measure excellence within an African comparative context: highly cited research publications. It is not held in high regard by many survey respondents (see Annex 1), but it nonetheless presents an interesting case in point on how an established performance indicator, which has become increasingly popular in more mature economies, can in fact be upgraded and contextualized for evaluative applications within African science. The next subsection presents a customized application of this ‘highly cited’ indicator.

³ We use the term ‘assessment’ for *ex ante* value judgements of RE (notably with regards to research grant proposals or research progress) and the term ‘evaluation’ for *ex post* judgements of research outputs or impacts.

⁴ InCites is an information product of Thomson Reuters’ IP and Science division, which was sold in October 2016. This business division now operates under the new name *Clarivate Analytics*.

4.2. Top 1% highly cited research publications

Vinker (2007) notes that if we accept the argument that large numbers of citations are an adequate approximation for research quality, a range of RE indicators become feasible: number of highly cited research publications, number of publications in highly cited journals, or the number of highly cited authors employed by an organisation or located within a country. The starting point is a performance distribution of those research publications, scholarly journals, or authors - in descending order of number of citations they received from other publications. For reasons of comparability this distribution has to be appropriately normalized. Hence, the next step is to introduce the notion of the 'upper tail': usually top 1%, 5% or 10% performers in a distribution. A second essential normalization parameter relates to the research domain: the top percentile should be defined per separate (sub)field of science to correct for domain-specific differences in citation patterns. Introducing this top percentile approach, Tijssen et al. (2002) suggested a focus on either the top 1% and the top 10% most highly cited research publications per field of science. The top percentile approach has become a generally accepted method for identifying features of RE in international science. Rankings of universities published by CWTS (*Leiden Ranking*), based on WoS-indexed publications, and *SCImago (SIR)*, based on the *Scopus* database, use the top 10% definition as RE indicators (Waltman et al., 2012; Bornmann et al., 2012).

In this case study, we adopt a very selective definition of RE: the top 1% most highly cited publications per subfield of science. Given the fact that African countries represent a mere 2% of the research publications in the WoS database, we expect very few 'excellent' publications with African (co-)authors. Given that skewed distribution of global science, most of the citations to publications in this uppermost part of the upper tail will also originate from publications produced by the dominant nations in the world science system⁵. In order to account for contributions of those nations in African science, we incorporate information pertaining to research cooperation. More specially, the institutional or geographical spread of research partners. Earlier research has shown that international research cooperation is a key contributor to African knowledge production of the kind published in scholarly journals

⁵ Worldwide science is dominated by the USA, China, United Kingdom, Germany, Japan, France, Canada, Brazil, Netherlands, Switzerland and the Nordic countries; collectively these nations present more than 90% of the world's publication output in international research databases such as the *Web of Science* or *Scopus*. Africa as a whole presents about 2.6% of all research publications worldwide in these sources, and sub-Saharan Africa accounts for about 1.4% (UNESCO, 2015, p. 36).

(Tijssen, 2015). The empirical findings suggest that type of research-active university, and its orientation toward international mainstream science, heavily affect the probability to produce highly cited ‘excellent’ research publications.

Examining the relationship between RE and research cooperation within African science, we defined the following subcategories of research publications according to the countries listed in the author affiliate addresses of each publication:

- global cooperation: at least one of the co-authoring main organization(s) is located in a foreign country (may include other African countries);
- intra-Africa cooperation: at least one of the co-authoring main organization(s) is in another African country (excludes non-African countries);
- domestic cooperation: all co-authoring main organization(s) are based in the same country;
- no cooperation: no affiliate author addresses referring to another main organisation.

For practical reasons only, we focus our meso-level case study on a selection of universities in Sub-Saharan Africa. We assume that the cooperation patterns within these universities are sufficiently representative for research in those countries, and SGC-funded science in Africa in general. We present results at the aggregate (‘main organisation’) level only. Our information source to extract those publications is the CWTS in-house version of the *Web of Science* (WoS) database⁶. The data comprise the publication years 1996-2015 and the citation count distributions are calculated across the main field worldwide. We selected those large, research-intensive universities in Sub-Saharan Africa that managed to produce more than 100 WoS-indexed research publications, in the period 1996-2015, that were among the world’s top 1% most highly cited in their subfield of science. In other words, each of these universities produced at least an average of five ‘top publications’ per year. These numbers are sufficiently large to address two key questions:

- (1) are ‘top1% publications’ a meaningful RE indicator in the case of African science?
- (2) what is the effect of international research collaboration?

⁶ The WoS database is owned by *Clarivate Analytics* (see footnote 4). The CWTS version of the WoS is proprietary and specifically developed for advanced bibliometric analysis.

Table 3 presents the data for the 12 selected universities, where the ‘top 1%’ publications were identified at the level of subfields of science. Not only do the numbers of these publications differ, by an order of magnitude, the distribution across collaboration categories also differs significantly. Where the University of Cape Town (South Africa) is by far the largest in terms of quantities (440 top1% cited publications), it is not the most ‘globalized’ one at this level of performance; that position goes to Eduardo Mondlane University (Maputo, Mozambique).

