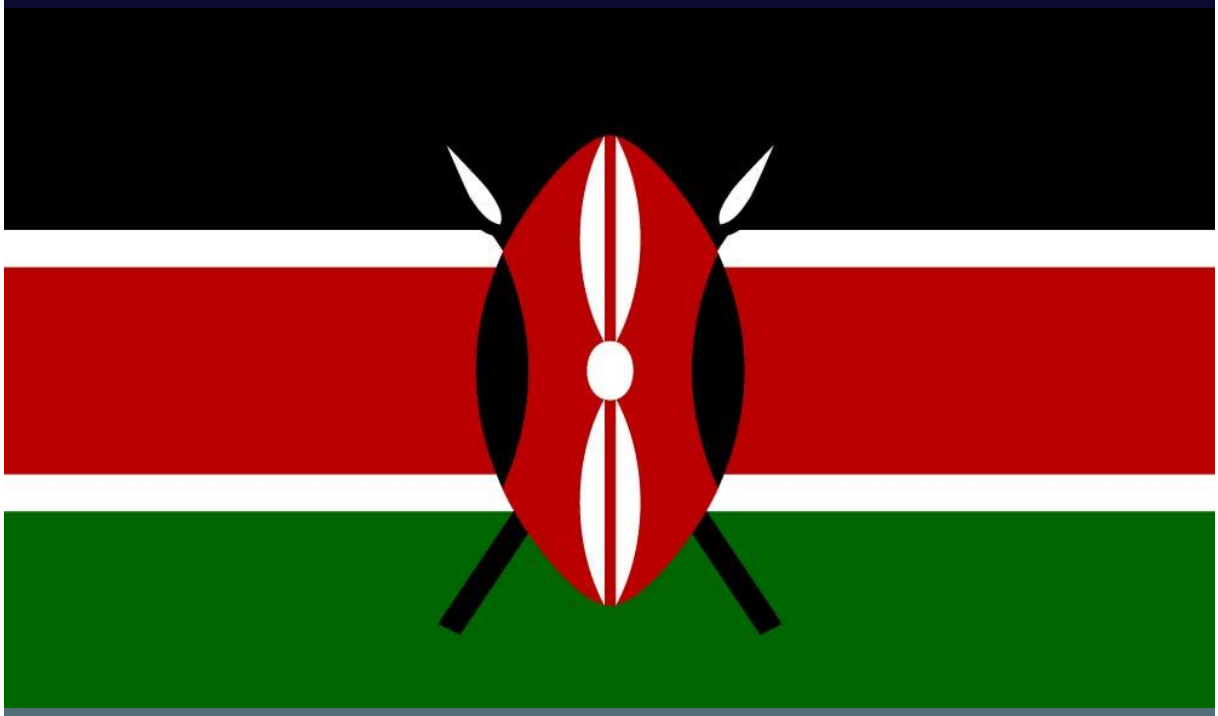
Research Consulting

HEART
HIGH-QUALITY TECHNICAL ASSISTANCE FOR RESULTS

Assessing the needs of the research system in Kenya



Report for the SRIA Programme

October 2019

UKaid
from the British people

"Assessing the needs of the research system in Kenya. Report for the SRIA programme."

Report commissioned by: The UK Department for International Development

http://www.dfid.gov.uk

Contact:
Dr Tom Drake

Research and Evidence Division

T-Drake@dfid.gov.uk

Report authors:

Mattia Fosci, Lucia Loffreda, Andrew Chamberlain, Nelisha Naidoo
www.research-consulting.com

Contact:
mattia.fosci@research-consulting.com

Report dated: October 2019

This work is licensed under a Creative Commons Attribution 4.0 International License.

Executive Summary

This report provides a high-level assessment of Kenya's research and innovation system and key research organisations. It seeks to identify the main challenges to research capacity strengthening and some priority areas for intervention in order to support decision-making at DFID and among Kenyan partners. The study does not seek to explore issues such as the historical causes of the current situation or the role of the media and other political actors which, albeit important, fall outside the scope of this investigation. Findings in this report are based on quantitative and qualitative data collected through desk-based research and informant interviews. Over 100 indicators are used to assess the country's research environment and political economy context, research production and research diffusion performance. Some of the qualitative findings are based on the views of a small but balanced number of stakeholders and should be verified through further research.

A. Needs Assessment for Kenya

Political economy context. Kenya is a lower-medium income country with high levels of poverty and a large rural population (World Bank). According to the World Bank, the country has high political instability and low levels of government effectiveness. Regulatory quality is higher than other countries considered in this study, but it suffers from high levels of perceived corruption according to Transparency International's Corruption Perceptions Index. Despite these challenges, Kenya's research system is deficient but not undeveloped. The review found that the country has well-developed national strategies on science, technology and innovation (STI) but it only has a draft STI policy and no dedicated research policy. Its institutional framework for research relies on the role of the National Commission for Science Technology and Innovation (NACOSTI), the National Research Fund (NRF) and the Kenya Innovation Agency (KENIA). Similarly, the consultation found that national institutions have clear mandates but often lack the financial capacity to implement these effectively. Kenya also hosts many international research organisations and intermediary organisations that are well integrated in the national context and make the country a major hub for research in East Africa.

Research production. Kenya has a higher proportion of researchers per million of population than all other countries considered in this study, but a much lower share of these have doctoral qualifications according to UNESCO. The government spends 0.8% of GDP in research and development (R&D), higher than any other country in this study but still shy of its own 1% target. Moreover, international sources contribute to 47% of the domestic R&D expenditure (UNESCO). However, informant interviews reveal that lack of funding is reportedly a major challenge across the system, affecting the capacity of national actors, the effectiveness of policy implementation, the performance of research organisations and the options available to individual researchers. Kenya also has a large network of research organisations performing internationally recognised research, and it has almost tripled the number of universities since 2012. The consultation process suggests there is margin to improve research production by improving research training at universities, increasing incentives to perform high-quality research and improving the research infrastructure which remains, overall, severely deficient.

Research diffusion. In contrast with consultees' perceptions, Kenya performs better on research diffusion, with international collaborations playing a key role in the international dissemination of local research. Over 80% of papers reported by Scimago have been produced as a result of international research collaborations, and Kenyan research is highly cited (the country ranks in the top quartile globally for number of citations per paper). Despite the lack of an overarching strategy for knowledge exchange, Kenya also has good knowledge transfer practices and a good system for intellectual property protection, with over 120 resident patent applications each year (WIPO). However, the consultation revealed that, outside of a handful of research-intensive organisations, most universities lack the capacity or incentive to perform knowledge exchange activities and research uptake by government and other actors is still very limited.

B. Options for research capacity strengthening

Being further ahead than other African countries considered in this study, Kenya's research environment would benefit from initiatives that support national capacity in a way that may not be possible elsewhere. Three areas appear important:

- **Support implementation capacity across national institutions**. Improving government effectiveness appears to be a key opportunity to push the research agenda. Building national capacity not just among funding councils (NRF) but also policymakers (NACOSTI) and intermediaries (KENIA) is crucial. Support should be targeted and focus on implementation problems identified by the beneficiaries, including the clear challenges emerging around measuring, monitoring and enforcing policy.
- **Promote research quality**. Creating national mechanisms for research quality evaluation and increasing NACOSTI's capacity to monitor research quality in the country is also important. The consultation revealed that research is not valued for its contribution to the economy and society, but instead is promoted as a vehicle for leveraging external funding. By focusing on research quality, interventions can be tied to the impact agenda of Vision 2030 and be aligned with government priorities. To achieve that, 'research quality' should be defined by national stakeholders, perhaps with stronger links to development objectives over publication or citation-based notions of scientific excellence.
- **Strengthen the role of national intermediaries**. The needs assessment revealed an important role played by national stakeholders such as KEMRI in bridging the gap between research and policymakers. Government-funded think-tanks play a much more central role in Kenya than they do in high-income countries, but they are often limited by lack of funding and capacity. These actors can help create a platform for research to influence policy and practice, and their work has the potential to elevate the importance of research among policymakers. Moreover, they could be made even more central in disseminating bodies of evidence rather than promoting their own research.

Contents

UKaid from the British people

Glossary

Organisations

AAS	African Academy of Sciences
ACBF	African Capacity Building Foundation
AIRC	Agricultural Information Resource Centre
ARC	Advisory Research Committee
ARIPO	African Regional Intellectual Property Organisation
CAPREx	Cambridge-Africa Partnership for Research Excellence
CARTA	Consortium for Advanced Research Training in Africa
KARLO	Kenya Agricultural & Livestock Research Organization
KEFRI	Kenya Forestry Research Institute
KEMRI	Kenya Medical Research Institute
KENIA	Kenya Innovation Agency
KIPI	Kenya Intellectual Property Institute
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KIRDI	Kenya Industrial Research and Development Institute
NACOSTI	National Commission for Science Technology and Innovation
ReMPro	Research Management Programme

Other acronyms

GDP	Gross Domestic Product
GERD	Gross domestic Expenditure in Research and Development
ICT	Information and communication technology
KE	Knowledge exchange
LMIC	Low- medium income country
NRF	National Research Fund
PCT	Patent Cooperation Treaty
PPP	Purchasing power parity
R&D	Research and development
R&I	Research and innovation
RCS	Research capacity strengthening
STI	Science, technology and innovation

1. Introduction

This report presents the results of an assessment of Kenya's research needs and it is part of a broader needs assessment of the seven countries in the 'Strengthening Research Institutions in Africa' (SRIA) programme: Ethiopia, Ghana, Kenya, Nigeria, Rwanda, Tanzania and Uganda.

