

# Assessing the needs of the research system in Ghana

Report for the SRIA programme

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**“Assessing the needs of the research system in  
Ghana. Report for the SRIA programme.”**

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## Executive Summary

This report provides a high-level assessment of Ghana'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 Ghanaian partners. Findings in this report are based on quantitative and qualitative data collected through desk-based research and informant interviews. It uses over 100 indicators 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. 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.

### *A. Needs Assessment for Ghana*

**Political economy context.** The World Bank classifies Ghana as a lower-medium income country with a GDP per capita of USD 2,202, the highest among the seven countries considered in this study. The country's economy is growing fast and poverty is declining. Freedom House suggests that Ghana enjoys moderately good governance and considerable civil freedoms, while the World Bank indicates that its political stability and government effectiveness are relatively high. Although Ghana does not have a national policy for research, it has a comprehensive policy framework for science, technology and innovation (STI). In particular, the 2017 National STI Policy identifies key barriers to innovation and commits to supporting the adoption of foreign innovation as an economic driver. The analysis of national institutions and interviews with local informants highlight a lack of synergy between industry-focused innovation policy and teaching-focused university policy as well as a need to further develop the country's institutional and funding framework for research.

**Research production.** UNESCO data shows that Ghana has half the number of researchers per million people than the average for Sub-Saharan Africa. While more of them are qualified thanks to investments in research training and in the creation of new universities, the quality of research training and research support have been called into question by interviewees at the World Bank and the University of Ghana. Most universities in Ghana are vocational and perform very little research. Funding for research and development is low overall (0.4% of GDP) but high on a per-researcher basis. However, the main government research funding mechanism (the Research and Book Allowance) provides a monthly allowance to academics and college teachers irrespective of whether or not they perform research in practice. This appears to undermine incentives to produce research.

**Research diffusion.** Research diffusion in Ghana provides a mixed picture. According to the Scimago data, Ghana produces 104 publications per million people, over twice the average of other countries considered in this study and has a high number of international collaborations. However, papers from Ghanaian researchers average only 0.57 citations per document which is one of the lowest among the in-scope countries. On the innovation side, WIPO data shows that the number of patents filed in the country remains very low, but it has risen in recent years and intellectual property appears to be given

adequate protection. Consistent with government policy, the **World Economic Forum** indicates that business is dynamic and able to adopt innovation, but this is sourced primarily from abroad since knowledge exchange activities remain limited to a handful of large universities.

### ***B. Options for research capacity strengthening***

Overall, Ghana's research system appears underdeveloped and underperforming relative to the country's wider economic trajectory. Interventions could address the following issues:

- **Support the development of an alternative research incentive mechanism.** One of the fundamental challenges for Ghana is that researchers have little incentive to perform research. The Research and Book Allowance, in fact, acts as a disincentive since academics receive it regardless of their research work. Given the political sensitivities surrounding the Allowance, donors could help the government identify alternative financial arrangements for research. For instance, the government could explore the potential for public-private partnerships to raise funds for research projects in line with national priorities, and through which incentives could be built in for the researcher. Alternatively, seed funding could be provided in order to attract international research grants, in a similar way to Ethiopia's national research funding.
- **Help establish a national infrastructure for scholarly communication.** Ghana does not have an adequate research communication infrastructure. The University of Ghana aside, universities lack publication and data repositories and it is a matter for individual colleges or faculties to secure monies for that infrastructure. Moreover, Ghana has very few national academic journals. There seems to be an opportunity to support the development of research communication infrastructure in a coordinated fashion. This could include preprint services for African researchers such as **AfricArXiv**, and networks of research data and publication repositories such as the one established in Nigeria by the **Nigerian Research and Education Network**. Establishing a network of this kind would require a critical mass of research organisations, but DFID could look at building on the World Bank's experience given that the organisation has an established presence in the country through its African Centres of Excellence programme.
- **Strengthen research management capacity using the hub-and-spoke model.** There is a need and an opportunity to strengthen research management capacity across other research-intensive institutions following the example of the University of Ghana's ORID office. Inclusion of other public universities with significant research activities in the ReMPro initiative could be the first step towards building awareness of the profession, while the positive experience with the ORID office could provide a model of best practice for other universities to follow and a basis to create a national network of professionals.

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## Glossary

### Organisations

- CSIR** Council for Scientific and Industrial Research
- MESTI** Ministry of Environment, Science, Technology and Innovation
- NDC** National Democratic Congress
- NPP** New Patriotic Party
- ORID** Office of Research, Innovation and Development
- PACSTI** Presidential Advisory Council on Science, Technology and Innovation
- RGI** Research and Grant Institute
- WIPO** World Intellectual Property Office

### Other acronyms

- ACE** Western and Central Africa Higher Education Centres of Excellence Project
- FDI** Foreign Direct Investment
- GDP** Gross Domestic Product
- GERD** Gross Domestic expenditure in Research and Development
- GPRSII** Growth and Poverty Reduction Strategy II
- IP** Intellectual Property
- LGBT** Lesbian, Gay, Bi-sexual and Transgender
- LMIC** Low- and middle-income country
- NSTF** National Science and Technology Fund
- R&D** Research and Development
- ReMPro** Research Management Programme in Africa
- STI** Science, Technology and Innovation
- TETF** Tertiary Education Trust Fund
- TTO** Technology transfer office

## 1. Introduction

This report presents the results of an assessment of Ghana'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.

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### *1.1. Structure of the report*

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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.

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### *1.2. Methodology*

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The evidence presented here has been obtained through desk research and informant interviews. Desk research gathered quantitative data from 15 sources (see Appendix E), while qualitative data was obtained from interviews with nine informants, working for research organisations, intermediaries and international organisations based in Ghana (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. They informed the authors' views on the country performance on each of the indicators listed in Appendix A.

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.

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### *1.3. Limitations*

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The study provides a high-level assessment of the strengths and weaknesses of the Ghanaian 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 qualitative findings are based on the views of a small but balanced number of stakeholders and should be verified through further research.

## **2. Structures**

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

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### *2.1. Social and political context*

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Ghana is a presidential republic which has held competitive multiparty elections since 1992. The country's political system is dominated by two parties: the New Patriotic Party (NPP) and the National Democratic Congress (NDC). The former, led by Nana Akufo-Addo, came into power after a contested general election in 2016. According to the [World Bank](#), Ghana has relatively strong rule of law compared to other Sub-Saharan African countries (scoring 59 out of 100, where 0 is worst and 100 is best) but it experiences relatively high political instability and low government effectiveness (each scoring slightly lower at 49/100). However, in terms of political stability, the country still performs considerably better than many other Sub-Saharan governments in Africa. Similarly, perceived corruption is high relative to high-income countries, but low relative to most Sub-Saharan African countries. Ghana ranks 78<sup>th</sup> out of 180 countries in Transparency International's [Corruption Perceptions Index](#), only behind Rwanda among the seven SRIA countries.

Ghana's citizens enjoy significant political freedom and civil liberties in comparison to other SRIA countries. The World Bank ranks voice and accountability relatively high at 67/100, while the charity [Freedom House](#) describes Ghana as a 'free' country with an aggregate freedom score of 83/100; it gives Ghana a score of 36/40 for political rights and civil liberties (where 0 is worst and 40 is best). These scores are the highest of all countries considered in this study, which suggests that Ghanaian citizens are able to participate in selecting their government and enjoy considerable freedom of expression and freedom of association in public and private life, but political attacks on journalists have recently increased and the country has lost its status as Africa's best-ranked country in the [World Press Freedom Index](#). Outstanding problems largely concern discrimination against minority groups, including women and the LGBT community. Overall, the country's socio-political context does not seem to present insurmountable structural challenges for research. Researchers enjoy considerable academic freedom and operate in a context where the rule of law is established. However, some



concerns regarding limited government effectiveness appear to potentially undermine the efficacy of research policy.