Table 3. Production of top 1% most highly cited publications per African university; sorted by share of publications in the ‘global cooperation’ category (1996-2015)*

	Global cooperation	Intra-Africa cooperation	Domestic cooperation	No cooperation
Eduardo Mondlane Univ.	83%	7%	1%	9%
Univ. Cape Town	82%	0%	7%	11%
Stellenbosch Univ.	82%	0%	6%	11%
Makarere Univ.	78%	5%	5%	12%
Univ. Nairobi	78%	1%	9%	12%
Univ. Witwatersrand	77%	0%	10%	13%
Univ. KwaZulu-Natal	75%	1%	8%	17%
Univ. Ghana	71%	1%	8%	20%
Univ. Dar es Salaam	70%	6%	4%	20%
Univ. Pretoria	67%	3%	10%	21%
Univ. Mauritius	54%	5%	10%	31%
Univ. Botswana	45%	11%	3%	42%

Data source: Thomson Reuters *Web of Science Core Collection* database (SCI Expanded, SSCI, AHCI).

* Document types: ‘research articles’ and ‘letters’. Citation window: publication year up to and including 2015.

‘Top 1%’ publications were identified at the level of subfields of science.

The vast majority of these top 1% publications are the product of ‘global cooperation’ with non-African nations, irrespective of the field of science.⁷ Hardly any top 1% publications are the product of collaboration with other African countries exclusively. With the possible

⁷ This is typical for sub-Saharan African science, where more than 69% of all research articles involve international research partners (UNESCO 2015, p. 36).

exceptions of the Universities of Mauritius and Botswana, none of these universities seem to have benefited much from cooperation with partners on the African continent to generate publications that are highly cited worldwide. The same applies to domestic cooperation within the same country. A sizeable share is the result from research without extra-mural cooperation. The University of Botswana however has a remarkable large share of ‘in-house’, which suggests the (former) presence of niches with the university that can produce excellence research independent of external partnerships.

4.3. Validity and relevance

Does the ‘top 1% most highly cited’ criterion present us with valid reference value? Overall, most of the top 1% cited publications with an author affiliate address referring to an African country are in fact the result of international cooperation with countries outside Africa. Hence, this ‘global top 1% most highly cited’ criterion is not the appropriate frame of reference to assess African RE on its own merit. Other definitions are possible, for example a more comprehensive notion including the upper two deciles (top 20%) or the upper quartile (top 25%), but here one can expect to find similar degrees of ‘contagion’ by international cooperation.

Should we then replace our very restrictive and ‘strong’ global quality standard by a ‘weaker’ one that applies only to African countries? By discarding all co-authored publications that involve a foreign country, we re-compute the citation counts distribution to determine the top 1%, thus creating a domestic or regional African comparative framework. The citations to these top 1% publications would still emanate from publications worldwide. This should capture a wider diversity of RE dimensions within African science, including information on the ‘African’ research topics of these highly cited publications. The top percentiles in the upper tail would now become an African standard for RE, but still framed within a global (citation impact) context. Global excellence is now partially replaced by ‘African excellence’. A full replacement can be done by selecting only those highly cited publications that are cited exclusively, or predominantly, by other Africa-authored publications. These intra-Africa citation links will tend to reflect topics of local interest and relevance.

In the course of this data reduction process we have now narrowed down the scope for comparison to a minute fraction of world science. Is that meaningful and justifiable reduction

in scope? The definition of RE has now to be broadened towards establishing if and how the research has addressed specific local issues or problems ('local impact') – supplementary to if and how the research results may indicate niches of excellence within the researcher's country and/or organization ('global impact'). From a technical viewpoint such a broadening is valid as an alternative to the 'ordinary standard' mentioned in section 1.1, but from a normative perspective it is questionable because it undermines the 'unusually good' criterion in so far as many outside Africa are likely to be equally good or (much) better on the weaker definition of the top 1%. Moreover, as the numbers of highly cited publications become smaller, and annual citations counts tend to fluctuate much more, the need for additional information increases to support claims of excellence.

5. Concluding discussion and recommendations

5.1. Need for further clarity

The aims of this research project was to help African science granting councils to better understand the notion of RE from an “assessment and evaluation” perspective. When trying to grasp RE one cannot simply rely on the popular colloquial expression “I will know when I see it”. There is too much at stake nowadays to rely on intuition only; we need transferable and convincing evidence of RE in Africa. And we need it as soon as possible.

Our evidence-based analysis highlights under which conditions this ambiguous, multidimensional concept of RE can be successfully operationalized in order to transcend above the ‘buzzword’ level in policy discourses on research quality in Africa. Our empirical findings offers some relevant insights and concrete recommendations for designing or adapting information systems, assessment methods and performance indicators aimed at fostering excellent research – either at the level of research proposals, projects, or programs. Those recommendation, presented below, are embedded in a series of practical issues faced by African government organisations, national science granting agencies and international donor organisations. These are the key actors that should play a key role in the process of establishing a broad set of quality dimensions, develop appropriate standardized ratings, and implement customized performance indicators. And those methodological challenges should, ideally, be embedded in consistent policies and processes to promote an ‘excellence culture’ within African science.

5.2. Research quality criteria

Do we need international quality standards and generally accepted indicators to identify and appreciate RE within Africa? Yes, we do. The ‘Top 1% most highly cited’ indicator is a case in point: the method enables comparisons of universities across the continent in a global frame of reference. But it is clearly insufficient and inappropriate for all scientific research in Sub-Saharan Africa. Establishing a broad set of quality dimensions are an essential first step towards appropriate rubrics, associated standardized ratings, and meaningful metrics.