1.1. Structure of the report

The document is divided into two parts. The first part presents a political economy analysis of the country, building on DFID's guidance. Section 2 discusses the country's 'structures', or long-term contextual factors that have a direct or indirect effect on the research system. Section 3 looks at the legal and policy framework for research, while section 4 analyses relevant political economy dynamics within the country, specifically looking at relations between public sector bodies, research organisations and individual researchers. The second part of the document assesses research performance in the country. Section 5 explores research production by assessing research inputs, research culture and support, and research outputs. Section 6 assesses research diffusion by looking at actors and networks working on knowledge exchange (KE), and existing KE practices. The last part of the document focuses on the main bottlenecks or constraints affecting the research system and discusses opportunities to strengthen research capacity. It builds on the performance indicators explored in the previous section and considers the overall impact of each indicator on the research system. A full list of indicators and their relative score is contained in Appendix A.

1.2. Methodology

The evidence presented here has been obtained through desk research and informant interviews. Desk research gathered quantitative data from 16 sources (see Appendix E), while qualitative data was gathered from interviews with 16 informants, working for the government, think tanks, research organisations and intermediary organisations based in Kenya (see Appendix C). Interviews were conducted, recorded, transcribed and analysed using a consistent methodology. Qualitative findings reflect the perceptions of more than one stakeholder, and they have been compared, wherever possible, with available data from published sources.

This report has been peer reviewed by the individuals listed in Appendix D and circulated with interviewees for comments and clarifications. Previous versions have been significantly improved in response to the constructive feedback provided by Dr Tom Drake and Dr Alba Smeriglio (DFID), as well as input from DFID staff located in relevant country offices.

1.3. Limitations

The study provides a high-level assessment of the strengths and weaknesses of the Kenyan research system and research organisations. It paints a broad picture of the current situation to inform understanding and action by DFID and others; it does not seek to explore issues such as the historical

causes of the current situation or the role of the media and other political actors which, albeit important, fall outside the scope of this investigation. Some of the qualitative findings are based on the views of a few stakeholders and should be further verified in subsequent iterations of this study.

2. Political economy

This section provides an overview of the country's demography and of key political-economic parameters.

2.1. Social and political context

Kenya is a country of over 51 million people, mostly living in rural communities (73%). The country's official languages are English and Swahili, and the literacy rate is 79%, which is lower than the global average but close to the average for low- and medium-income countries (LMICs). Kenya is a democracy affected by political instability. President Kenyatta was re-elected in October 2017 in a disputed election characterised by violence and intimidation. The World Bank places the country near the bottom in a ranking by political stability (percentile score of 13, where 0 is least stable and 100 is most stable). Kenya scores slightly better with regards to the rule of law (41/100), however it is perceived to be affected by high levels of corruption. The country ranks 144 out of 180 countries in Transparency International's Corruption Perception Index 2018, with corruption perceived to affect both national and county governments. State institutions tasked with combating corruption have not yet managed to effectively curb corruption, which is thought to be on the rise.

The World Bank ranks Kenya 43/100 for its regulatory quality but only 30/100 for government effectiveness. This mirrors findings from this study that the main barrier to an effective national research policy lies less with policy formulation and more with their implementation (see section 3). Elaborate rules govern public finance in Kenya, but enforcement is often lacking. Kenya performs below average (40/100) with regards to voice and accountability, or the extent to which its citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The judiciary is generally considered to be independent, but judicial procedures are inefficient.

The charity Freedom House ranks Kenya as 'partly free' overall, and has given Kenya a score of 10/16 for freedom of expression. Academic freedom is considered traditionally robust (3 out of 4) and scores better than most other indicators, including media freedom (2/4): however, this appears increasingly threatened by political interference, ethnic divisions, and violence. In particular, Freedom House cites evidence that "ethnic considerations have influenced university hiring, leaving the staff of some institutions with significant ethnic imbalances".

2.2. *Economic context*

With a GDP per capita of USD1,710, Kenya is a lower-middle income country using the current World Bank classification.[a] This puts the country in line with the Sub-Saharan Africa average but below the average for lower-middle income countries.

Kenya has a predominantly service-based economy (42% of GDP). Agricultural activities also contribute a significant portion of national income (34% of GDP), and 73% of the population live outside of urban centres. Industry accounts for 16% of GDP, with manufacturing accounting for 11% alone. Despite the growing service and industrial sectors of the economy, 36.8% of the country population lives below the poverty line (calculated as USD1.90 a day) and Kenya is ranked 142 in the world in the composite Human Development Index. Kenya was ranked 91st out of 137 countries in the Global Competitiveness Index, and the country was scored lowly for its current technology readiness and level of innovation. However, it was given an average score (4.3/7) for its capacity to innovate, indicating a relatively high economic dynamism and a positive outlook for growth.

3. Institutions

This section looks at the strength of the national policy framework for research. Specifically, it looks at the national research policy and capacity of national research institutions.

3.1. *National policy for research*

Kenya's research policy has three pillars. The first is Vision 2030 and the related *Sector Plan for Science and Technology*, launched in 2008. Vision 2030 sets out the country's development programme from 2008 to 2030, which aims to address the country's development problems and necessary strategies to achieve the 2030 goals. Through Vision 2030 Kenya wants to create a competitive country with a high quality of life through innovation. While the Vision advocates for a strong science, technology and innovation (STI) policy and performance management frameworks, Kenya only published a *draft* STI policy in 2008. A review of the STI policy by the National Commission for Science Technology and Innovation (NACOSTI) is currently taking place but no firm date has been set for its completion. The second pillar is the 2013 National Science, Technology and Innovation Act, which establishes the national research institutions tasked with implementing Vision 2030 and the STI plan (see section 3.2). Finally, the third pillar is the Universities Act of 2012, which regulates the accreditation and governance of both public and private universities while also establishing the Commission for

[a] Low income countries = $995 or less; Lower-middle income countries = $995 - $3,895; Upper-middle income countries = $3,896 - $12,055; high-income countries = $12,056 or more. In addition, the World Bank identifies further groupings based on their average GDP per capita, which are useful reference points for this analysis: Low income = average $787; Least developed countries = average $1,072; Lower middle countries = average $2,209; Middle income = average $5,282; Upper middle = average $8,610; OECD countries = average GDP $45,721; High income = average $47,892.

University Education, the Universities Funding Board and the Kenya University and Colleges Central Placement Services Board. The Universities Act legislates that production and dissemination of scholarly research and the promotion of innovation are two key objectives of universities, but it is unclear how research policy and university policy interact with each other.

Overall, Kenya has a relatively mature policy framework and ambitious objectives for research and innovation, although the policy implementation appears limited. Stakeholders voiced concerns about the lack of an implementation roadmap, the lack of resources dedicated to implementation and the lack of clear goals and performance indicators. The most significant advancements have come from the creation of a national institutional framework for research in 2013 (see below). However, insufficient knowledge of and expertise in knowledge exchange (KE), technology transfer, contract management and industry engagement among government officials, alongside a widespread lack of staffing and funding, appear to be major barriers to the implementation of research and innovation policy. The consultation indicated that the Government focuses on the design of policy but few "tools" exist to support its implementation, monitoring, enforcement or evaluation.

3.2. National institutions for research

The National Science, Technology and Innovation Act established the national institutional framework for research. Four organisations established by the Act are particularly relevant:

- **National Commission for Science Technology and Innovation (NACOSTI)**: NACOSTI develops the national STI priorities, leads inter-agency efforts to implement the policy, accredits research institutes and grants licenses to undertake research, decides on funding priorities, develops and enforces relevant regulations, and monitors progress in STI.
- **Advisory Research Committees (ARCs)**: ARCs advise NACOSTI on the programmes and projects required to implement the priorities identified in the national STI policy and maintain a database of existing research programmes, projects and facilities.
- **Kenya Innovation Agency (KENIA):** among others, KENIA is tasked with institutionalising relationships among research actors and between those and non-research actors, designating centres of excellence, disseminating scientific knowledge or technology, and developing the national capacity and infrastructure to protect and exploit research IP.
- **National Research Fund (NRF)**: NRF awards research contracts, grants and scholarships, finances the acquisition or establishment of research facilities, and supports research capacity building across the country.