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## 2.2. Economic context

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Ghana is a country of almost 30 million people. In 2018, Ghana had a GDP per capita of USD2,202, growing from just over USD1,700 in 2015 and just around USD400 in the 1990s. This is significantly higher than the African average of USD1,574 and the highest GDP per capita of all seven countries considered in this study. According to the World Bank's current **classification**<sup>a</sup>, Ghana is a lower-middle income country. World Bank data also suggests that 13% of Ghana population was living in poverty (less than \$1.90 per day) in 2016, following a **sharp decline** since the 1990s. This is far below the African average of 41% and in line with the average percentage of the population in other lower-middle income countries (11%). Ghana is ranked 140<sup>th</sup> in the world according to the UNDP's composite **Human Development Index**.

In comparison to other Sub-Saharan African countries, the **Ghanaian economy** is less reliant on agriculture: according to the **World Bank**, just 22% of the country's GDP is generated in the primary sector, while industry contributes just over 30% to national GDP. The service sector, including tourism, retail and personal services, accounts for almost 43% of the Ghanaian economy. The country has a well-developed digital infrastructure, with an internet penetration of 35% and mobile use of 67% of the population in 2018 according to a **recent study**. . According to World Bank estimates, Ghana has a relatively high literacy rate (71.5%), which is above the African average (64%) as well as the average rate of other LMICs (61%). Despite its relative maturity and rapid growth, however, Ghana's economy has some structural deficiencies. Ghana scores slightly above average (4.2 out of 7) for innovation capacity according to the World Economic Forum, but below average for technology readiness (3.6/7). Ghana's overall economic competitiveness is very low, as its economy ranks only 111<sup>th</sup> out of 137 countries in the Global Competitiveness Index.

## 3. Institutions

This section looks at the strength of the national policy framework. Specifically, it considers whether the country has a national research policy or strategy and whether it was updated in the last 10 years. It also looks at the existence of an innovation strategy and of national mechanisms for research quality evaluation.

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<sup>a</sup> 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.

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### 3.1. *National policy for research*

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Ghana does not have a national policy dedicated to research or a coherent higher education policy.<sup>b</sup> Instead, the government has developed a national policy on science, technology and innovation (STI) which combines elements of both. The focus on STI over other research disciplines is consistent with the instrumental view of other Sub-Saharan African countries that look at the adoption of technology and innovation as a direct driver of competitiveness and growth. The government has placed developing STI high on its political agenda, as reflected in various policy documents such as the **Growth and Poverty Reduction Strategy II (GPRS II)**. For example, the GPRS II recommends establishing a Science and Technology Fund to support research activities in tertiary and research institutions, providing incentives to strengthen the linkage between research and industry, and initiating a Young Researchers Programme to stimulate interest in research and technological innovation among pupils.

The framework for research in Ghana is set by the 2017 **National Science, Technology and Innovation Policy**. Following the development of similar policy documents over the past two decades that never progressed to the implementation stage, the publication of the 2017 STI policy is a significant advancement for the country's research system. The STI policy affirms the government's ambition to pursue innovation-driven socio-economic development and aims to provide a framework for stimulating innovation in the Ghanaian economy.<sup>c</sup> In order to achieve that, the policy aims to restructure the National Science and Technology Advisory system, improve research infrastructure and improve education and research training. The document also sets sector-specific policies for agriculture, health, education, energy, industry, trade, the environment, infrastructures and digital technology and basic research.

Although the STI policy has had the merit of establishing a coherent governance structure for STI (see section 3.2), it is too early to say whether meaningful progress has been made against the ambitious list of objectives listed in the document. The policy itself gives a sobering assessment of the barriers faced in developing the national STI system. Three areas seem to emerge most strongly. First, the inability to train and sustain larger numbers of scientists curtails research production capacity. The document highlights the failure to develop the capacity of the universities to educate and train significant number of scientists and technologists, an over-reliance on the use of foreign expertise and poor remuneration and poor conditions of service for researchers which causes so-called 'brain drain'. Second, STI policy is ineffective due to poor coordination, weak mechanisms for implementation, evaluation and review of STI projects and weak linkages between various agencies and organizations in STI. Finally, diffusion and uptake of research and innovation is undermined by weak linkages

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<sup>b</sup> The higher education sector in Ghana still relies on the recommendations of the Government White Paper on the Reforms of the Tertiary Education System (1991) and the subsequent recommendations of the Universities Rationalisation Committee.

<sup>c</sup> Innovation is intended as "the use of knowledge to bring about scientific and technological applications which are new in the context of usage even though they may not be new in other parts of the world" – therefore emphasizing the importance of adopting and applying existing technology over developing new ones.

between STI actors and national development planning, and between industry and the R&D system. The consultation found that many of the challenges identified in the STI policy remain valid today.

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### 3.2. *National institutions for research*

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Ghana's Science, Technology and Innovation Policy (2017) establishes a governance structure for STI which includes the following institutions for management and coordination of research:

- **Council for Scientific and Industrial Research (CSIR):** coordinates the implementation of government policies on research and development and assists the government in policy formulation. CSIR also plays a role in the commercialisation and dissemination of research outputs and technologies specifically in the development of the agricultural, environmental and health sectors of the economy.
- **Ministry of Environment, Science, Technology and Innovation (MESTI):** responsible for the management and implementation of Ghana's science and technology policies. MESTI also oversees and coordinates the activities and programmes of the CSIR and the 13 research institutes within this. The Ministry plays a major role in facilitating linkages between government ministries through STI.
- **Presidential Advisory Council on Science, Technology and Innovation (PACSTI):** advises the Government of Ghana on STI issues to inform the development of policy and decision-making. The key responsibility of PACSTI is to ensure that STI remains at the heart of Ghana's socio-economic development.

Ghana has a centralised institutional framework for STI, with MESTI coordinating all STI activity through the Council for Scientific and Industrial Research (which in turn controls 13 research institutes) and in government departments such as the Ghana Atomic Energy Commission, the Environmental Protection Agency and the Town and Country Planning Department. At the same time, research undertaken at universities falls under the remit of the Ministry of Education and appears separated from STI and the broader development agenda. This resonates with the views expressed by interviewees and is compounded by a lack of awareness of national STI priorities at university level.

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## 4. Agents

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### 4.1. *Stakeholder mapping*

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Ghana's research system is characterised predominantly by publicly-funded organisations (see Appendix B). The main research policymakers are the Ministry of Environment, Science, Technology & Innovation (MESTI) and the Ministry of Education, that are respectively responsible for STI policy formulation and STI policy in relation to education. Government directorates are responsible for STI policy formulation and for the coordination of research activities and support, alongside advisory committees and research organisations. The Council for Scientific and Industrial Research (CSIR) and

the Ghana Atomic Energy Commission within MESTI for example coordinate 13 and six research institutes respectively. These research bodies significantly support the Ghanaian Government in the development of STI policies in line with national development. They play a significant role in encouraging scientific and industrial research in areas of national priority such as agriculture, health and technology. The Presidential Advisory Council on Science, Technology and Innovation (PACSTI) monitors and coordinates the implementation of STI policies.