But any process to start identifying RE, or contemplate how to select or design appropriate RE indicators, one needs proper understanding of the accountability frameworks in which

many African science funding agencies operate - in so far as they are expected to identify, select and fund research of high quality – either at the level of individuals, research projects or large-scale programs. Resource-poor research funders in Africa (or NGO-supported Excellence initiatives) may tend to focus on incentivizing ‘incremental’ research or application-oriented research, marked with lower risks of failure and more reliable returns on investment, which tend to be removed from prioritizing cutting-edge research projects or programs aimed at achieving ‘world-class excellence’. Within such application-oriented contexts one needs to separate ‘merit’ from ‘relevance’ of sub-dimensions of RE. Where merit demonstrates that Africa-based researchers are of the same global quality standards (regardless of whether these standards are fully valid or appropriate in Africa), ‘relevance’ is more likely to be assessed in terms of local expectations or needs. Any Africa-centric notion of RE should go beyond international research publications and scientific impact in the academic community, to embrace the wider impacts of researchers in their local or domestic environments. Truly excellent researchers should also be assessed on their ability to create broader impacts such as of science-based teaching and training, fund raising, networking, mobility and cooperation, commercialization and innovation.

A research portfolio approach incentivizes researchers to submit higher-risk grant proposals with a larger chance of producing cutting-edge, excellent research with a higher likelihood of creating scientific and socioeconomic impacts (Wallace and Rafols, 2015). Such an incentive structure (and subsequent assessment culture) would shift from risk-avoidance and seeking incremental, short-term output-oriented gains (‘incremental excellence’) to longer-term impact-oriented outcomes (‘radical excellence’) and accepting the inevitable larger margins of uncertainty. It does not penalize failed grants. A risk-balanced research grant portfolio should have a mix of both short-term and long-term projects. Research performance evaluations in terms of ‘successful outputs’ and ‘significant impacts’ should therefore preferably be done at the level of grant portfolios rather than individual grants, and should take a longer term perspective of RE with regards to identifying possible impacts and follow-on activities of the researchers.

5.3. Research performance indicators

Research performance metrics are merely surrogates – what you measure is what you get. Even a top 1% most highly cited research publication is very unlikely to tick all the

excellence boxes when the research was primarily designed to address local African issues or problems. The options, preferences and choices for particular indicators should be informed by the longer-term funding strategies and short-term research portfolios of these research funders. Any meaningful notion of excellence should go beyond the production of research publications in international journals, and counting citations to those publications from colleagues or peers in global academic communities. When judging specific African features of research grant proposals or final scientific results, supplementary information will have to come from a customized set of Africa-relevant indicators and quality standards. Judging by our survey findings we need to expand the range of parameters quite considerably to capture relevant features of African research excellence. Such customized RE indicators will offer significant added value in assessments and evaluation of African scientific research – especially within a global comparative context and where international scientific cooperation is concerned.

In order to become useful and generally accepted these indicators need to: (a) provide meaningful information, (b) be convincing, and (c) be perceived as fair. Ideally, each indicator should be ‘locally relevant and Africa consistent’. Working towards a broader ‘menu’ of performance indicators and that are adapted (or adaptable) to the context of African research, will require a critical review of data resources within Africa and the possibilities for comparative data either according to ‘weak measurement’ methods (rating categories on a scale) or ‘strong measurements’ (performance scores on a statistical distribution).

5.4. External information sources

One of the main methodological challenges, irrespective of the kind of metric or quantification, is the ability to compare and assess very different types of research. In addition to the choice of quality standards and reference values, as discussed in the case of highly cited publications (see section 4), the domain of science concerned also matters in RE perceptions. Where researchers from the ‘hard’ sciences are more likely see certain citation impact metrics as useful, those who are active in the ‘soft sciences’ generally see such metrics as problematic since the information sources (such as the WoS database) and related bibliometric indicators (for example, the H-index) that tends to serve those who publish in English-language international journals and conference proceedings. Many researchers in the social sciences and humanities (still) publish predominantly in local language journals and/or books. We need

more information sources to (partially) capture outputs and impacts across all fields or science.

Addressing the need to collect a wider range of information – including freely-available Open Access (OA) sources - science funding agencies could introduce mandatory *Google Scholar* profiles for each researcher or principal investigator who submits a research grant proposal to an African science granting council. The free available web-based GS profiles may contain all publications by a research (from blog posts on English-language websites to books in the local language) where Google automatically tracks how often each publication are mentioned ('cited') on the internet within the global research literature. Supplementary information from service providers, like *Almetrics.com*, may also help assess the impact of research in the social media.

Clearly, putting such OA sources on the indicator menu should be supported by all major institutional stakeholders, including researchers. To benefit optimally from such sources, SGCs should considering establishing online platforms and publication repositories to make their SGC-funded research more available and visible to the outside working. It goes without saying the such research publications should mention SGC funds in a footnote or funding acknowledgement.

Establishing the added value of indicators based on OA sources requires a series of pilot studies in Africa to validate if and how such quantifications (either weak or strong) may reflect (sub)dimensions of research excellence that reflect the societal goals and daily realities of African research. It is relatively straightforward to test the possibilities of introducing mandatory GS profiles for each principal investigator who submits a research grant proposal to an African SGC.