Kenya's national framework for research, as established by law, appears well developed. The law assigns clear competences to national actors, and these cover the research process from production to diffusion. However, the research system faces clear challenges – as evidenced by both the analysis of publicly-available data and the stakeholder interviews. Firstly, the system is highly centralised, lacking autonomous (e.g. non-governmental) national research funders. Secondly, there seems to be some confusion and overlaps between the roles and responsibilities of national actors, with limited and insufficient coordination among government bodies: for instance, NACOSTI and KENIA share competencies on research coordination and priority-setting, while NACOSTI and the NRF share

competencies on research funding decisions. Thirdly, the consultation highlighted that national institutions have been poorly resourced: for instance, the NRF was given an initial budget of KSN 3 billion in 2013 to distribute as grant funding but did not have the physical staffing capacity to do so and therefore the annual budget has diminished to KSN 1.8 billion for 2019-20. Finally, tools and processes for monitoring research quality, standards and ethics appear inadequate.

4. Agents

4.1. Stakeholder mapping

Kenya has a fairly large number of active research stakeholders, both public and private (see Appendix B). Nationally, the Ministry of Education, Science and Technology sets and implements the research policy, but the Ministry of Agriculture, Livestock, Fisheries and Irrigation, the Ministry of Health and the Ministry of Industrial Innovation also play a role in commissioning specific research projects and have a direct relationship with NACOSTI. Kenya has a mixed university system comprising of 31 public universities and 30 private institutions. The country also has a relatively high number of think tanks undertaking research on: agricultural policy and technology (the Agricultural Information Resource Centre (AIRC) and the Kenya Agricultural & Livestock Research Organization (KARLO)); forestry (the Kenya Forestry Research Institute (KEFRI) economic management and development (Kenya Institute for Public Policy Research and Analysis (KIPPRA)); industrial policy and technology (the Kenya Industrial Research And Development Institute (KIRDI)); and medicine (the Kenya Medical Research Institute (KEMRI)). In addition, several private research institutes are also active in the country in the areas of agriculture, health and technology.

Kenya is also home to a large number of international stakeholders, positioning the country as the predominant research hub in East Africa. This research revealed that at least 14 international public research funders and four private research funders are active in the country. Building on its historically strong connections, the UK has a dominant presence in the country with nine active funders (see Appendix B). Several influential research intermediaries are also active, among which the African Academy of Sciences (AAS), the Inter-University Council for East Africa and the African Capacity Building Foundation (ACBF) are considered the most influential. The African Development Bank was singled out as a potential delivery partner in supporting capacity development given the importance R&D plays towards the Bank's goal of spurring sustainable economic development and social progress in its member countries. Finally, Kenya also hosts the headquarters of international research organisations and think tanks such as the Royal African Society, the Pan-African University (public), the African Population Health Research Centre, the Africa Institute for Capacity Development, and the African Economic Research Consortium (private).

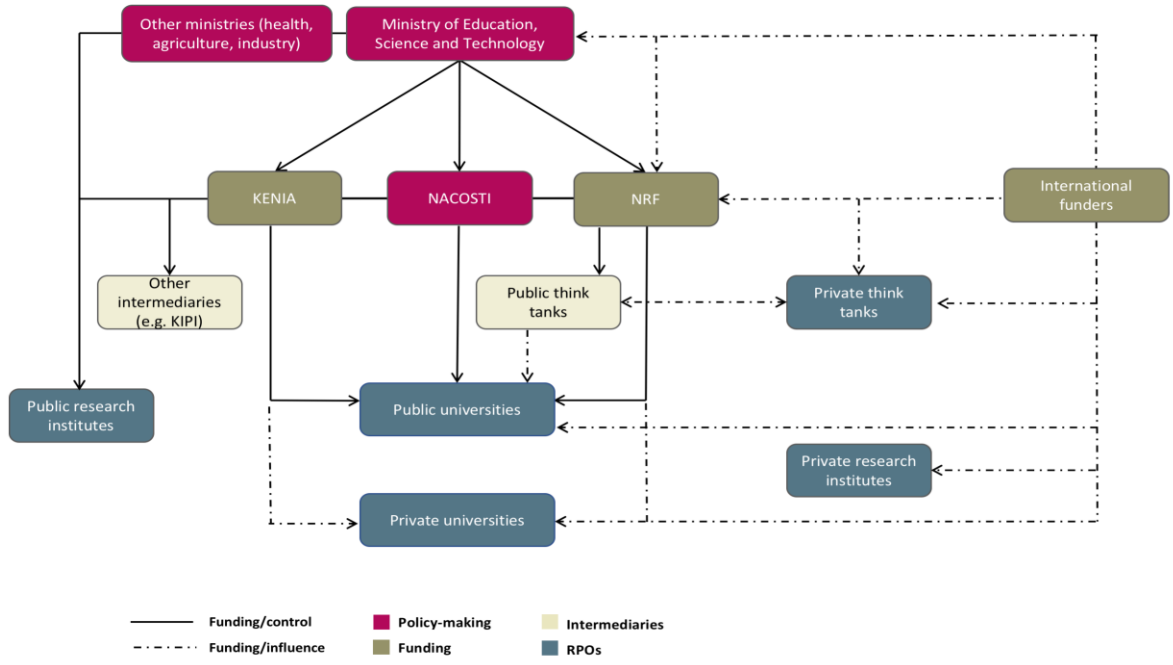
4.2. Relations and interdependencies

One of the main concerns highlighted by stakeholders is that the various research stakeholders within Kenya's national system do not seem to operate in a coordinated fashion. In particular, there seems

to be some disconnect between the national research policy and the research policies of universities, which is attributed to the lack of an implementation roadmap at the national level (see above). Interviewees reported a lack of coordination between NACOSTI (which sets the national research agenda), the NRF (which funds research at universities) and KENIA, which does not have sufficient funding to implement its plan. Efforts to promote coordination and alignment are underway as NRF, NACOSTI and KENIA each sit on each other's Boards, but stakeholders indicated that this has not yet resulted in meaningful coordination - especially around financial controls, consideration and monitoring of research ethics, and the processes for ensuring quality and standards.

Think tanks try to bridge gaps in research policy by acting as an intermediary between government, the research sector and industry, and by creating a platform that research organisations can use to advise policymakers. The consultation highlighted views that international collaborations can also play an important role in the national research system, but that building such relationships requires better mechanisms for both South-South and pan-African networking. Enhanced cross-border, interdisciplinary and/or discipline-focused networks counter these issues when they allow LMICs to take the lead in developing collaborative proposals. This does, however, require adequate and sustained investment in research management and infrastructure.

Figure 1. Stakeholder relationships in Kenya's research system



5. Research production

This section discusses the factors necessary for research production within a national system. It considers three components of a research system:

1. Research inputs, or the tangible assets that are directly connected with research production: human resources, financial resources and infrastructure.

UKaid from the British people

2. Research culture and support, or the enabling environment for research.
3. Research outputs, including the products of research and the incentives for producing research.

5.1. Research inputs

A. Human capital

Kenya hosts 225 full-time researchers per million inhabitants, lower than South Africa (493 per million) but much higher than the other countries considered in this study (e.g. Tanzania has 26.5 researchers per million inhabitants). However, a very low number of Kenyan researchers have PhD-level qualifications or equivalent: this is 32% considering only academic staff, but only 6.1% considering all R&D personnel working in government, private sector, non-profits and academia. By contrast, the proportion of all R&D personnel with doctoral qualifications across the other countries considered in this study is above 30%. Overall, 60% of researchers are employed in higher education, 20% in government and the remainder are split between private non-profit and commercial sectors. A 2014 directive issued by the Commission for University Education, which regulates the higher education sector, stipulated that lecturers had to obtain a PhD qualification November 2018 (then pushed back to October 2019) if they were to continue in their jobs. The initiative has faced criticism due to its extremely tight timeframe and it is unclear what impact it has had on the number of PhD qualifications awarded in the past few years, or indeed whether the deadline will be further postponed.

Only 1 in 5 researchers are female. This compares favourably to countries like Ethiopia (13% of researchers), but still lags considerably behind the African average of 31.6% female researchers. In Sub-Saharan Africa, South Africa is the only major country with a proportion of female researchers comparable to high-income countries (44.6%).

By contrast, Kenya lacks human capital in other research-related roles and national research institutions appear under-resourced. For instance, the NRF has five staff members and KENIA has only two. Staff are employed by the Directorate of Research, Science and Technology under the Ministry for Education, and complex hiring procedures have reportedly impacted these organisations' ability to hire more staff to implement their mandate. Similarly, research support staffing at universities is very limited (see section 5.2).

B. Research funding

Kenya's Gross domestic Expenditure in Research and Development (GERD) is almost 0.8% of the GDP, which is 95% higher than the average for Sub-Saharan Africa and four times the average for low income countries. However, in 2014, the Government committed to spend 1% of GDP on R&D (aligned with the wider commitment of African Union members). In 2010, Kenya spent USD85 per full-time researcher in current parity purchasing prices (000 PPP), considerably lower than the average for Sub-Saharan Africa in 2010 (USD150, 000 PPP). This may be connected to the finding that many Kenyan researchers are more numerous and less qualified (see above) compared to colleagues in other African countries, and therefore receive lower salaries on average.