The Ghanaian government does not appear to have established a dedicated funding body for research in the country. Instead government ministries and departments have so far taken on the role of research funders. Universities rely on the Ministry of Education for research funding, while research institutes are funded by MESTI, and other Ministries appear to fund individual research projects in an autonomous and somewhat uncoordinated fashion. Overall, there is significant reliance on international donors to sustain the research system. Eight international research funders (see stakeholder table in Appendix B) were identified from our desk research, but it is likely that many more are operating in Ghana. Ghana has a complex classification of universities, comprising public universities, technical universities, professional public institutes and universities, chartered private universities and private institutions (largely colleges) affiliated to the public universities (section 5.1).

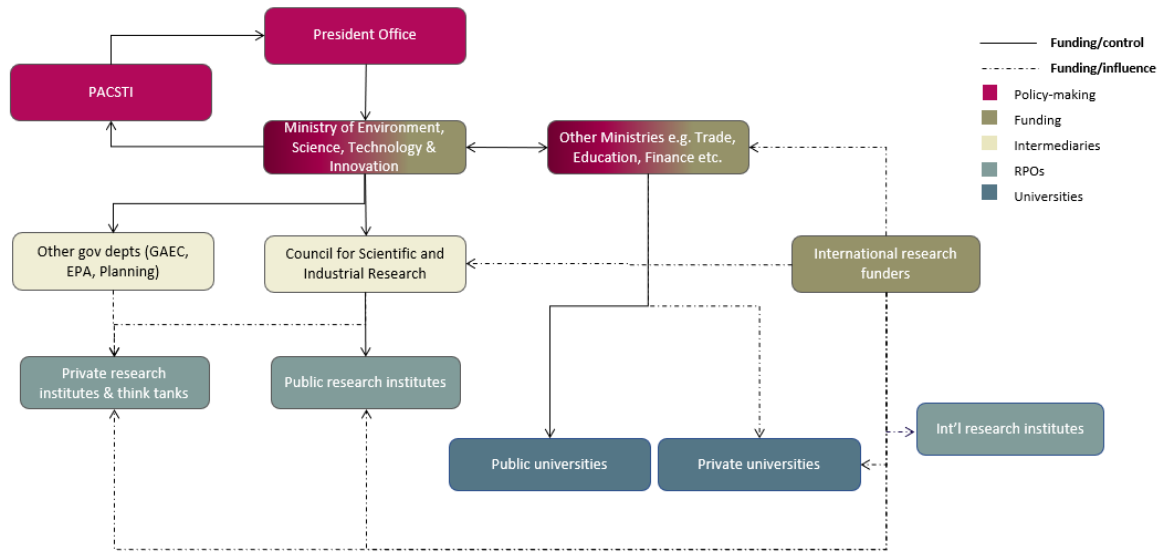
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#### *4.2. Relations and interdependencies*

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The Ghanaian Government relies heavily on research intermediaries and research performing organisations to support the formulation and coordination of national STI policy. Despite this support for STI policy at a national level, the consultation indicated that communication between stakeholders could be improved. Specifically, there appears to be some disconnect between government institutions and research performing organisations meaning that research is often not aligned to government priorities. In many cases, research organisations develop their own research strategies which are not coordinated or harmonized with the national development strategy. The lack of a dedicated research funder and the extensive reliance on external funding also contribute to the misalignment between national priorities and the research produced in the country. Ghanaian researchers appear reluctant to support a reform of research funding that undermines the current **Research and Book Allowance** - a monthly payment to all academics as an incentive to perform research. For example, when it was proposed that the National Research Fund would replace the Allowance, researchers engaged in public protests across the country against the proposed change.

**Figure 1. Stakeholder relationships in Ghana’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:

- Research inputs, or the tangible assets that are directly connected with research production: human resources, financial resources and infrastructure.
- Research culture and support, or the enabling environment for research.
- Research outputs, including the products of research and the incentives for producing research.

### 5.1. Research inputs

#### A. Human capital

According to the **World Bank**, Ghana hosts 38.4 researchers in R&D per million inhabitants, less than half the average for Sub-Saharan Africa (95.1). The majority of Ghana’s research personnel are employed in the higher education sector (59.9%), 38.3% of researchers work in government and just 1.8% of researchers are employed in business enterprise or the private non-profit sector. Just 17% of Ghana’s researchers are female compared to the African average of 31.6 %. Through the Western and Central Africa Higher Education Centres of Excellence Project (**ACE**), the World Bank has sought to address this issue by improving access to funding for female researchers.

34.4% of Ghana’s researchers are educated to PhD level or equivalent, which is above the average of the seven countries considered in this study. Much of the drive behind the rapid increase of PhD graduates is the Ministerial directive that by 2020 lecturers will be required to hold a PhDs in order to teach at university. This has sparked a lively debate around funding for research training and the

vocational nature of postgraduate courses in Ghana (see section 5.1. C). The 2017 STI policy has highlighted the need to train more researchers to PhD level, and the Ministry of Education has established a requirement that university lecturers are educated to a doctoral level. However, the focus on increasing the quantity of researchers with PhDs appears to have undermined training quality (see section 5.2 B).

### ***B. Research funding***

Latest available data from **UNESCO** (2010), shows that Ghana had a Gross domestic Expenditure in Research and Development (GERD) of USD 277 million. Ghana's GERD was however only 0.4% of GDP, considerably less than half of the 1% target which was set by the African Union in its 2015 **Ten Year Implementation Plan** but in line with other countries considered in this study. Over two thirds of Ghana's GERD was performed by the government (68.3%), among the highest of the in-scope countries. By contrast, higher education, business and domestic private non-profit sources only contribute 0.5% GERD combined. Overall, Ghana has a higher concentration of research funding compared to most other countries in this study, and an especially low contribution from universities. The University of Ghana is somewhat of an exception in this context, as it currently has a large internal research fund (USD200,000) dedicated to supporting research that meets national needs. The fund is administered by the Office of Research, Innovation and Development (ORID).

Most public research funding in Ghana is distributed through the Research and Book Allowance scheme, which provides a monthly allowance to all academics and, recently, college teachers, as an incentive to perform research. However, the allowance is not linked to research production and there are **accounts** of lecturers using the allowance for purposes other than research – an issue that was also raised in consultation with World Bank representatives. In this case, interviewees explained that the proposal to restrict the distribution of the Allowance to only the researchers carrying out research was met by strikes. The country does not have a central research funder. The STI policy recommended the establishment of a National Research Fund, and there are **reports** that the USD50 million fund has already received cabinet approval. However, the establishment of the NRF is opposed by some academics fearing this would result in a reduction to their monthly income. As a result, the country appears to lack domestic mechanisms to provide financial incentives linked to research production. In this context, availability of international funding is likely to exercise a significant influence on the domestic research agenda and could contribute to the reported gap between national research priorities and research production. **UNESCO data** shows that, in 2010, international sources contributed USD 86 million to research and development, equating to 31% of Ghana's national GERD.

### ***C. Research organisations***

Ghana has a complex network of research performing organisations, most of which are publicly-funded. Public research institutes are coordinated by sectoral bodies under the Ministry of Environment, Science, Technology & Innovation. The Council for Scientific and Industrial research coordinates 13 research institutes, the Atomic Energy Commission coordinates six research institutes and other institutes fall under the remit of the Country and Town Planning Department and the Environment Protection Agency. These organisations are closely linked to the government and produce research in line with Ghana's national priorities.