In our bibliometric case study of highly cited publications (see section 4) we've demonstrated that RE can be identified across countries and fields of science by applying automated computational algorithms to 'big data' information sources. One could also easily extend the 'top 1% most highly cited publications per field' study presented in this paper across other all large and medium-sized research-activities universities in Africa, or apply a series of top percentiles (ranging from say the top 1% to the top 25%) . The associated RE indicators may offer added value in assessments and evaluation of African scientific research – especially

with a global or national comparative context and especially where international research cooperation is concerned. Our micro-level units of analysis in these case studies - either individual researchers or their published outputs - can also be used in meso-level assessments and evaluations of research programs funded by African SGCs.

5.5. Good practices

Whether or not such additional performance indicators are truly able to capture African RE in a convincing way, depends on the degree to which the data and the indicator meets a series of quality criteria related to user acceptability:

- information value (reduce complexity and extract meaningful information);
- operational value: (based on acceptable concepts, definitions and criteria);
- analytical value (produce accurate data, measurements and performance indicators);
- assessment value: (present relevant information and knowledge for users);
- stakeholder value (create credibility among stakeholders and public confidence).

Given this multitude of interrelated criteria, there is no single best way of judging the usefulness of an indicator; it will always be context-dependent and goal-dependent.

Of course, many key characteristics of scientific research are not amenable to the kind of large-scale comparative data collection. Many dimensions of research quality and RE are difficult to disentangle and are not measurable in any convincing systematic fashion. These methodological limitations are not typical for Africa, they are equally applicable to research worldwide.

Nonetheless, a certain degree of measurement and associated quantitative indicators is extremely helpful to bring about more standardization and precision in research assessment and evaluation processes. The *Leiden Manifesto for research metrics* introduces the following 10 principles to guide the design and implementation of this transparency process (Hicks et al., 2015):

- Quantitative evaluation should support qualitative, expert assessment;
- Measure performance against the research missions of the institution, group or researcher;
- Protect excellence in locally relevant research;

- Keep data collection and analytical processes open, transparent and simple;
- Allow those evaluated to verify data and analysis;
- Account for variation by field in publication and citation practices;
- Base assessment of individual researchers on a qualitative judgement of their portfolio;
- Avoid misplaced concreteness and false precision;
- Recognize the systemic effects of assessment and indicators;
- Scrutinize indicators regularly and update them.

It is important to realise that expert opinions should always be the prime source of information for value judgements on research quality and excellence. Neither a predominantly peer-review based evaluation system, nor one based mainly on quantitative metrics will ever be the best solution, as both have their inherent problems. Peer review panels and subject experts must also understand and appreciate the advantages of metrics and quantitative indicators. Acknowledging these possibilities opens up possibilities for mixing qualitative opinions with quantitative statistics ('narratives with numbers') where experts complement their assessments with, for example, bibliometric data. One needs both sources of information, preferably with a focus on the qualitative side; assuming otherwise would have negative impacts on how African research should be assessed and evaluated.

Applying a mix of qualitative information and quantitative data, requires dealing with the lack of information, interpretative inconsistencies and informational trade-offs. In this delicate balancing act between oversimplification and undue complexity, there is an obvious need to consider and incorporate contextual factors. Inevitably, peer review is needed to address these factors: only subject experts who are (or were) active in the same research area can accurately judge the quality and relevance of a given piece of research: excellence indicators cannot replace expert judgment. Such 'informed peer-review' methods do not necessarily help young researchers (without a publication track record), minorities working outside mainstream science, or those who work on problems that are difficult to fully comprehend and assess by others (for example in mathematics).

The accumulating good practices across Africa's numerous excellence-initiatives may also serve as an information source to establish quality assurance mechanisms, assessment practices and performance benchmarks. Science granting councils in Africa can and should

play a key role in this process of identifying excellence - not only in the assessment of grant proposals they receive, but also the evaluation of SGC-funded research programs in terms of their scientific outputs and socioeconomic impacts.

5.6. Supporting a research excellence culture

Understanding and operationalising the fuzzy notion of research excellence in Africa, from an evidence-based perspective, is mostly uncharted territory. Our review revealed a lack of scholarly literature on this topic. While several Sub-Saharan countries have experienced a rapid expansion of their universities, the majority of these organizations is not research oriented. Our survey findings (section 3) suggest that a quality-driven research culture has yet to be developed, accompanied by an increase of the remuneration of researchers, gender transformation of the research landscape, and an ethical base that guides research activities. Generally held beliefs and common notions about research quality and excellence are very often dominated by specific ways in which opinion-leaders in science policy and academic disciplines tend to perceived ‘good quality’ research. These views, usually embedded in implicit scientific norms regarding quality standards or driven by selected showcases of successful research, need not necessarily be (fully) shared by African science granting actors or be applicable in day-to-day assessment and evaluation processes.

According to the views of surveyed SGC research coordinators, there was also an indication that current legal frameworks still constitute a developmental challenge since they do not explicitly foster the pursuit of research quality involving research collaboration networks (national and international, among researchers and with users/stakeholders). As a result, a ‘silo mentality’ still often prevails in African research performance, which is seen as a major deterrent to achieve RE. Overcoming these constraints would involve simultaneous advances on multiple fronts: (1) increasing the domestic funding to R&D (with larger participation of private sector), (2) improving the conditions and opportunities for female researchers, (3) the establishment of research programs as PhD centres of excellence, (4) give strategic support to young researchers, through scholarships and mentorship, (5) promoting interdisciplinary research, (6) promotion of national and international research collaboration and (7) sharing of research infrastructure.