NACOSTI expects every institution to spend at least 2% of turnover on research, with the objective of leveraging these funds to create partnerships, develop research collaborations and attract external funding. In reality, NACOSTI estimates that even the most research-intensive institutions are only spending circa 1% of government funding to leverage additional research income. 47% of Kenya's national GERD comes from international funders, revealing, on the one hand, Kenya's position as a regional hub for international research funding and, on the other hand, the large influence that international donors and funders have on the national research landscape. The high GERD from international donors is partly explained by the fact that the country is home to several international and regional research funding and research performing organisations, such as the African Academy of Science, the African Population Health Research Centre and the Pan-African University, among others. Despite the significant investment of external funding, some interviewees noted that there is a lack of confidence amongst funders to fund LMIC researchers directly. International donors therefore continue to fund Northern institutions on the basis that they involve LMIC partners, but little or no financial benefit is realised by those Southern partners.

According to OECD, more than 60% of R&D in scientific and technical fields is performed by industries, and 20% and 10% respectively by universities and government in the OECD area. The distribution of R&D expenditure is generally different in LMICs, with the government broadly playing a larger role. However, high R&D expenditures from higher education and the private sector are generally seen as positive (Table 3 in Appendix A proposes an adjusted GERD distribution for LMICs). In Kenya, GERD by business enterprise is 8.7% of the total, which is much lower than the figure for South Africa (41%) but still considerably higher than the other countries considered in this study. The lion's share of GERD comes from governmental sources (40.6%) and higher education (39.1%), but non-profit organisations also contribute a significant amount (11.6%). The consultation revealed that industry-led R&D is very limited, despite pharma, oil, energy, tobacco and agriculture multi-nationals having a major presence in the country and, indeed, across the continent. This may suggest that both multinationals and local companies see Africa as a market or a continent for low-cost production, but do not yet see it as an R&I hub.

Overall, stakeholder interviews consistently opined that research suffers from under investment from national governments across the continent, who are not fully recognising the value research and innovation can provide to the economy, albeit many have published national economic strategies which reference R&D as a central component of development. Moreover, they highlighted the need to increase NRF's ability to manage national research funding and to make the case for increased investment in research among government leaders. It was suggested that external funding could be used to demonstrate the benefits of R&D investment to national governments.

C. Research organisations

Kenya has a large network of research organisations, comprising 31 public universities (i.e. established and maintained out of public funds) and 30 private universities (which are established and largely funded by a private sponsor). Before introduction of the Universities Act 2012, the country had only 22 universities. Every university is expected to have some research activity, but capacity is limited, especially in those organisations which focus on learning and teaching. The World Economic Forum ranked Kenyan scientific institutions 45 in the world (out of 137 countries), only behind South Africa

(42) and Senegal (44) in Sub-Saharan Africa. Kenya was rated 4.3 in a range from 1 (extremely poor) to 7 (extremely good) in this area. Kenya also compares favourably against other Sub-Saharan African countries for the quality of its top institutions. Nine of Kenya's research organisations are included in the first 1000 globally according to Scimago's institutional rankings, a composite raking that combines indicators on research performance, innovation outputs and societal impact. Of these, five are universities: the University of Nairobi, Moi University, Jomo Kenyatta University of Agriculture and technology, and Egerton University (all ranked 719th globally and 26th out of 84 institutions in Africa). Kenyatta University ranks considerably lower at 41st out of 84 African institutions.

The research environment is strengthened by the presence of a large number of specialised think tanks and research institutes, both private and public, national and international (see Appendix B). Interviewees indicated that these specialised centres are responsible for the most impactful research generated in the country, which in part is because of their better links with Government. These institutes produce research in a variety of fields, with critical concentrations in the areas of agriculture, health and technology. Think tanks and research institutes are both government-funded and internationally sponsored.

5.2. Research culture and support services

A. Research culture

The consultation has consistently indicated that the government is yet to fully understand how to realise the socio-economic value of R&D and harness the impact of innovation, despite the recent (significant) policy advances. Consultees called for the government to be a more convinced user of research as a way to stimulate demand for impactful research and drive the agenda (see section 6.2).

The perceived lack of mechanisms to promote accountability in policy implementation, e.g. via data collection and review of research performance, quality, standards, ethics, etc., appears to be key challenge. At university level, the lack of accountability mechanisms for the use of research funding appears to have undermined incentives for research production and maintained universities' focus on teaching. As a result, while research institutions have become adept at negotiating with their funders in top-slicing their grants to cover overheads and establish research facilities, they have not been as resourceful in using research funds to create specialist research support functions or to invest in adequate research governance.

In Kenya, effective incentives for research production would improve research quality. However, expectations of research production are seen as unrealistic and unfair on academics considering the inadequate research infrastructure and the competing demands from the education agenda. Similarly, there does not seem to be a system of incentives for universities and social actors to engage in knowledge exchange activities (see section 6.2). The lack of both push and pull factors for research appears to be hampering the development of a national research agenda for sustainable development and limiting its positive impact on the Kenyan society.

B. Capacity building

The consultation process highlighted no national research capacity strengthening (RCS) activities. However, a number of international RCS initiatives are active in the country. For instance, the Consortium for Advanced Research Training in Africa's CARTA programme is an influential programme for strengthening doctoral training in Africa, which has been running for 10 years and provides an effective approach to strengthening capacity in specific areas. The ReMPro initiative has been mentioned as an example of activities designed to address gaps in institutional leadership, sustainability of the research management function (financial and people), establishment of research/research management standards and self-assessment tools for institutions, and capacity building and training.

C. Research support and administration

The consultation indicated that university-level processes, systems and governance structures for supporting research are rarely in place and that the autonomous structure of university departments fragments the limited existing research support capacity. Stakeholders mentioned that research support roles and funding are embedded in research projects and they do not exist as a standalone activity. For instance, the CARTA programme focuses mainly on strengthening academics' skillsets in research management more than strengthening the skills of staff in administration, library and ICT – thus reflecting a reality in which researchers often end up managing grants and projects with little or no support from their institution.

Scarce research support across Kenyan universities is a consequence of the limited importance given to research by institutional leaders. This has also led to a widespread lack of research management expertise amongst academic and support staff across all areas. The consultation revealed skills gaps in identifying funding, developing proposals, financial management and research uptake and innovation. There are pockets of good practice but these invariably were driven by funder intervention, for example the Carnegie-funded CAPRex initiative, the CARTA scheme, the Good Financial Grant Practice project and ReMPro, where were mentioned several times by stakeholders. Consultees pointed out that skills development will require far broader and more consistent intervention by the national government as well as research donors, and that may take a generation to create the necessary critical mass.

D. Infrastructure and data

The quality of the research infrastructure is poor outside of research-intensive institution. The consultation revealed that the physical infrastructure (laboratories, libraries, IT systems, etc) is often not fit-for-purpose and not conducive to a sustainable research environment. Poor research infrastructure is one of the factors contributing to the brain-drain from Africa to the western hemisphere, with many postgraduates continuing their studies overseas, where they have access to better resources for research.

The digital infrastructure of Kenya's research organisations should be seen within the broader national context. ICT is managed by the ICT Authority, a state entity that supports the development and deployment of ICT infrastructure in the country and its use for innovation. In the country at large, 26% of the population had access to the internet in 2017, just above the Sub-Saharan average of 22% but

far below the access rates of South Africa (56%), which is Sub-Saharan Africa's research powerhouse. Where an internet connection is accessible, average broadband speed of 69 kilobytes per second (kb/s) place Kenya far above neighbouring countries but far below South Africa (147kb/s) and high-income countries. Advances in mobile technology (4G and 5G networks) and the higher penetration of mobile devices are likely to reduce the digital divide, but investments in digital infrastructure will be needed to allow data-intensive research to be carried out across the country.

New universities, which are expected to have research activity, have virtually no research infrastructure in place. A 2018 NRF call for enhancing research infrastructure received 100 applications but only four were supported due to insufficient funding. Critical gaps in research infrastructure identified by consultees also concern research diffusion, with a publishing landscape dominated by western journals and publishers and a lack of infrastructure for Open Access in Africa.

5.3. Research output and evaluation

A. Research publications

Kenya has a relatively high production of academic literature, compared to other Sub-Saharan countries, as Scimago shows 3,209 scholarly papers were published in Kenya in 2018. This equates to 64 publications per million people - the second highest figure of all countries considered in this study – placing Kenya after only Ghana which had 104. In 2018, Kenyan publication contributed to 0.1% of the total global output. On average, almost 50% of the papers published in the last five years were open access. With regards to the quality of the scientific publications produced in Kenya, the average publication received 18.59 citations in the 1996-2018 period, ranking Kenya 51 out of 236 countries by the number of citations per publication. Similarly, Kenya's h-index (which measures both the productivity and citation impact of scientific publications) ranks Kenya 54 out of 236 countries. This has to be seen in the context of a broader pattern of international collaboration, which account for over 80% of all publications recorded on Scimago.

While both productivity and citation of Kenyan authors' scientific publications is connected to the large number of international collaborations and international research funding in the country, the relationship is not linear. Informant interviews suggest that Northern research tend to be cited as lead authors because they are the main funding recipients, and therefore those researchers and institutions benefit from more visibility than research partners in LMICs.