By contrast, Ghana's universities are accredited, regulated and funded by the Ministry of Education. Ghana has 26 public universities. In recent years, former polytechnics and professional institutions have claimed university status and, as a result, the number of technical universities has increased. The composition of the 26 public universities therefore includes nine traditional/established universities, 8 technical universities and nine professional institutions. The country also has two chartered private universities and a large number of privately-funded universities and university colleges that are affiliated with a public university (e.g. the University of Ghana alone has over 25 affiliated private universities). Despite the Book and Research Allowance being distributed to researchers and teachers in most universities and colleges, chartered universities appear to carry out little research. When they do so, they tend to set their own research agenda which is independent from the national STI policy (the consultation suggests that this is the case at the University of Ghana). The consultation suggested that polytechnic universities in Ghana consider themselves to follow the traditional academic university model and are seeking to move away from vocational teaching, but a lack of skills and resources prevent them conducting any significant research. The *Times Higher Education* reports that only 7% of the 5,774 master's degrees awarded in 2014-15 required students to undertake a research project and write a thesis under the supervision of a faculty member. Private university colleges focus almost exclusively on teaching and do not appear to undertake significant research.

The *World Economic Forum* gives Ghanaian scientific research institutions a below-average rating and ranks them 74<sup>th</sup> in a list of 137 countries, behind Kenya, Rwanda, and Tanzania but above Ethiopia, Nigeria and Uganda. Four of Ghana's universities appear in *Scimago's institutional rankings*. The Kwame Nkrumah University of Science and Technology appears 19<sup>th</sup> in Scimago's ranking of 133 higher education institutions in Africa, while the University of Ghana follows just behind in 20<sup>th</sup> place. The remaining two universities considered (University for Development Studies, University of Cape Coast) rank 52<sup>nd</sup> and 53<sup>rd</sup> respectively. Finally, the country has three centres of research excellence across two of its university campuses - The Regional Water and Environmental Sanitation Centre at the Kwame Nkrumah University of Science and Technology, and the West Africa Centre for Crop Improvement and the West Africa Centre for Cell Biology of Infectious Pathogens at the University of Ghana.

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## 5.2. *Research culture and support services*

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### A. *Research culture*

Interviewees suggested that the Research and Book Allowance scheme does not appear to introduce meaningful individual accountability regarding the use of research grants. This in turn encourages a self-interested research culture whereby funding theoretically earmarked for research is actually seen as a 'salary enhancer' with no practical connection to individual direct spend on research activities. At an institutional level however, there appears to be an internal culture of social responsibility. Established universities have a system of promotions that value academic publication and encourage researchers to participate in membership organisations, national research boards and learned societies. The University of Ghana is reportedly making significant efforts to align its research with international initiatives that promote the social good (for example, its research strategy is shaped

around the UN's Sustainable Development Goals). Some of the stakeholders interviewed, however, suggested that a desire to be aligned with international funders' priorities plays an important role in the development of universities' research strategy. It is unclear to what extent the same alignment is sought with the goals set out in national policy documents, the national STI policy or the Growth and Poverty Reduction Strategy, which are not directly linked to funding opportunities.

### ***B. Capacity building***

The consultation suggested that the quality of the doctoral qualifications in Ghana needs improvement. In particular, the focus on increasing the number of academics with PhD qualifications appears to have compromised quality, with mentorship and training being provided by underqualified lecturers to post-graduate research students in a cycle of low-quality. The requirement that all university lecturers hold a PhD is placing unsustainable demands on the training capacity of universities, therefore compromising training quality.

Various initiatives are in place to strengthen research capacity in the country. Some research universities and organisations like **Research & Grant Institute (RGI)** have put in place initiatives to support early career researchers through conference travel grants, research grants and targeted research training initiatives. The World Bank-funded Western and Central Africa Higher Education Centers of Excellence Project (**ACE**) is also providing research capacity strengthening through training for female researchers in the context of research priorities that reflect Ghanaian socio-economic issues, such as food security (training plant breeders, seed scientists and technologists), water and environmental sanitation, and infectious pathogens. Several consultees supported this approach and expressed the view that African solutions can only be reached through African-led research. Informant interviews also suggested that while individual initiatives are insufficiently resourced, the sum of these initiatives appears to be tackling the brain drain phenomenon, with an increasing number of young academics deciding to remain or even return to Ghana to develop their research careers. However, no data was readily available to confirm this observation. They pointed out that securing the longevity of these initiatives after the end of current project funding would be key to increase and retain capacity in the system.

### ***C. Research support and administration***

The consultation highlighted the **Office of Research, Innovation and Development (ORID)** at the University of Ghana one of the strongest examples of good research management practice outside of South Africa. ORID is a centralised research management service with six specialist teams covering intellectual property and technology transfer, research performance, ethics, publications and dissemination, pre- and post-award services, and capacity development. The consultation suggested that ORID provides an effective research support environment and places a strong emphasis on the accessibility, uniformity, consistency and value of research support services, as reflected, for example, in ORID's commitment to a 5-day turnaround on post-award services. Funding from the Wellcome Trust over the past three years has enabled ORID to make measurable improvements to its work. Over the same time the Office has increased its research grant income from \$3m in 2015-16 to \$35m in 2018-19, which is spread across 167 current projects. ORID has largely operated in isolation from other Ghanaian research organisations because it has established close relationships with all of the major



international donors, allowing them to be responsive to but also helping to inform funder priorities. ORID is not currently a member of the West African Research and Innovation Management Association (WARIMA), and it is not participating in the ReMPro programme. In terms of international collaboration however, the University is the only university in Ghana to be a member of the African Research Universities Alliance (ARUA) and does take part in a number of international research projects.

While the University of Ghana has established itself as lead partner in most international research collaborations, it does not appear that the same research-supported practices extend to other research organisations in the country. There may be scope to make the University of Ghana a national hub for disseminating good research management practice within the country.

#### ***D. Digital infrastructure and data***

Ghana's digital infrastructure ranks unfavourably against the six other countries considered in this study. According to data from the **World Economic Forum**, 34.7% of the population are internet users, below countries like Nigeria (50%) and Kenya (85%) and also below the African average (37%). However, an average broadband speed of 9.9 kilobytes per second make internet use especially difficult. This is especially the case with regards to research data, but low speed can also affect access to publications.

Ghana does not have a national repository for research publications of research data, and, at present, there are no plans to create one. At an institutional level, research organisations often collect and store their own research publications electronically but very little is done to do so systematically, and research data is seldom collected and stored in permanent repositories. Innovations for Poverty Action and the University of Ghana's Office for Research and Information have rare examples of good data management practice at organizational level, but information gathered by individual organisations does not feed into a national system or repository – making it difficult for the government to access, monitor and disseminate research data and outputs.

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### ***5.3. Research output and evaluation***

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#### ***A. Research publications***

According to **Scimago**, Ghana's researchers produced 3,017 publications in 2018, which equates to 104 publications per million people – over twice the average of the other countries considered in this study. Between 1996 and 2008 Ghana increased its share of Africa's total research outputs from 1.79% to 3.93% and ranked in eighth place out of 57 African countries for research productivity. In 2018, international collaborations accounted for 65.4% of research outputs in the country, up from just 44.6% in 1996. While the proportion of international collaborations is lower than other countries considered in the study it is still very significant. In 2018, 39.05% of publications in Ghana were open access.

The average quality of scientific publications in Ghana, as inferred from citation impact is low in comparison to other Sub-Saharan nations. Ghana's h-index (a measurement of both the productivity and citation impact of scientific publications) ranked the country as 87<sup>th</sup> out of 239 in terms of

research productivity and citation impact. This places Ghana behind Kenya (54<sup>th</sup>), Nigeria (68<sup>th</sup>), Uganda (77<sup>th</sup>) and Rwanda (78<sup>th</sup>) in this study. The average number of citations received by Ghana's research between 1996 and 2018 is 11.8 per publication. This is the third lowest number of citations across the seven nations considered in this study, standing only above Nigerian and Ethiopian literature.