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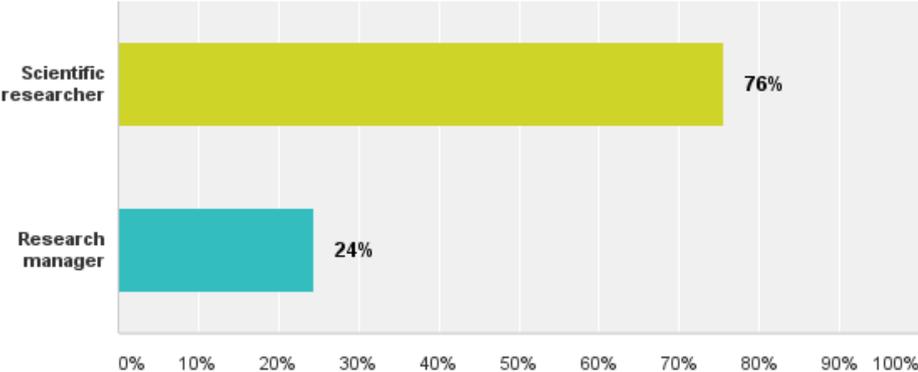
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Annex 1. Responses of researchers in online survey

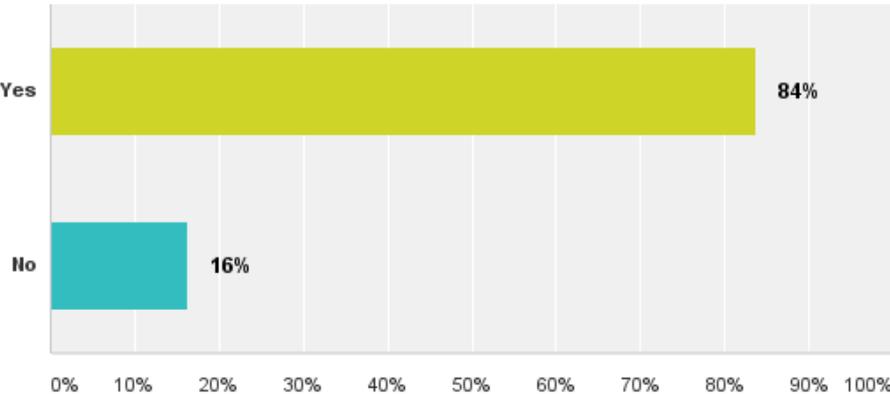
Q1 I am answering this questionnaire in my following current capacity:

Answered: 45 Skipped: 0



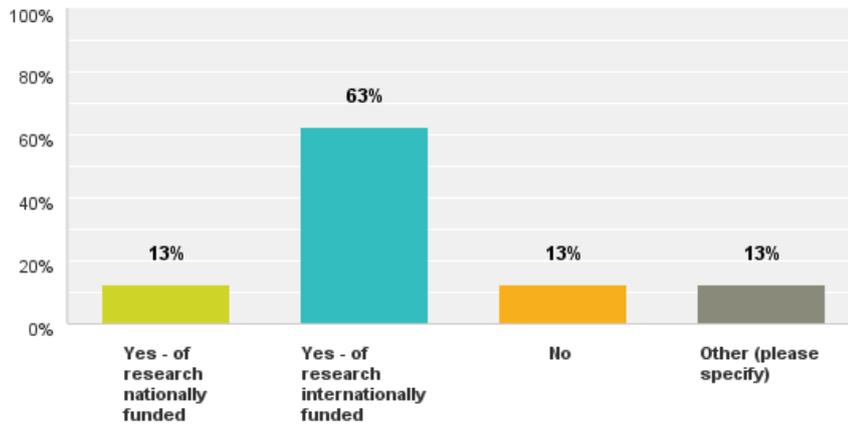
Q3 Are you the recipient of a research grant?

Answered: 43 Skipped: 2



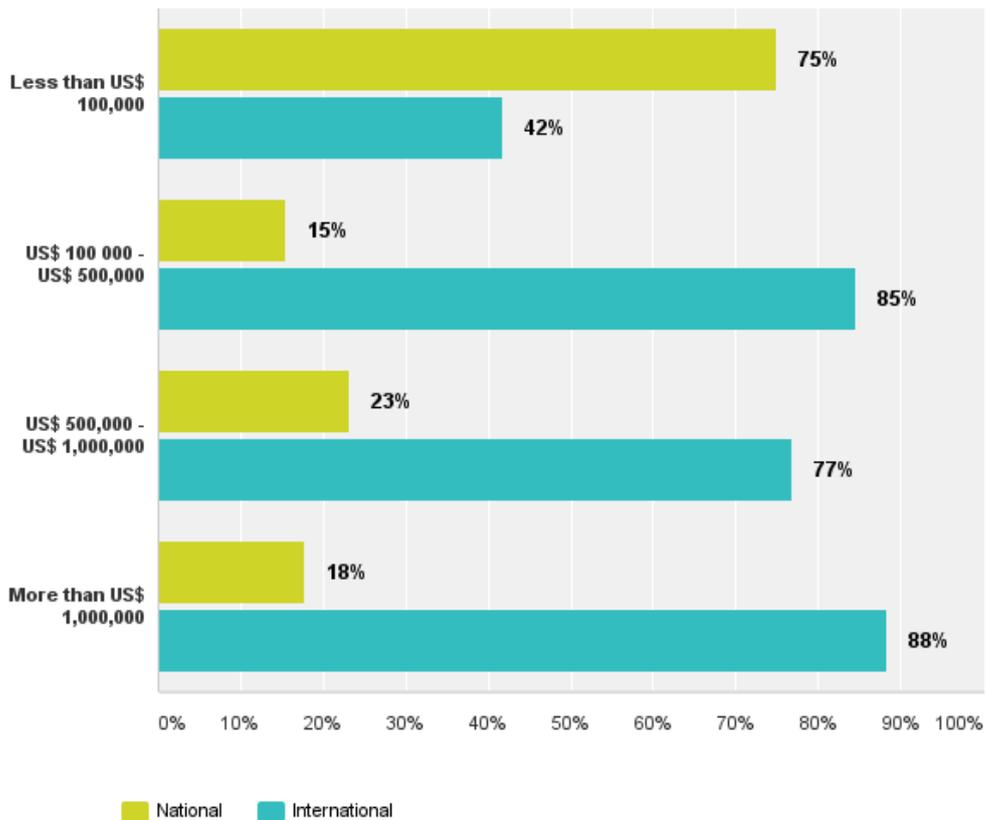
Q5 Are you the primary recipient/grant holder of the funding?