B. Research ethics and evaluation

The Directorate of Research, Accreditation and Quality Assurance is responsible for registration of research institutions, accreditation and quality assurance, licensing, monitoring and evaluation of research programmes and projects. NACOSTI's research priorities document states that monitoring and evaluation of the performance of the identified research priorities will be conducted by NACOSTI through collection and analysis of administrative data and periodical R&D reviews. However, it is unclear to what extent the evaluation of research projects takes place in practice. NACOSTI's strategic plan recognises monitoring and evaluation reporting systems as a weak point and aims to address this. Interviewees suggest that NACOSTI performs no meaningful quality assurance due to financial constraints and that universities encourage academics to publish – prioritising quantity over quality.

Moreover, there does not seem to be any incentive for academics to demonstrate that their research has a material impact on society.

Research licences are based on ethical clearance given by institution-based ethics committees, but resource constraints mean they cannot fulfil their QA role.

6. Research diffusion

This section focuses on the stakeholders and practices underpinning the dissemination of scientific research and its use by different stakeholder groups within the country and internationally.

6.1. Actors and networks

A. National users of research

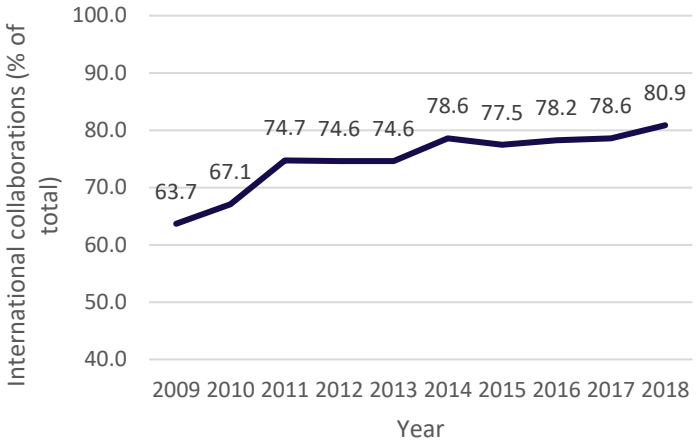
The consultation indicated that neither the government nor the business community are habitual users of research. Data from the World Economic Forum show that the Kenyan government's purchasing decisions have an average impact in fostering technological innovation, and the score has been steadily increasing over the past five years. However, interviews revealed that the Government has shown an interest only in some areas of research, prioritising ICT and software in recent years but neglecting other areas of science.

Kenyan businesses have a relatively high capacity to absorb cutting-edge technology in their production systems which are more readily available than in other African countries. These indicators do not prove firms' connection with the national research system, as technology absorption often comes through internal practices and technology transfers within multinational companies and not straight from the lab bench. However, Kenya also has a relatively high performance for university-business collaborations. This partly contradicts perceptions from interviewees who stressed that the practicalities, costs and value of the commercialisation/spin-out reinvestment model, and the actions required to create and maintain sustainable business systems, are yet to be understood by both the government and the commercial sector. They also suggested that, in order prove the value of research for innovation and economic development and generate higher level of awareness, Kenya needs some success stories – promising technologies and profitable spin offs emerging from its research system.

B. *International exposure*

As seen above, almost half of Kenya's research budget comes from international sources. However, the proportion of publications that are based on an international collaboration is much higher. Scimago data shows that in 2009 just under 64% of the total number of publications were linked to an international collaboration, and this went up to almost 81% in 2018. Kenya's main research partners are the US, the UK, South Africa, Germany and the Netherlands. While international partnerships have a positive influence on Kenya's research visibility, such a high volume casts further doubts about the visibility of Kenya's locally-led research. The citation data in section 5.3 should also be seen in this light.

Figure 2. International collaborations in scientific publications (% of total)

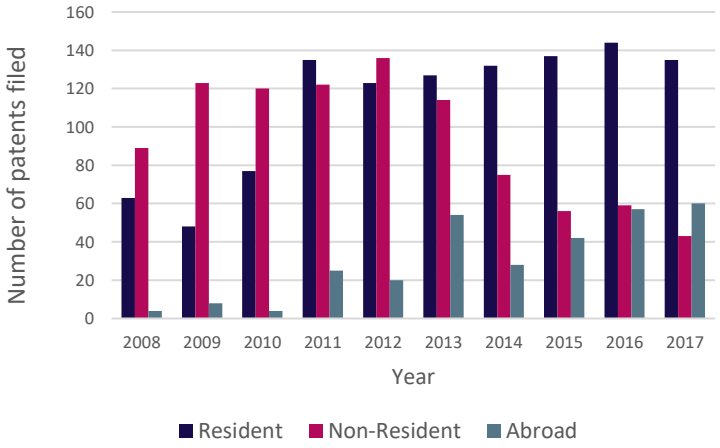


6.2. *Knowledge exchange practices*

A. *Intellectual property*

Kenya has a national body for the protection of intellectual property, the Kenya Intellectual Property Institute (KIPI). Moreover, the country is a member of the African Regional Intellectual Property Organisation (ARIPO). Kenya filed only 0.2 patents per million inhabitants under the Patent Cooperation Treaty (PCT). The total number of patents registered in the country from residents has been increasing over the past few years and totals 1121 between 2008 and 2017 (see Figure 3). By contrast, only 302 patents were filed by Kenyan nationals abroad. This compares well with other SRIA countries but still places Kenya towards the bottom of global rankings (90th among 119 countries).Within the African context, Kenya is currently ranked 6th out of 21 Sub-Saharan countries, andalmost all of the countries ranked lower globally come from Africa. Kenya's number of patent applications also compares unfavourably with South Africa (5.8 per million inhabitants).

Figure 3. Number of patents filed in Kenya



UKaid from the British people

B. Knowledge exchange support and administration

Kenya is comparatively active in knowledge exchange (KE). At the policy level, the Sector plan for STI sets a goal to "establish an effective and efficient system for innovation connecting all actors in the STI chain". In order to achieve that goal, the plan seeks to, among other things:

- Establish a Knowledge Information Management System to provide research-related information to STI institutions;
- Promote innovative technology transfer practices to enhance and generate new ideas through advances in technologies and innovativeness of the fundamental component of STI;
- Incentivise research actors to publish and present to stakeholders and policy makers relevant reports and policy briefs and to reference information available on STI.

Moreover, under the Universities Act of 2012, universities have the objective to promote private-public partnerships in education and development, while representatives from the private sector have an active role in selecting the members of the Commission for Universities, which regulates the sector at the national level. The World Economic Forum gives Kenya a score of 4.3 out of 7 for university-industry collaborations, ranking the country 32nd worldwide and 3rd in Africa.

However, these encouraging results seem at odds with stakeholder perceptions, which report a lack of KE support in research organisations. Interviews with NACOSTI and the NRF revealed that, outside of a small group of research-intensive universities, Kenyan research organisations do not have a KE or technology transfer office, lack knowledge and capacity to perform KE activities and struggle to build connections with non-academic actors. Moreover, no system of incentives is in place for academics to engage in KE activities whilst the private sector has a limited appetite for university-industry collaborations. It is possible that KE collaborations happen largely in the context of international research programmes as opposed to domestic dynamics. However, we have not been able to collect sufficient information to prove or disprove this hypothesis and the state of knowledge diffusion and university-industry collaborations in the country remains unclear. The research dissemination and utilisation/uptake process however is not yet working except for a limited number of think tanks.

7. Needs assessment

This section summarises the overall score of each component of the research system using a 7-point scale (see Appendix A). Research system component scores are calculated as an average of all indicator scores within it (see Table 4). All research system components are assigned a component ID (see Table 1). The aim of this exercise is to show which components are most deficient. However, there is no exact equivalence between a low score for one component and identification of needs since different components have a different impact on the system. Section 8 discusses other considerations that influence the choice of priorities for action, such as the feasibility of interventions.

Kenya's political economy presents critical challenges for research, which are both political (governmental instability and perceived corruption) and economic (poverty and non-competitive digital infrastructure). Looking at individual indicators in isolation, the areas in which Kenya struggles the most are all related to the political and economic context of the country rather than the aspects more directly related to research. The importance of research is acknowledged at the highest level,

and the country's national policy and institutional frameworks appear strong on the surface. This suggests that Kenya's research system is performing well relative to the political-economic context and the country is, in fact, among the best in Sub-Saharan Africa. In particular, the country hosts a good number of research organisation performing internationally recognised research and innovation (RCS8, score 5.5/7).

Kenya does have considerable unmet needs, however, and an overall deficient research system. Averaging scores of 3.3/7, improving policy implementation and monitoring, and better resourcing institutions (RSC4) is a key need, reflecting problems of government ineffectiveness. Moreover, high-level policy ambitions are undermined by under-investment in the research sector (RCS7, score 3.7/7). As a result, research production is overall uncompetitive. Kenya has a high number of R&D staff and researchers compared to other SRIA countries, yet a very low proportion of those are qualified at PhD level. Kenya relies on international funding for about half of its national research expenditures, which encourages the production of knowledge for audiences in far off distant countries. Most critically, averaging 2.7/7, universities are neither incentivised nor equipped to perform high-quality research (RSC11), and the burden is left to individual academics to design, fund and manage their own research projects (RSC9, 3/7).