### **B. Research evaluation & ethics**

There do not appear to be any mechanisms to monitor research quality at national level and national bodies for research ethics are currently in place in Ghana. As a result, there is limited monitoring of research spending, and research quality and ethics are not prioritised nationally. Instead, ethics issues are managed internally at an organisational level, with research organisations generally having their own research evaluation and ethics teams. The consultation revealed that, in some cases, research organisations operating directly under the control of a Ministry have different research ethics policies. For instance, the Ghana Health Service has a different ethics policy to the Ghana Health Service Council despite both being funded by the Ministry of Health.

Interviewees suggest that insufficient communication between research institutes often means that research is duplicated and organisations do not share good practice. Few incentives exist to encourage researchers to collaborate in Ghana as research funding is provided on an individual basis regardless of whether research is actively conducted or not.

## **6. Research diffusion**

This section focuses on the stakeholders and practices underpinning the diffusion of scientific research in the country.

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### **6.1. Actors and networks**

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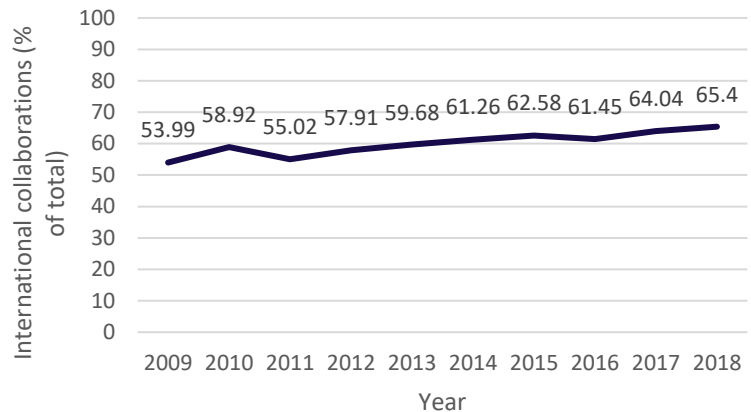
#### **A. National users of research**

In the *STI policy*, the government has placed considerable importance on the adaptation, absorption and mastery of technology. However, it is unclear how much progress there has been in this area. The World Economic Forum found that government procurement of technology products is limited (3.7/7). In terms of technology readiness, Ghana operates at the average level of the other countries involved in this study. The country scores 4.3/7 for FDI and technology transfer and 4.2/7 for firm-level technology absorption. This indicates moderate capacity to make use of latest technologies and to modernise the production and distribution of goods and services in the way envisaged in national policy documents.

**B. International exposure**

Ghana’s international exposure is measured by looking at the diffusion of its best scholarly production (measured as the percentage of papers in the 10% most-cited papers in a field of research) and by looking at the number of international collaborations. 8.8% of Ghana’s papers are among the 10% most cited in a discipline or field. In 2018, 65.4% of papers produced came from international collaborations. This proportion has been rising steadily across this period. This is in line with increasing research funding from international donors. International

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



collaborations in Ghana are primarily with institutions based in the USA, UK, Germany, South Africa and the Netherlands.

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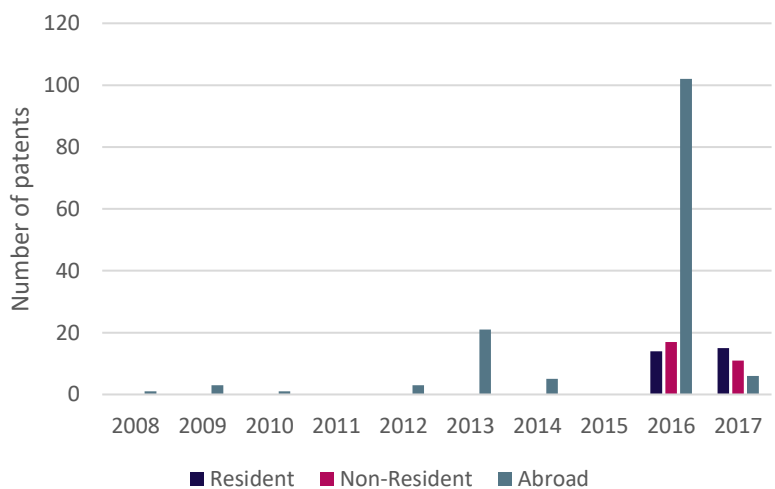
**6.2. Knowledge exchange practices**

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**A. Intellectual property**

Ghana launched its National Intellectual Property Policy in January 2016, but the consultation has shown limited awareness of national policies on IP across research organisations, and most do not have an intellectual property policy. The University of Ghana appears to be the only research organisation that has an IP policy and a team dedicated to IP protection within its research support office. However, their IP policy was developed in-house and disconnected from the national policy. Despite the lack of external coordination, the internal system for IP protection appears effective and has resulted in the filing of two patents in the past two years. According to WIPO, Ghana residents filed 15 patent applications in 2017, but only

**Figure 3. Number of patents filed in Ghana.**



one patent was granted in this time. Six patent applications were filed abroad by Ghanaian nationals in the same year. According to the World Economic Forum, Ghana does not perform well in this area internationally, where it is ranked 103<sup>rd</sup> out of 119 countries for patent applications per million people. Of the 21 Sub-Saharan countries, Ghana ranks 12<sup>th</sup> out of 21 for the number of patent applications per million inhabitants.

### ***B. Knowledge exchange support and administration***

The government has shown awareness of the importance of knowledge exchange and technology transfer. The STI policy commits the country to strengthening the commercialization and dissemination of research results, whilst research commercialization is also referenced as a priority in the national IP policy. However, these ambitions appear beset by a significant implementation gap. Our study revealed no national body exists for knowledge exchange (KE) or technology transfer (TT). There appears to be little capacity for Ghana to lead on this on a national scale, and most research institutions do not have a KE or TT office or policy in place. Many stakeholders expressed the feeling that there is a lack of knowledge and skills in this area among both government officials and university staff. At present, Ghana scores 3.5/7 in terms of university-industry collaborations.

The most direct connection of research production and commercialization seems to be limited to public research institutes operating under the Ministries. The University of Ghana's ORID also has a technology transfer team, but it's unclear whether the same exists in other universities. The consultation has not revealed any national-level initiative, funding or organisation dedicated to research diffusion, knowledge exchange or technology transfer involving other research organisations.

## **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.

Ghana is a fast-growing West-African country that has examples of good research practice but whose research system still faces considerable headwinds. With a score of 4.3/7, the country's social and political context compares very positively to other Sub-Saharan African countries (RSC1) but is still not on par with wealthier economies. Structural barriers for the research system – such as below average rule of law, political stability and government effectiveness and a relatively high perception of corruption – are balanced by a high degree of political and civil liberties, including freedom of expression, academic freedom and a free media. Despite rapid economic growth in recent years, scoring 3/7, Ghana still has a poor economic situation (RSC2), with a GDP per capita of just USD2,202 but only 13% of the population living in poverty. Ghana's economy is less reliant on agriculture than

other Sub-Saharan African nations, the population's literacy is above the average for Sub-Saharan Africa and the country has slightly above-average innovation capacity. However, Ghana's economy remains very uncompetitive overall and technology readiness is lagging behind. In this context of limited resources, relying on research for economic development remains challenging but also holds substantial potential for the modernisation of a dynamic economy.

Ghana's policy and institutional framework for research appears underdeveloped overall. Whilst the government has recently enacted an STI policy containing objectives and provisions for specific sectors of the economy, Ghana still lacks a dedicated policy for research (RSC3, 3.0/7). The country also does not have basic national research institutions, such as a national research funder or even a government department dedicated to research (RSC4, 2.2/7). Overall, Ghana's focus on science and technology as an economic driver is in line with other African countries, but on balance efforts appear more focused on the adoption of existing technology than on the development of new knowledge, and there appears to be limited consideration for research in non-technical disciplines. Moreover, there appears to be significant room for clarifying and better coordinating the roles and responsibilities of national research actors (RSC5 2.2/7).