Answered: 40 Skipped: 5



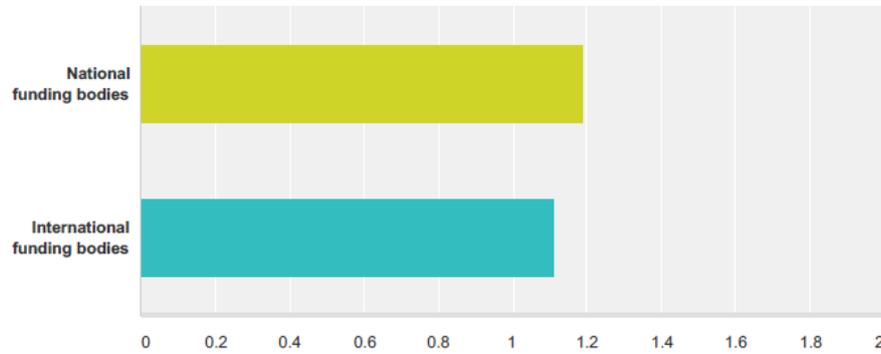
Q6 What is the size of your grant(s)?

Answered: 37 Skipped: 8



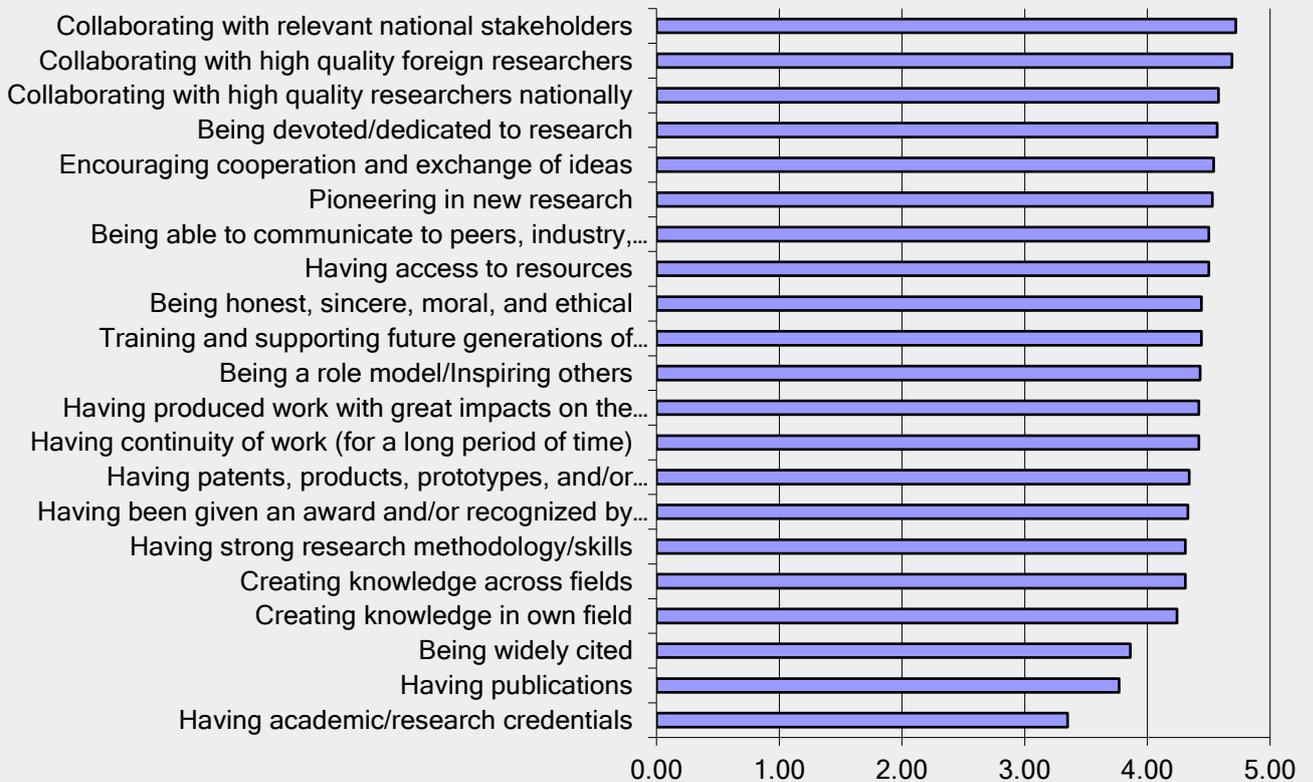
Q7 Is your research regularly evaluated by funding bodies or national agencies?