In contrast with stakeholder perceptions, Kenya appears to perform better on research diffusion. In particular, research benefits from considerable international exposure from collaborations (RSC16, 6/7), and a high number of publications and citations (RSC13, 4.8/7). Kenya also scores slightly above average (4.3/7) on indicators concerning the transfer of knowledge to non-academic actors (RSC15) and the protection of intellectual property (RSC17, 5/7), despite there being a lack of an overarching KE strategy or approach. However, scoring just 4/7, the country's research evaluation system shows room for improvement (RSC14).

Table 1. Scoring of research system components

Section	Research system component	Score	Component ID
National context	Social and political context	3.2	RSC1
	Economic context	3.3	RSC2
	Section average	**3.3**	-
Policy and institutional framework	National policy for research	4.2	RSC3
	National institutions for research	3.3	RSC4
	Stakeholder composition & relationships	3.7	RSC5
	Section average	**3.7**	-
Research inputs	Human capital	3.8	RSC6
	Research funding	3.7	RSC7
	Research organisations	5.5	RSC8
	Section average	**4.3**	-
Research culture and support	Research culture	3	RSC9
	Capacity building	4	RSC10
	Research support	2.7	RSC11
	Infrastructure and data	3.5	RSC12

	Section average	**3.3**	**-**
Research outputs and evaluation	Research publications	4.8	RSC13
	Research evaluation	4	RSC14
	Section average	**4.4**	**-**
Knowledge exchange (KE) actors and networks	National users of research	4.3	RSC15
	International exposure	6	RSC16
	Section average	**5.1**	**-**
KE practices	Intellectual property	5	RSC17
	KE support and administration	3.4	RSC18
	Section average	**4.2**	**-**

8. Recommendations

8.1. Identification of priorities

This section identifies options for research capacity strengthening in Kenya by looking at the low-scoring indicators and considering their overall impact on the research system and their tractability, or the feasibility of external interventions in that area. Three areas appear important:

- **Support implementation capacity across national institutions**. Improving government ineffectiveness appears to be a key opportunity to push the research agenda. Building national capacity not just among funding councils (NRF) but also policymakers (NACOSTI) and intermediaries (KENIA) is crucial. Support should be targeted and focus on implementation problems identified by the beneficiaries, including the clear challenges emerging around measuring, monitoring and enforcing policy.

- **Promote research quality**. Creating national mechanisms for research quality evaluation and increasing NACOSTI's capacity to monitor research quality in the country is also important. The consultation revealed that research is not valued for its contribution to the economy and society, but instead is promoted as a vehicle for leveraging external funding. By focusing on research quality, interventions can be tied with the impact agenda of Vision 2030 and be aligned with government priorities. To achieve that, 'research quality' should be defined by national stakeholders, perhaps with stronger links to development objectives over publication or citation-based notions of scientific excellence.

- **Strengthen the role of national intermediaries**. The needs assessment revealed an important role played by national stakeholders such as KEMRI in bridging the gap between research and policymakers. Government-funded think-tanks play a much more central role in Kenya than they do in high-income countries, but they are often limited by lack of funding and capacity. These actors can help create a platform for research to influence policy and practice, and their work has the potential to elevate the importance of research among policymakers. Moreover, they could be made even more central in disseminating bodies of evidence rather than promoting their own research.

8.2. Conclusions

Kenya's research system is deficient but not undeveloped. The country has a large number of established international players with existing long-standing relationships with local stakeholders, ranging from non-governmental organisations such as the AAS to intergovernmental organisations like the African Development Bank. It also has an established layer of national policies and institutions that, whilst under-resourced, are significant actors domestically. In order to achieve systemic impact on the research system, Kenya therefore offers development donors the possibility of working with national institutions.

The review showed a gap in research support capacity across Kenya's universities, which highlights the importance of initiatives like ReMPro. However, three factors would seem to undermine the long-term impact of capacity strengthening in research organisations. First, the lack of clear incentives to invest in research and to prioritise research quality at institutional level (which affects the sustainability of interventions); second, the disparity in research capacity among Kenyan universities, most of which have no capacity for research (which affects the reach of such interventions); finally, there is a risk that institutions join capacity strengthening programmes in order to attract international funding (which is a stated goal of NACOSTI) and not with the purpose of creating a support system for high-quality research.

For these reasons, initiatives that support national-level capacity and commitment to research are likely to have a more systemic impact on research in Kenya, and they are ideally placed to complement organisation-level interventions. In sum, organisation-level interventions without system-level changes to policy, incentives and capacity seem unlikely to produce long-term impacts. We recommend assessing whether capacity-strengthening should be delivered across the national institutional landscape, particularly considering the role of policymakers (NACOSTI) and intermediaries tasked with translating research into policy and practice (such as public think tanks).

Appendix A – Full list of indicators and scores

Table 2. How to read the scales

Score	1	2	3	4	5	6	7
Qualitative indicators	Very poor	Poor	Somewhat poor	Neither poor nor good	Somewhat good	Good	Very good
Quantitative indicators	Very low	Low	Below average	Average	Above average	High	Very high

Table 3. Score conversion table

Data type	Description	Score conversion
Absolute country rank	Country ranks are converted to scores by dividing the total number of countries ranked in seven groups of equal size and then positioning the country in one of the seven groups.	Variable based on number of ranked countries
Country scores (1-7)	A number of indicators have already been scored on a 1-7 scale. Decimal numbers will be rounded up or down to their closer whole number.	Maintained (rounded)
Country score (1-16)	Freedom House (FH) scores freedom of expression and belief from 1 to 16. We convert the score to 7, but consider performance of the sub-rating "academic freedom" when rounding up the overall score for freedom of expression.	FH score 1-2 = Needs Assessment score 1; 3-5 =2; 6-7 =4; 8 =5; 9-10 =6; 11-16 =7
Percentile score / percentile rank (1-100)	This scale uses a 1-100 score, generally with 0 indicating the lowest score and 100 the highest (in a few cases, 0 is the best score and 100 the worst). Scores are divided in 7 groups, and the score is given depending on what group a country falls under. Note that percentile score is expressed differently from the percentage value (%) which indicates quantity.	Original score 1-14 = Needs Assessment score 1; 15-28 = 2; 29-43 = 3; 44 – 58 = 4; 59-72 = 5; 73-86 = 6; 87-100 = 7.
University rankings	A score is assigned based on the position in the combined position on the global rankings of the country's top three universities (sum of individual rankings divided by three).	1-500= 7; 501-1000= 6; 1001-2000= 5; 2001-3000= 4; 3001-5000= 3; 5001 -8000 =2; 8001+ =1
Percentage values	Indicators such as literacy rates, access to internet etc are measured with percentage values (%). For percentage values, scores are given based on a country's performance relative to other countries.	Relative to other countries' performance

Data type	Description	Score conversion
Yes/No	Some indicators are scored using a binary system, e.g. whether a country has a or has not a research strategy. Where additional qualitative evidence is available, this will be reflected in the score. Where no additional evidence is available, Yes is equated with the median point of the high rating (6) and No is scored with the median of the low range (2).	When no additional qualitative evidence is available: Yes = 6; No = 2
GERD per capita	We use the 1% African Union target as best outcome (score 7), and modify the score based on the actual GERD. GERD higher than 1% is scored 7.	GERD 0-0.2% = score 1; 0.3-0.5% =2; 0.6-0.8% =3 0-9-1.1% =4; 1.2-1.4% =5; 1.5-1.7% =6; 1.8-2% =7
GERD funding from abroad	The extent to which external funding in R&D is seen positively or negatively depends on many factors. For instance, foreign investment in business R&D is seen as a positive tech transfer opportunity, whilst excessive dependence on foreign funding in HE R&D is rated negatively. Based on existing studies, we take 35% as an optimal value for GERD from abroad for LMICs. Deviation from optimal value is rated negatively.	Deviation (+ or -): 0-5% =7; 6-10% =6; 11-15% =5; 16-20% =4; 21-25% =3; 26-30% =2; <31% =1
GERD performance by sector	We use the following GERD distribution as optimal (based on a slightly modified distribution from the OECD estimate to take into account LMICs unique circumstances): business enterprise = 50%; HE = 25%; government = 15%; non-profit = 10%. Deviation from this distribution is rated negatively.	Total deviation: up to 20% = 7; 21-35% = 6; 36-50 =5; 51-65% =4 66-80 =3; 81-95 =2; <96% =1
Number of journals listed in Scimago	A high number of local journals is positively correlated with research diffusion.	0-5 journals =1; 6-10 =2; 11-20 =3; 21-30 =4; 31-40 =5; 41-50 =6; <50 =7
Internet speed	We consider internet speeds of around 2MB per second sufficient to browse the net for research, considering download and upload times for documents (score 4). Lower speeds are insufficient for any research activities, higher speeds are necessary for data-intensive research.	0-500kb/s =1; 501-1MB/s =2; <1-2MB/s =2; <2-5MB =4/ <4-10MB/s =5; <10-15MB/s =6; <15MB/s =7
Country income classification	The World Bank identifies further groupings based on their average GDP per capita: Low income = average $787; Least developed countries = average $1,072; Lower middle countries = average $2,209; Middle income = average $5,282; Upper middle = average $8,610; OECD countries = average GDP $45,721; High income = average $47,892.	Low income = 1; Least developed = 2; Lower middle = 3; Middle income = 4; Upper middle = 5; High income = 6; Very high income = 7
Poverty	The score is based on the percentage of population living with less than $1.9/day, using World Bank estimates.	40% or more =1; 25-39% =2 15-25% = 3; 10-15% =4; 9-5% =5; 1-3% =6; less than 1% =7
Urban/rural divide	We assume that there is a positive correlation between the proportion of people living in cities and research. We see a proportion of urban v rural dwellers above 50% as optimal, while lower proportions are rated negatively.	1-10%=1; 11-18%=2; 19-26% =3; 27-34% =4 35-42%=5 43-50%=6; >51%=7
Literacy rate	Low literacy is negatively correlated with research. Given the international standards of literacy, we weight low literacy more heavily than relatively high literacy and only give full score to those countries where almost all the population is literate.	1-20%=1; 21-40%=2; 41-60%=3; 61-75%=4; 76-85%=5; 86-95%=6; 96-100%=7