With regards to research production, Ghana faces some clear challenges but has also shown some improvements (score 3.2/7). The government has supported researcher training at PhD level, which has increased the number of researchers with PhD level qualifications but might have undermined training quality (RSC6, 2.5/7). The country spends an amount of money for each researcher far superior to the African average. With an average score of 3.8/7, the Ghanaian government is aware of the need to establish different funding mechanisms administered by a National Research Fund (RSC7). However, opposition from academics is slowing down progress. Finally, the country has greatly increased the number of universities in recent years but only a handful of large universities perform research and only the University of Ghana appears to have significant research activity. There are several public research institutes with direct links to government, but evidence about their influence on policy is mixed.

Ghana's research culture is improving among flagship universities and the government (RSC9, score 2.5/7), but among academics, incentives to perform research are undermined by the fact that research funding is provided through the Book and Research Allowance and not tied to actual research performance. Research support at universities is limited (RSC11, 3/7), although the University of Ghana's ORID is an example of good practice at pan-African level that could be built upon in the country. However, with a score of 2.5/7, the country's research infrastructure needs considerable support (RSC12). As a result of these and other factors, Ghana's research production is far below the country's potential (RSC13 2.5/7), as inferred by its socio-economic context and research investment. This seems caused primarily by the lack of a research policy, adequate incentives for research, and research evaluation processes (RSC14, 1.5/7). In line with the STI policy's ambitions, Ghana performs better in the area of knowledge exchange (KE), largely thanks to a well-functioning intellectual property system (RSC17) that encourages innovation, indicated by a score of 4.7/7. National users of research score moderately at 3.5/7, as demand for research from both business and government actors is limited (RSC15), partly offset by relatively good international exposure of Ghanaian research

(RSC16, 4/7). In contrast, KE support and administration (RSC18) appear to be an area for improvement scoring only 2.8/7 with good practice limited to the University of Ghana and no evidence of national initiatives or organisations operating in this space.

**Table 1. Scoring of research system components**

Section	Research system component	Score	Component ID
National context	Social and political context	4.3	RSC1
	Economic context	3.0	RSC2
	<b>Section average</b>	<b>3.7</b>	-
Policy and institutional framework	National policy for research	3.0	RSC3
	National institutions for research	2.2	RSC4
	Stakeholder composition & relationships	2.2	RSC5
	<b>Section average</b>	<b>2.5</b>	-
Research inputs	Human capital	2.5	RSC6
	Research funding	3.8	RSC7
	Research organisations	4.0	RSC8
	<b>Section average</b>	<b>3.5</b>	-
Research culture and support	Research culture	2.5	RSC9
	Capacity building	2.7	RSC10
	Research support	3.0	RSC11
	Infrastructure and data	2.5	RSC12
	<b>Section average</b>	<b>2.7</b>	-
Research outputs and evaluation	Research publications	2.5	RSC13
	Research evaluation	1.5	RSC14
	<b>Section average</b>	<b>2.0</b>	-
Knowledge exchange (KE) actors and networks	National users of research	3.5	RSC15
	International exposure	4.0	RSC16
	<b>Section average</b>	<b>3.8</b>	-
KE practices	Intellectual property	4.7	RSC17
	KE support and administration	2.8	RSC18
	<b>Section average</b>	<b>3.7</b>	-

## 8. Recommendations

### 8.1. *Identification of priorities*

This section identifies options for research capacity strengthening in Ghana by looking at the worst-performing 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 the review of the Research & Book Allowance.** One of the fundamental challenges for Ghana is that researchers have little incentive to perform research. The Research and Book Allowance, in fact, acts as a disincentive since academics receive it regardless of their research

work. Given the political sensitivities surrounding the Allowance, donors should help the government identify alternative financial arrangements for research. For instance, the government could explore the potential for public-private partnerships to raise funds for research projects in line with national priorities. Alternatively, seed funding could be provided in order to attract international research grants, in a similar way to Ethiopia's national research funding.

- **Help establish a research communication infrastructure.** Ghana does not have an adequate research communication infrastructure. The University of Ghana aside, universities lack publication and data repositories and is a matter for individual colleges or faculties to secure monies for infrastructure. Moreover, Ghana has very few national academic journals. There seems to be an opportunity to support the development of research communication infrastructure in a coordinated fashion. This could focus on supporting the development of preprint services for African researchers (such as [AfricArXiv](#)) or of networks of research data and publication repositories such as the Ghanaian Research and Education Network ([GaRNET](#)) which appears substantially less developed than other countries (e.g. the [Nigerian Research and Education Network](#)). DFID could look at collaborating with the World Bank to strengthen the network and ensure it includes universities and research institutes, such as those that are part of the African Centres of Excellence programme.
- **Strengthen research management capacity using the hub-and-spoke model.** There is a need and an opportunity to strengthen research management capacity across other research-intensive institutions following the example of the University of Ghana's ORID office. Inclusion of other public universities with significant research activities in the ReMPro initiative could be the first step towards building awareness of the profession, while the positive experience with the ORID office could provide a model for other universities to follow and a basis to create a national network of professionals.

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## *8.2. Conclusions*

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The needs assessment has indicated that Ghana's research system is underperforming relative to the wider economic trajectory within the country. A large part of the problem lies with the Research & Book Alliance and with an academic culture that does not see research as integral to career development and financial success. Resources earmarked for research are now spent on anything but, creating inefficiency. The political will to address this problem is present, but respect for academic freedom should be maintained and conflict between government and academics minimised by engaging stakeholders in conversations aimed at finding better ways to incentivise and support research. Donors could play a mediation role between the government and the academic community and help agree on an acceptable solution.

At the same time, donors could work directly with research organisations to address some of the structural problems affecting research – namely the underdeveloped research communication infrastructure, and the limited research support services offered by Ghanaian universities. There are examples of networked approaches to such problems that have proven effective, and good practice

from the University of Ghana could be shared with other research organisation using the hub-and-spoke model.

More dialogue between research stakeholders and a shared understanding of the importance of research is needed. To achieve that, donors should establish long-term presence in the country, working through local stakeholders that understand the local environment and have the time and ability to establish personal relations with key national players.



# Appendix A – Full list of indicators and scores

**Table 2. How to read the scales**

	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
<b>Absolute country rank</b>	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
<b>Country scores (1-7)</b>	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)
<b>Country score (1-16)</b>	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
<b>Percentile score / percentile rank (1-100)</b>	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.
<b>University rankings</b>	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).	1-100= 7; 101-300= 6; 301-500= 5; 501-1000= 4; 1001-2000= 3; 2001 -3000 =2; 3001+ =1
<b>Percentage values</b>	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 relative performance.	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 <b>existing studies</b> , 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 <b>OECD estimate</b> 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
N. of journals	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 <b>GDP per capita</b> : 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 <b>World Bank estimates</b> .	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 assume see a proportion of urban v rural dwellers above 60% as optimal, while lower proportions are rated negatively.	1-10%=1; 11-20%=2; 21-30% =3; 31-40% =4 41-50%=5 51-60%=6; >61%=7
Literacy rate	Low literacy is negatively correlated with research. Given the international standards of literacy, we weigh 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. List of country indicators and scores**