Answered: 41 Skipped: 4

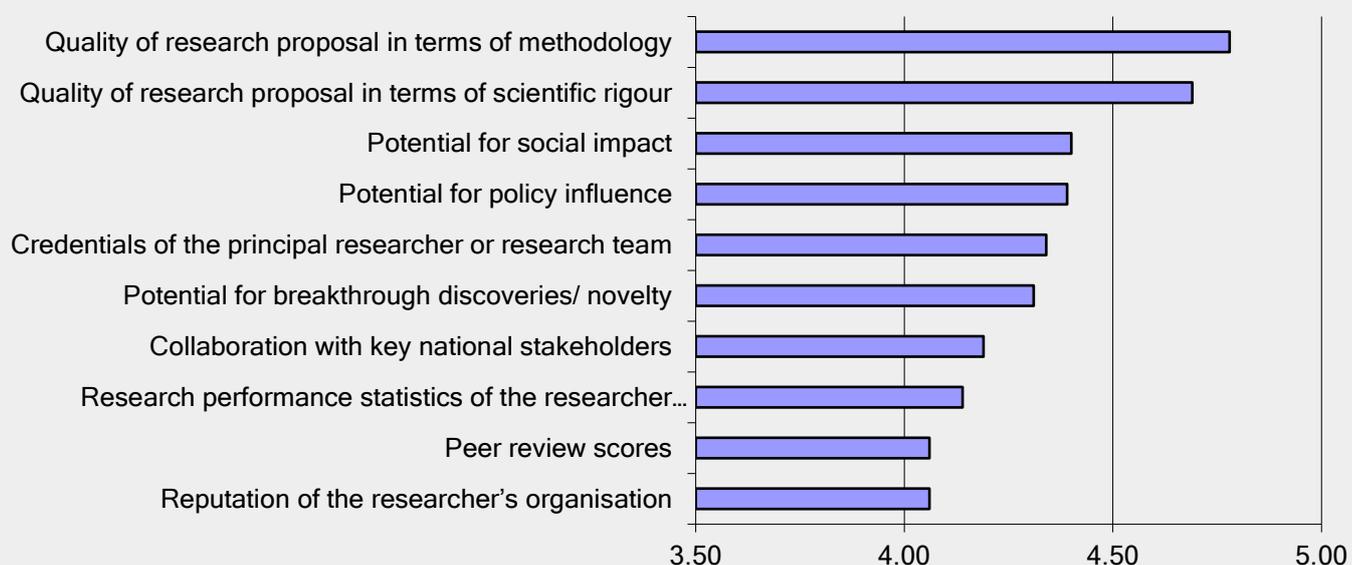


	Yes	No	Total	Weighted Average
National funding bodies	80.77% 21	19.23% 5	26	1.19
International funding bodies	89.47% 34	10.53% 4	38	1.11

What criteria would you use to describe an "excellent" researcher?



Which performance indicator(s) should the science council in your country apply to assess a research proposal?



Question 10

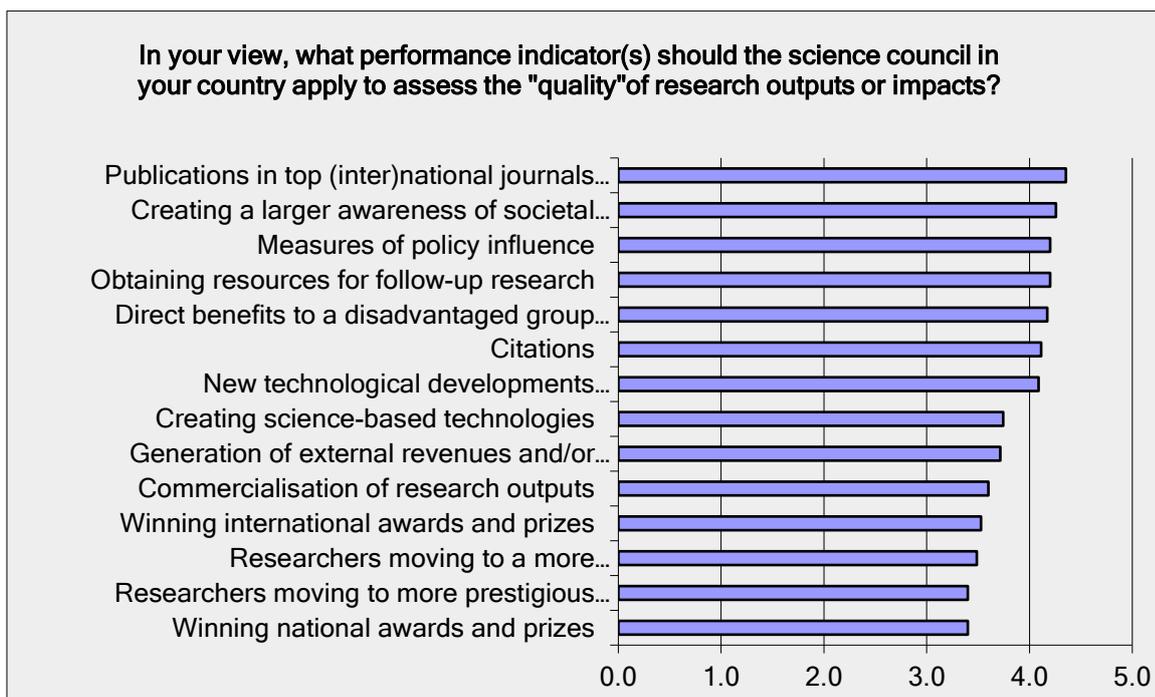
Please describe in your own words what you consider a "high-quality" research proposal