Table 4. Kenya research system performance

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
National context					
Social and political indicators (RSC1)					
Social and political factors	Working language	English, Kiswahili	-	No direct impact on research performance	[1]
	Total population	51.3 million	-	No direct impact on research performance	[2]
	Urban population (% of total)	27%	2	Kenya has a low proportion of urban dwellers, which is negatively correlated with HE and research	[2]
	Type of government	Democratic	-	No direct impact on research performance	[3]
	Political stability	13/100	1	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Rule of law	41/100	4	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Regulatory quality	43/100	4	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Government effectiveness	30/100	4	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Voice and accountability	40/100	3	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Corruption (ranking)	144/180	2	See table 3. Ranking goes from 1 (best) to 180 (worst)	[5]
	Access to information	113/150		See table 3.	[6]
	Freedom of expression	10/16	4	See table 3. Rated 'partly free'	[3]
	Adult literacy rate (% population aged 15+)	79%	3	Literacy rates are lower than the global average but on average for LMICs	[7]
	Gender Development Index	0.931	5	Women's achievements in health, education and command are lower than men's, underlying gender inequality in line with the African and LMIC average	[8]
Economic indicators (RSC2)					
Economic development	GDP per capita USD	$1,710	3	See table 3.	[9]
	Agriculture, value added (% of GDP)	34%	-	No direct impact on research performance	[9]
	Manufacturing, value added (% of GDP)	11%	-	No direct impact on research performance	[9]
	Population living in poverty ($1.9/day)	36.8%	2	See table 3.	[9]
Digital infrastructure	Access to internet (ranking out of 137)	104/137	2	See table 3.	[10]
	Individual using Internet/100 people	26/100	-	Scored under 'Access to internet'	[10]
	Broadband internet subscription/100 people	0.3/100	-	Scored under 'Access to internet'	[10]
	International internet bandwidth, kb/s per user	69	1	Broadband speed is very slow and inadequate for all types of research. See table 3	[10]
	Mobile internet subscriptions/100 pop	26/100	6	Mobile internet is on the rise, but 4G connections are not widespread. See table 3	[10]
Competitiveness	Global Competitiveness Index (ranking 2018)	91/137	4	See table 3	[10]
	Overall technology readiness	3.7/7	3	See table 3	[10]
	Capacity for Innovation	4.3/7	4	See table 3	[10]

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
	Innovation index	30/100	3	See table 3	[11]
Policy and institutional framework					
National policy for research (RSC3)					
National policies	Existence of a national research policy	YES	5	See section 3.1	Interview
	Existence of sector-specific research policies	YES	5	See section 3.1	Interview
	Research policy updated in the last 10 years	Partly	4	See section 3.1. Vision 2030 and STI plan are 11 years old, but review underway	[11]
	Existence of an appropriate Strategy for STI	NO	3	See section 3.1. STI policy only in draft form.	[11]
	Capacity development is part of the Strategy	YES	5	It is part of the *draft* STI policy	[11]
	Country has appropriate indicators tracking R&D	NO	3	The 2012 innovation report mentions African STI indicators (ASTII), but these are not used in practice	[11]
National institutions for research (RSC4)					
National institutions	The country has a ministry or department for research	YES	6	See section 3.2. Directorate of Research, Science and Technology	Interview
	The ministry/department for research is sufficiently resourced	NO	2	NACOSTI testified that they (and NRF and KENIA) are under-resourced.	Interview
	The country has one or more national research funders	YES	6	Kenya has two national funders: NRF (basic & applied research); KENIA (R&D)	Interview
	The research funders have sufficient financial resources	NO	3	Insufficient financial resources to administer research funds (see NRF interview record) or to provide support to sector.	Interview
	Research funder management capacity	NO	1	National research funding pot has reduced from 3bn KSN to 1.8bn KSN because insufficient capacity to manage funds	Interview
	The country has a national research ethics body	NO	2	No national ethics body. NACOSTI relies on institution-based ethics committees as part of its research licensing process.	Interview
Stakeholder composition and relationships (RSC5)					
Stakeholder composition	Clarity of relationships between national actors	Partial	4	See section 4.2	Interview
	Clarity of decision-making and accountability processes	Low	2	See section 4.2	Interview
	Level of coordination between government department	Above average	5	NRF, NACOSTI and KENIA each sit on each other's Boards to promote coordination and alignment	Interview
	Cohesion between policy mechanisms	Low	2	KIPPRA explained that the national emphasis is on policy development with very little regard for implementation, monitoring or evaluation.	Interview
	Level of participation in decision-	High	6	Government-sponsored and independent think tanks	Interview

UKaid from the British people

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
	making/standard-setting			engage with and influence government policy, suggesting a good level of participation.	
	Quality of monitoring & enforcement mechanisms (M&E)	Somewhat poor	3	Little evidence to suggest M&E mechanisms are in place, and there is limited funding to purchase M&E tools/systems	Interview
Research inputs					
Human capital (RSC6)					
Human capital	Total R&D personnel per million people (FTE)	1029.4	6	See table 3	[12]
	Researchers per million inhabitants (FTE)	225	5	See table 3	[12]
	Researchers (FTE) - Business enterprise	11.4%	2	See table 3	[12]
	Researchers (FTE) - Government	20.2%	4	See table 3	[12]
	Researchers (FTE) - Higher education	60.7%	5	See table 3	[12]
	Researchers (FTE) - Private non-profit	7.7%	5	See table 3	[12]
	Researchers (FTE) - Female	20.2%	2	See table 3	[12]
	Researchers (FTE) with ISCED 8 %	6.1%	1	See table 3	[12]
Research funding (RSC7)					
Research funding	Total GERD (in current PPP$, 2010)	788,221,000		-	[12]
	GERD per capita (%GDP)	0.8%	3	See table 3	[12]
	GERD per researcher FTE (in current 000 PPP$)	$84.7	-	Indirect measure (GERD/number of research). Not scored as high numbers may be due to inefficiencies.	[12]
	GERD financed by abroad (% total)	47.1%	5	See table 3	[12]
	GERD performed by: business (% total)	8.7%	3	See table 3	[12]
	GERD performed by: gov (% total)	40.6%			[12]
	GERD performed by: HE (% total)	39.1%			[12]
	GERD performed by: private non-profit (% total)	11.6%			[12]
Research organisations (RSC8)					
Research organisations	Average quality of research organisations	45/137	5	See table 3	[10]
	Global ranking of University of Nairobi	719/3471	6	See table 3	[13]
	Global ranking of Moi University	719/3471		See table 3	[13]
	Global ranking of Jomo Kenyatta University of Agriculture and Technology	719/3471		See table 3	[13]
Research culture and support					
Research culture (RSC9)					
Research culture	Perceptions of the utility of research	Low	3	See section 5.2	Interview
	Time allocated to research	N/A	-	N/A	Interview
Capacity building (RSC10)					
Capacity building	Overall research training capacity	Below average	3		Interview