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
<b>1. National context (structures)</b>					
<b>1.1 Social and political indicators</b>					
1.1.1 Social and political factors	Working language	English	-	No direct impact on research performance	[1]
	Total population (millions)	29.8million	-	No direct impact on research performance	[2]
	Urban population (% of total)	36.68%	3	Ghana 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	50/100	4	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Rule of law	59/100	5	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Regulatory quality	50/100	4	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Government effectiveness	49/100	4	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Voice and accountability	67/100	5	See table 3. Score goes from 0 (worst) to 100 (best)	[4]
	Perception of corruption (ranking)	78/180	3	See table 3. Ranking goes from 1 (best) to 180 (worst)	[5]
	Access to information	N/A	N/A	See table 3. Score goes from 0 (worst) to 150 (best)	
	Freedom of expression	14/16	7	See table 3 and section 2.1	[3]
	Adult literacy rate (% population aged 15+)	71.5%	4	Literacy rate lower than the global average but higher than the average for Sub-Saharan Africa	[6]
Gender Development Index	0.910	3	Women's achievements in health, education and command are lower than men's, underlying gender inequality in line with the African average.	[7]	
<b>1.2 Economic indicators</b>					
1.2.1 Economic development	GDP per capita USD	\$2,202	2	See table 3.	[8]
	Agriculture, value added (% of GDP)	22.40%	-	No direct impact on research performance	[8]
	Manufacturing, value added (% of GDP)	5.14%	-	No direct impact on research performance	[8]
	Population living in poverty (\$1.9/day)	13.3%	4	See table 3	[8]
1.2.2 Digital infrastructure	Access to internet (ranking)	94/137	3	See table 3	[9]
	Individual using Internet/100 people	34.7	-	Scored under access to internet.	[9]
	Broadband internet subscription/100 people	0.3	-	Scored under access to internet.	[9]
	International internet bandwidth, kb/s per user	9.9	1	See table 3	[9]
	Mobile internet subscriptions/100 pop	71.3	5		[9]
1.2.3 Competitiveness	Global Competitiveness Index (ranking 2018)	111/137	2	See table 3	[9]

**Table 4. List of country indicators and scores**

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
	Overall technology readiness	3.6/7	3	See table 3	[9]
	Capacity for Innovation	4.2/7	4	See table 3	[9]
	Innovation index (score)	34.1/100	3	See table 3	[10]
<b>2. Enabling environment (institutions)</b>					
<b>2.1 Policy and institutional framework</b>					
2.1.1 National policies	Existence of a national research policy	NO	2	See section 3.1	Interviews
	Existence of sector-specific research policies	Partly	4	The STI policy has sector-specific policies, but these are not focused on research specifically. See section 3.1	Desk
	Research policy updated in the last 10 years	NO	2	STI policy updated in 2017	[10]
	Existence of an <u>appropriate</u> Strategy for STI	YES	5	Ambitious STI Policy with limited detail on implementation. See section 3.1	Interviews
	Capacity development is part of the Strategy	Partly	4	STI policy talks about developing <i>scientific</i> resources, i.e. nothing about IP, ethics, finance, and all other aspects of managing research.	Interviews
	Country has <u>appropriate</u> indicators tracking R&D	NO	1	There are no national indicators. Institutions collate their data, but nothing is fed into a national strategy/repository. The Ghana Statistical Service has collated data and fed in NEPAD (ASTII) but	Interviews
2.1.2 National institutions	The country has a ministry or department for research	Partly	4	The country has a ministry for science and technology, not for research. See section 3.2	Interviews
	The ministry/department for research is sufficiently resourced	NO	2	Different ministries fund different aspects of education, research and innovation with no coordinating body	Interviews
	The country has one or more national research funders	NO	2	The Ghana government via different ministries. Most funding is distributed via the Book & Research Allowance to individual academics. Very few projects are funded. See section 5.1	Interviews
	The research funders have sufficient financial resources	-	2	Informants testified that the Government resources are insufficient.	Interviews
	Quality of the research funder management capacity	NA	NA	We have no evidence in this regard	Interviews
	The country has a national research ethic body	No	1	See section 5.3	Interviews
<b>3. Stakeholder analysis (agents)</b>					

**Table 4. List of country indicators and scores**

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE	
3.1.1 Stakeholder composition	Clarity of relationships between national actors	Below average	3	There appears to be some confusion of roles of government and national funders among interviewees	Interviews	
	Clarity of decision-making and accountability processes	Below average	3	The evidence suggests that research has limited influence on government policy	Interviews	
	Level of coordination between government department	Very poor	1	See section 4.2	Interviews	
	Cohesion between policy mechanisms	Poor	2	See section 4	Interviews	
	Level of participation in decision-making/standard-setting	Below average	3	IGC has a good relationship with Government but appears a microcosm of good practice. Personal relationships at a senior level seem to be the most effective way to influence decision-making	Interviews	
	Quality of monitoring & enforcement mechanisms (M&E)	Very poor	1	There is no evidence to suggest M&E mechanisms are in place and there are no tools or funding to purchase the tools/systems to monitor/enforce. See section 3.2	Interviews	
<b>4. Production of research</b>						
<b>4.1 Research inputs</b>						
<b>People and resources needed to produce robust research.</b>						
4.1.1 Human capital	Total R&D personnel per million people (FTE)	122.6	3	See table 3	[11]	
	Researchers per million inhabitants (FTE)	38.4	2	See table 3	[11]	
	Researchers (FTE) - Business enterprise	1.0%	1	See table 3	[11]	
	Researchers (FTE) - Government	38.3%	4	See table 3	[11]	
	Researchers (FTE) - Higher education	59.9%	4	See table 3	[11]	
	Researchers (FTE) - Private non-profit	0.8%	3	See table 3	[11]	
	Researchers (FTE) – Female	17.3%	1	See table 3	[11]	
	Researchers (FTE) with ISCED 8	34.3%	3	See table 3	[11]	
4.1.2 Funding	Total GERD (in current '000 PPP\$)	276,669	-	See section 5.1	[11]	
	GERD per capita (%GDP)	0.4%	2	See table 3	[10]	
	GERD per researcher FTE (in current '000 PPP\$)	294	5	See section 5.1	[11]	
	GERD financed by abroad (% total)	31.2%	7	See table 3	[10]	
	GERD performed by	business (% total)	0.1%	1	See table 3	[11]
		gov (% total)	68.3%			[11]
HE (% total)		0.3%	[11]			

**Table 4. List of country indicators and scores**

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
	private non-profit (% total)	0.1%			[11]
4.1.3 Research organisations	Average quality of research organisations	3.7/7	4	See table 3	[9]
	Global ranking of Kwame Nkrumah University of Science and Technology	698/3471		See table 3	[12]
	Global ranking of University of Ghana	703/3471	4	See table 3	[12]
	Global ranking of University for Development Studies	762/3471		See table 3	[12]
<b>4.2 Research culture and support services</b>					
<b>Set of cultural rules and principles, activities and interactions supporting the production of research</b>					
4.2.1 Research culture	Perceptions of the utility of research	Poor	2	See sections 3.1 and 5.1	Various
	Time allocated to research	Below average	3	Academics are expected to research but classes are too large; the Book & Research Allowance removes incentives to look for additional research funding. See section 5.2	Interviews
4.2.2 Capacity building	Local availability of specialized research and training services	NO	2	No evidence that these are in place	-
	Funding for Research Capacity Strengthening	Below average	3	Yes from international sources, not from national sources. See section 5.2	Interviews
	% HEI with PhD programmes	34.3%	3	Rapid growth in the number of PhDs but still low proportion; concerns about quality. See section 5.2	-
4.2.3 Research support and administration	Level of access to proposal writing support	Below average	3	The UoG is exceptional (ORID) and should be highlighted as an exemplar of best practice but below that the quality of RMA varies and as institutions descend the rankings, access to adequate research support worsens. See section 5.2	Interviews
	Existence of institutional policies				Interviews
	Quality of administrative support				
4.2.4 Infrastructure and data	Is there a central repository for research data?	NO	2	See section 5.2	Interviews
	Quality of research infrastructure	Below average	3	There is no consistency of quality – the University of Ghana aside, there is little coordination for improving infrastructure and is a matter for individual colleges or faculties to secure monies for infrastructure. See section 5.2	Interviews
<b>4.3 Research output and evaluation</b>					