Answer Options	Response Count
	30
<i>answered question</i>	30
<i>skipped question</i>	15

Number	Response Text
1	One which is intended to improve key problems in society
2	Clear, unambiguous, focussed, novel, hypothesis-based and deliverable
3	With novel ideas, well described objective and clarity of how the objectives will be attained
4	Relevant topic addressed in good quality methods executed with relevant partners and with potential for social impact
5	rigorous methodology and a sound data analysis plan...the problem should be well defined
6	One that demonstrates ability to address identified problem(s)
7	Clear research methods, clear projected outputs and clear impact
8	Tackling new solutions , publishable research, applicable research to solve problems
9	A high-quality research proposal is one that has a well define research problem and methodology on how to address with a potential of influencing policy or practice
10	A proposal that clearly identifies roles and responsibilities of international and national researchers and the capacity building that will take place
11	Rigorous research methodology and well defined problem
12	innovative, good design, and scalability and reproducibility
13	An innovative, novel idea by an investigator with the ability (proven or expected) to deliver on the proposed approaches.

- 14 Clear statement of research aim that explains research questions and objective as well as a clear methodology. The methodology should be able to achieve the research questions. The expected impact of the proposed research and beneficiaries
- 15 clearly stated problem statement, appropriateness of research design, and clear exposition of potential impact of research outcomes
- 16 innovation, scientific rigour, quality of partnership, potential for socio-economic-environmental improvement
- 17 A proposal that places impact ahead of outputs, one with a human face, with strong stakeholder ownership
- 18 organized, with all components of the proposal, methods clearly described, ethical and sound implementation team
- 19 consistent, logical, well-structured, with sound scientific/article base
- 20 High-quality research is proposal is a proposal that has potential to add to body of knowledge in its field and can influence policy.
- 21 A proposal which intend to come up with new information which is vital in solving or answering some of the serious issues facing the nation or the target community, a research that will come up with results which will make a positive impact and which can also be extrapolated into other communities with minimal modification to solve/answer problems affecting those communities
- 22 Scientifically rigorous with good clear focus and clear goals
- 23 A high quality research proposal should meet the objectives of the call for proposal and also the research agenda of the scientist per se, it should not always be donor driven. It should be impact oriented and there should be an exit strategy after the deliverables so that national agencies or extension workers can take up the technology and disseminate.
- 24 Novel science rigorously proposed along with an execution plan that is feasible
- 25 Important public health impact, scientific rigor, innovation
- 26 Methodologically robust, innovative and with potential to influence policy or programs.
- 27 A proposal that clearly outlines the breadth of the problem and the work proposed to address part or all of the problems - clear theory of change
- 28 Should solve real society challenges
- 29 The only way I know to evaluate across fields is impact factor H
- 30 A high-quality research proposal addresses constraints and/or catalysators for the advancement of livelihoods, science and policy making

Question 11



Question 12

Please describe in your own words what you consider a "high-quality" research output or impact

Answer Options	Response Count
	30
<i>answered question</i>	30
<i>skipped question</i>	15

Number	Response Text	Categories
1	One which contributes to solving society's problems	
2	Clear-cut, unambiguously interpretable results, with novel and directly actionable conclusions	
3	Objectively measurable outputs which can be replicated	
4	Research that is concluded with outputs that easily leads to outcomes of impacts to the scientific and real world	
5	Research that helps to shape policy and practice	
6	One that solves the main problems faced by the community	
7	The output is applied and is measurable directly or indirectly	
8	Making a difference in the lives of other people	
9	A fully costed intervention	
10	Publications in high impact factor journals and policy impacts	
11	publication in peer-reviewed journal	
12	Research that adds substantially to the existing body of work and changes ideas, approaches or impacts the field.	
13	High quality research impacts should be capable of contributing to solving societies problems (social, political and economic challenges).	
14	capacity to influence public policy and lifestyle	
15	publications, attractivity of the field/topic for young researchers and academics	
16	User uptake, practical use by target beneficiaries	
17	generates new knowledge or influence the current practice and relevant to the underlying population.	
18	visibility across sectors	
19	Output that has potential to change practice or policy	
20	Creating New technological developments emerging from research which assist in Creating a larger awareness of societal issues and formulation of science-based simple and user friendly technologies for poverty alleviation	
21	One with clearly defined goals and also policy implications	
22	Commercialized patents	
23	A high quality research output or impact should be determined by the timely deliverables and the number of people that are benefitted with the research results.	
24	peer reviewed publications, patents	
25	Public health impact	
26	well documented research that captures the outputs to impacts clearly	
27	Should emanate from society challenge; not on researcher's curiosity/fantasy	
28	A research that can sustain the researcher himself and benefit society	
29	I still would say impact factor	
30	High quality outputs and impact are made of comprehensive assessments and facilitate targeted decision support	