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
	Local availability of specialized training services (not research specific)	4.7/7	5	N/A	[10]
	Funding for Research Capacity Strengthening	N/A	-	N/A	
	% HEI with PhD programmes	N/A	-	N/A	
Research support (RSC11)					
Research support	Level of access to proposal writing support	Somewhat low	3	Evidence of limited research support across Kenyan universities, but pockets of good practice linked to international programmes	Interview
	Existence of institutional policies	Low	2	No evidence of institutional policies on research support and administration	Interview
	Quality of administrative support	Somewhat low	3	Limited capacity	Interview
Infrastructure and data (RSC12)					
Infrastructure and data	Is there a research data repository?	Yes	5	NACOSTI maintains the repository	Interview
	Quality of research infrastructure	Low	2	See section 5.1	Interview
Research output and evaluation **Products of scientific research (publications and patents) and incentives for producing research**					
Research publications (RSC13)					
Research publications	Total # of publications (2018)	3,209	-	Not scored, dependent on population size	[14]
	Total # of citable publications	2,840	-	Not scored, dependent on population size	[14]
	Citations per publication (1996-2018)	18.59	-	Scored by ranking (below)	[14]
	Citations per publication ranking (1996-2018)	51/236	5	See table 3	[14]
	H index ranking	54/136	5	See table 3	[14]
	# Journals listed in SciMago	6	2	See table 3	[14]
	Scimago country ranking 2018	67/239	6	See table 3	[14]
	Percentage of papers in 10% most-cited papers (2008–2012)	11.3%	6	The G20 average is 10.2%	[15]
	% of total publications for Africa	4.18%	-	Negative outlook (declined from 6% in 10 years)	[14]
Research evaluation (RSC14)					
Research evaluation	Existence of national mechanisms for research quality evaluation	Yes (partly)	4	See section 5.3	Interview
	Quality of incentives for research production	Average	4	The only incentive is to publish, not to demonstrate scientific impact of research	Interview
Knowledge exchange (KE) actors and networks					
National users of research (RSC15)					
National users of research	Firm Level Technology absorption	5.1/7	5	See section 2	[10]
	FDI and Technology Transfer	4.8/7	5	See section 6.1	[10]
	Gov't procurement of technology products	4.0/7	4	See section 6.1	[10]

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
	Government use of research information/products	Low	3	Little evidence to suggest government has utilized research outputs/outcomes	Interview
International exposure (RSC16)					
International exposure	International collaboration 2018 (% of total)	80.87%	6	As this indicator measures international exposure, higher percentages are better. See section 6.1	[14]
	Main foreign partners	4/5 North-South	-	USA, UK, South Africa, Germany, Netherlands	[14]
Knowledge exchange practices					
Intellectual property (RSC17)					
Intellectual property	Country has a body in charge of intellectual property protection	YES	7	See section 6.2	[16]
	Country is member of a regional IP organisation	YES	6	See section 6.2	[16]
	Number of patents applications per million people (global ranking)	90/119	2	See section 6.2	[10]
	Number of patents applications per million people (African ranking)	6/21	-	Scored by global ranking only	[10]
KE support and administration (RSC18)					
Knowledge exchange support and administration	Country has joined a regional initiative for the promotion of STI	YES	6	See table 3, see African Union section 5.1	[11]
	University-Industry collaboration (score)	4.3	4	University-industry collaboration in Kenya is above average for sub-Saharan African countries which is 3.5. KENIA confirmed that U-I collaborations are uncommon	[10]
	University-Industry collaboration (ranking)	32/137	-	Scored above.	[10]
	Existence of appropriate institutional policies for KE	Partial	3	Research-intensive universities only. See section 6.1.	Interview
	Quality of incentives for research diffusion	Very low	1	There are no incentives for researchers to engage in research dissemination, uptake, IP, commercialization	Interview
	Existence of commercial office	Partial	3	Research-intensive universities only. See section 6.1	Interview

Appendix B – Kenya stakeholder table

Table 5. Non-exhaustive list of the main research stakeholders in the country.

	National		International	
	Public	Private	Public	Private
Policymakers	• Ministry of Education, Science and Technology • Ministry of Agriculture, Livestock, Fisheries and Irrigation • Ministry of Health		• African Union Commission	
Research funders	• Kenya National Innovation Agency (KENIA) • National Research Fund (NRF)		• European Commission • World Bank • UKRI (UK) • DFID (UK) • Department for International Trade (UK) • International Development Research Centre (Canada) • Norwegian Agency for Development Cooperation (NORAD) • Swedish International Development Agency (SIDA) • The Netherlands Directorate-General for International Cooperation (DGIS) • Academy of Medical Sciences (London) • British Council • British Academy • Royal Academy of Engineering	• Bill and Melinda Gates Foundation • Carnegie Corporation of New York • Wellcome Trust • William and Flora Hewlett Foundation

			• Royal Society	
Intermediaries	• National Commission for Science, Technology and Innovation (NACOSTI) • Kenya Industrial Property Institute		• African Academy of Sciences • African Union Development Agency • UK Science Technology and Innovation Network • OECD • African Capacity Building Foundation	• East African Science & Technology Commission • Inter-University Council of East Africa
Universities	• 31x public universities	• 30x private universities	• Pan African University	
Think Tanks & research institutes	• Agricultural Information Resource Centre • Kenya Forestry Research Institute (KEFRI) • Kenya Industrial Research Institute (KIRDI) • Kenya Medical Research Institute (KEMRI) • Kenya Agricultural and Livestock Research Organization (KALRO) • Kenya Marine and Fisheries Research Institute • Kenya Institute for Public Policy Research and Analysis (KIPPRA) • National Crime Research Centre • Kenya Veterinary Vaccines Production Institute	• Center for Research and Technology Development • Rift Valley Institute • Agricultural Information Resource Centre • Academic Model Providing Access to Healthcare (AMPATH) • Technology and Innovation (PAUSTI) • Tegemeo Institute of Agricultural Policy and Development	• Royal African Society	• African Population Health Research Centre • Africa Institute for Capacity Development • Academic Model Providing Access to Healthcare (AMPATH) • International Livestock Research Institution (ILRI) • The International Centre of Insect Physiology and Ecology (ICIPE) • The World Agroforestry Centre (ICRAF)African Economic Research Consortium • African Technology Policy Studies Network

Appendix C - Interviewees

Name	Organisation
Allen Muyaama Mukhwana	African Academy of Sciences
Dr Tom Kariuki	African Academy of Sciences
Marjorie Moraa Okora	African Capacity Building Foundation
Olga Otieno	African Capacity Building Foundation
Dr Grace Amurle	African Economic Research Consortium
Dr Innocent Matshe	African Economic Research Consortium
Sandra Coyle	African Economic Research Consortium
Dr Witness Simbanegavi	African Economic Research Consortium
Dr Anne Khisa	African Population Health Research Center
Dr Evelyn Gitau	African Population Health Research Center
Christine Kariuki	KENIA, NRF, NACOSTI & MoE
Margaret Muthee	KENIA, NRF, NACOSTI & MoE
Dr Roselida Owuor	KENIA, NRF, NACOSTI & MoE
Dr Salome Guchu	KENIA, NRF, NACOSTI & MoE
Dr Rose Ngugi	Kenya Institute for Public Policy Research & Analysis
Sarah Odera	Strathmore Energy Research Centre, Strathmore University

Appendix D – Peer reviewers

The following table includes a list of individuals who peer reviewed the present report and whose support we gratefully acknowledge.

Name	Organisation
Ajoy Datta	On Think Tanks
Robin Drennan	The University of the Witwatersrand
Yaso Kunaratnam	UK Collaborative on Development Research

Appendix E – Key data sources

[1] Foreign and Commonwealth Office, "Living in Kenya," 2019. [Online]. Available: https://www.gov.uk/guidance/living-in-kenya. [Accessed 13 September 2019].

[2] World Bank, "Population," 2019. [Online]. Available: https://data.worldbank.org/indicator/SP.POP.TOTL?view=chart. [Accessed 15 May 2019].

[3] Freedom House, "Freedom House," 2019. [Online]. Available: https://freedomhouse.org/. [Accessed 15 May 2019].

[4] World Bank, "World Governance Indicators," 2019. [Online]. Available: https://info.worldbank.org/governance/wgi/#reports. [Accessed 10 May 2019].

[5] T. International, "Corruption Perceptions Index," 2018. [Online]. Available: https://www.transparency.org/cpi2018. [Accessed 27 June 2019].

[6] Right to Information, "Global Right to Information Rating," 2016. [Online]. Available: https://www.rti-rating.org/country-detail/?country=Kenya. [Accessed 7 July 2019].

[7] World Bank, "Literacy," 2019. [Online]. Available: https://data.worldbank.org/indicator/SE.ADT.LITR.ZS. [Accessed 2 July 2019].

[8] United Nations Development Programme, "Human Development Indicators," 2018. [Online]. Available: http://hdr.undp.org/en/countries/profiles/KEN. [Accessed 27 June 2019].

[9] World Bank, "GDP," 2015. [Online]. Available: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD. [Accessed 2 July 2018].

[10] World Economic Forum, "Global Competitiveness Index 2017-2018," 2017. [Online]. Available: http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings. [Accessed 5 July 2019].

[11] African Capcity Building Foundation, "Africa Capacity Report 2017: Building Capacity in Science, Technology and Innovation for Africa's Transformation," ACBF, Harare, 2017.

[12] UNESCO, "UIS Statistics," 2019. [Online]. Available: http://data.uis.unesco.org/#. [Accessed 15 May 2019].

[13] Scimago, "Scimago Institutions Rankings," 2019. [Online]. Available: https://www.scimagoir.com/index.php. [Accessed 13 September 2019].

[14] Scimago, "Scimago Journal & Country Rank," 2019. [Online]. Available: https://www.scimagojr.com/. [Accessed 15 May 2019].

[15] UNESCO, "UNESCO Science Report: Towards 2030," UNESCO, Paris, 2016.

[16] World Intellectual Property Organisation, "Statistical Country Profile," [Online]. Available: https://www.wipo.int/ipstats/en/statistics/country_profile. [Accessed October 2019].