**Table 4. List of country indicators and scores**

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
<b>Products of scientific research (publications and patents) and incentives for producing research</b>					
4.3.1 Research publications	Total # of publications (2018)	3,017	-	Not scored, depends on population size	[13]
	Publications per million people	104	5		
	Total # of citable publications	2,624	-	Not scored, dependent on population size	[13]
	Citations per publication (1996-2018)	11.8	-	Scored by citation per publication ranking	[13]
	Citations per publication ranking (1996-2018)	141/236	3	See table 3	[13]
	H index ranking	87/239	4	See table 3	[13]
	# Journals listed in SciMago	4	1	See table 3	[13]
	Scimago country ranking 2018	79/239	2	See table 3	[13]
	% of the total output for Africa	3.93	-	Not scored.	[13]
4.3.4 Research evaluation	Existence of national mechanisms for research quality evaluation	No	2		Interviews
	Quality of incentives for research production	Poor	2	Little incentives because academics are salaried for teaching and receive the B&R Allowance. See section 5.	Interviews
<b>5. Diffusion of research</b>					
<b>5.1 Actors and networks</b>					
<b>National users of research and international research partners</b>					
5.1.1 National users of research	Firm Level Technology absorption	4.2/7	4	See section 6.2	[9]
	FDI and Technology Transfer	4.3/7	4	See section 6.2	[9]
	Gov't procurement of technology products	3.7/7	3	See section 6.1	[9]
	Government use of research information/products	3.7/7	3	See section 6.1	Interviews
5.1.2 International exposure	Percentage of papers in 10% most-cited papers (2008–2012)	8.8%	3	The G20 average is 10.2%	[14]
	International collaboration 2018 (% of total)	65.4%	5	See section 6.1	[13]
	Main foreign partners	USA, UK, Germany, South Africa, Netherlands	4/5 Northern	-	[13]
<b>5.2 Knowledge exchange practices</b>					
<b>Activities and structures supporting the exchange of research-based knowledge</b>					
5.2.1 Intellectual	Country has a body in charge of intellectual	YES	6	See section 6.2	[15]

**Table 4. List of country indicators and scores**

COMPONENT	INDICATOR	VALUE	SCORE	DETAILS	SOURCE
property	property protection				
	Country is member of a regional IP organisation	YES	6	See section 6.2	[15]
	Number of patents applications per million people (global ranking)	103/119	2	See table 3	[9]
	Number of patents applications per million people (Sub-Saharan African ranking)	12/21	-	Score based on global ranking	[9]
5.2.3 Knowledge exchange support and administration	Country has joined a regional initiative for the promotion of STI	YES	6		-
	University-Industry collaboration (score)	3.5/7	3	See section 6.2	[9]
	Existence of <u>appropriate</u> institutional policies for KE	NO	2	The Government has no national KE policy (albeit the IP policy does reference commercialization).	Interviews
	Quality of incentives for research diffusion	Very poor	1	See section 5.3, 6.1 and 6.2.	Interviews
	Existence of commercial office	Partly	2	Unless they are research-intensive universities, it is unlikely that universities have a KE or tech transfer policy/office	Interviews



# Appendix B - Ghana stakeholder table

Non-exhaustive list of the MAIN research stakeholders in the country.

Role	Ghana		International	
	Public	Private	Public	Private
<b> Policymakers </b>	<ul style="list-style-type: none"> <li>Ministry of Education</li> <li>Ministry of Environment, Science, Technology &amp; Innovation</li> </ul>			
<b> Research funders </b>	<ul style="list-style-type: none"> <li>Ministry of Education</li> <li>Ministry of Environment, Science, Technology &amp; Innovation</li> </ul>		<ul style="list-style-type: none"> <li>DANIDA</li> <li>International Growth Centre</li> <li>SIDA</li> <li>South Africa National Research Foundation</li> </ul>	<ul style="list-style-type: none"> <li>Ford Foundation</li> <li>Knight Foundation</li> </ul>
<b> Intermediaries </b>	<ul style="list-style-type: none"> <li>Council for Scientific and Industrial Research (CSIR)</li> <li>Directorate for Research, Statistics and Information</li> <li>Directorate for Science, Technology and Innovation</li> <li>Ghana Atomic Energy Commission</li> <li>Presidential Advisory Council on Science, Technology and Innovation</li> </ul>	<ul style="list-style-type: none"> <li>Research and Grant Institute Ghana</li> </ul>	<ul style="list-style-type: none"> <li>Transformative Innovation Policy Consortium (TIPC)</li> <li>University of Sussex, Science Policy Research Unit</li> </ul>	
<b> Universities </b>	<ul style="list-style-type: none"> <li>26x public universities</li> </ul>	<ul style="list-style-type: none"> <li>25x private universities</li> </ul>		

<p>Research performing organisations and think tanks</p>	<ul style="list-style-type: none"> <li>• Animal Research Institute</li> <li>• Building and Road Research Institute</li> <li>• Cocoa Research Institute of Ghana</li> <li>• Crops Research Institute</li> <li>• Food Research Institute</li> <li>• Forestry Research Institute</li> <li>• Ghana Space Science and Technology Institute</li> <li>• International Growth Centre Ghana Office</li> <li>• Institute for Scientific and Technology and Information</li> <li>• Institute of Economic Affairs</li> <li>• Institute of Industrial Research</li> <li>• Noguchi Memorial Institute for Medical Research</li> <li>• Oil Palm Research Institute</li> <li>• Plant Genetic Resources Research Institute</li> <li>• Regional Water and Environmental Sanitation Centre, Kumasi (RWESCK)</li> <li>• Savanna Agricultural Research Institute</li> <li>• Science and Technology Policy Research Institute</li> <li>• Science and Technology Policy Research Institute</li> <li>• West Africa Centre for Crop Improvement (WACCI)</li> <li>• West Africa Centre for Cell Biology of Infectious Pathogens (WCCBIP)</li> </ul>		<ul style="list-style-type: none"> <li>• West African Think Tank Network</li> </ul>	<ul style="list-style-type: none"> <li>• Ghana ThinkTank</li> </ul>
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## Appendix C – Interviewees

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Name	Organisation
Prof Ernest Aryeetey	African Research Universities Alliance
Santiago Sanchez Guiu	Innovations for Poverty Action
Dr Henry Telli	International Growth Centre
Afua Yeboah	Office of Research, Innovation & Development, University of Ghana
Grace Annan	Office of Research, Innovation & Development, University of Ghana
Selasie Enyonam Agamah	Office of Research, Innovation & Development, University of Ghana
Dr Obed Asamoah Kissi	Research & Grant Institute of Ghana
Dr Samuel Adjorlolo	Research & Grant Institute of Ghana
Eunice Yaa Brimfah Ackwerth	World Bank

## Appendix D – Peer reviewers

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Name	Organisation
Ajoy Datta	On Think Tanks
Justin Pulford	Liverpool School of Tropical Medicine
Robin Drennan	The University of the Witwatersrand

## Appendix E – Key data sources

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