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for Development (IHERD)**

Background document

**Research and Innovation Management:
Comparative Analysis of Ghana, Kenya, Uganda**

Draft Report

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This synthesis report is derived from extracts and analysis of the various contributions that constitute the full IHERD report on *Governance of higher education, research and innovation in Ghana, Kenya and Uganda*, (Jowi, 2013). This includes the work of and the other contributing authors"

Executive summary

This synthesis report ties together the outcomes of a multi-country research project conducted by the African Network for Internationalization of Education (ANIE) on *Governance of higher education, research and innovation in Ghana, Kenya and Uganda* (Jowi et al, 2013). This research project is part of the wider OECD program on *Higher Education and Research for Development* (IHERD), which is funded by the Swedish International Development Cooperation Agency (Sida). The studies resulted in four separate analytic reports that explored and interrogated the policy and practice of research, innovation, and development management in Ghana, Kenya, and Uganda as well as at the overall Africa-wide level. This synthesis report summarises the results from the full report by:

- Exploring the current status, significance, and understandings of the connections between knowledge and national development planning in African countries,
- Summarising and contextualizing the account of the research and innovation management capacity in the three countries – Kenya, Uganda and Ghana
- Providing a comparative analysis and synthesis to illustrate the similarities and contrasts in the emerging policy, capacities, and institutional arrangements concerning the management of research and innovation systems in African countries;
- Identifying and analysing existing gaps and deficits in the policy and capacity for research, knowledge and innovation governance in the three countries; and suggesting options.

The case studies of Ghana, Kenya and Uganda show that:

- Recent development policy frameworks and program initiatives in the three countries demonstrate a clear focus on the interconnectedness between STI (science technology, and innovation) and development planning. However, the level of coherence within and among the existing policies, programs, and institutions still remains relatively weak. Policymakers require greater awareness and capacity building to ensure that national STI policies and programs capture the national development priorities and are internally and externally consistent in order to promote policy complementarily, coherence, and effectiveness.
- Notwithstanding the increasing mainstreaming of STI at the national development policy level, and despite the growing emphasis on the instrumentality of universities in promoting economic competitiveness and sustainable development, higher education institutions across the three countries remain poorly integrated into the emerging knowledge-based development paradigm and discourse. Higher education institutions

still lack the required vision, resources, capacity, and leadership to embrace science technology and innovation as a guiding principle for their strategic planning and academic programs. The disjoint between national-level policies and institutional realities represent a devastating challenge to the realisation of knowledge-based economies in African countries. Senior leadership within universities and research institutions therefore require skills and capacity strengthening to be able to embed knowledge, enterprise, and innovation into their own strategic plans and research programs in order to discharge their mandate as catalysts of development;

- The three countries demonstrate impressive but varying levels of sophistication with respect to recent policy frameworks and governance arrangements for the management of their national research and innovation systems. Ghana and Kenya represent more elaborate and dynamic governance landscapes than Uganda; but all three countries clearly demonstrate an unmistakable emphasis on developing more effective national institutional arrangements and policies to promote research governance and nurture knowledge economies. The key and most persistent weakness is the lack of national and institutional policies and programs that stimulate collaboration and knowledge exchange between research subsystems and the industrial and business subsystems.
- Inadequate and undiversified funding regimes remain a major challenge to the development of more vibrant research and innovation infrastructure in the three countries and across the sub-Saharan region. In the absence of private-sector funding and competitive grants, public universities and research institutes in the Sub-Saharan region predominantly depend on dwindling public subsidies as well as unpredictable international donor support. This narrow funding base suggests that research and innovation systems in the three countries face severe financial deficits and lack the capacity to formulate and drive their own domestic research agendas. National policymakers and university leadership need to be encouraged to work in closer partnership and to prioritize the strategic importance of research and innovation in national economic growth and competitiveness by investing more significantly in strengthening research capacity, infrastructure, and research opportunities in universities.
- The three country case studies demonstrate that internationalisation, particularly through transnational and transdisciplinary partnerships among universities; represent one of the most effective options for strengthening research capacity and governance arrangements for research and innovation in sub-Saharan countries.
- The studies demonstrate the need for systematic and coherent approaches to integrating STI Policy into national economic and development strategy. This embedding process should accord particular emphasis on the coherent translation and cascading of national development goals and STI policies into clear action plans and intervention programs that are directly connected to promoting economic growth and improving people's real livelihoods.

Acronyms and abbreviations

AAU	Association of African universities
AU	African Union
AfDB	African Development Bank
AHERS	African Higher Education Research Space
AMPATH	Academic Model Providing Access to Health
ASTII	African Science, Technology and Innovation Indicators Initiative
BERD	Business Expenditure on Research and Development
CAP	Consolidated Action Plan
CNDPF	Comprehensive National Development Planning Framework
CSIR	Council for Science and Industrial Research
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
GETFUND	Ghana Education Trust Fund
GOVERD	Government Expenditure on Research and Development
GPRS	Ghana poverty Reduction Strategy Paper
GSS	Government Support for Scientists
HERD	Higher Education Expenditure on Research and Development
IAU	International Association of Universities
IUCEA	Inter-Universities Council for East Africa
JCRC	Joint Clinical Research Centre
MOE	Ministry of Education
MOEST	Ministry of Environment Science and Technology
MOHEST	Ministry of Higher Education Science and Technology
NAB	National Accreditation Board
NABPTEX	National Accreditation Board for Professional and Technician Examinations
NEPAD	New Partnership for Africa's Development
NCTE	National Council for Tertiary Education
NCST	National Council for Science and Technology
NDPC	National Development Planning Commission

NESC	National Economic and Social Council
OECD	Organization for Economic Cooperation and Development
PNP	Private Non-Profit
R&D	Research and Development
RIT	Research Technology and Innovation
RIFORM	Regional Universities Forum for Agriculture
STI	Science Technology and Innovation
STREFUND	Science and Technology Research Fund
UCST	Uganda Council for Science and Technology
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNCTAD	United Nations Conference on Trade and Development
WIPO	World Intellectual Property Organization

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Introduction

The emergence of the idea of knowledge economies over the last two decades represents a profound paradigmatic shift worldwide with respect to the organisation of national economic and production systems as well as the reconfiguration of the role of national education and training systems (OECD 1996). The impact, structure, and outcomes of the knowledge economy differs across and within regions and countries; however, the overall consequence is that knowledge has become increasingly recognized as a powerful driver of economic competitiveness, growth, and sustainable development (OECD 1996; World Bank 2007).

In recent decades, African countries have re-embraced higher education as a key instrument for national and regional development in a knowledge-based economic world order (Bailey et al 2012). A distinctive and growing emphasis on knowledge production, scientific innovation, and closer convergence between research and sustainable development has been observed across many African countries (Obamba, 2013). The three country case studies presented in this report provide captivating overviews of the current landscape of research and innovation as well as the existing institutional and policy arrangements for the governance of research and development in the three countries. In particular, the studies focused on the policy environment for research and innovation at the governmental level; the funding and governance context of research within institutions; as well as the growing importance of internationalisation at national and institutional levels.

The aim of this section is to provide a brief comparative analysis of the scope and character of research and innovation management in the three countries. The paper will synthesise and interrogate areas of similarity and contrast and provide readers with a clear basis for understanding how the three countries compare with each other in terms of the configuration, capacities, and deficits of their research and innovation systems.

Higher Education and Development

The role of higher education in promoting rapid economic growth and sustainable development is now widely recognized across most African countries (Bailey et al 2012; Obamba 2012). This is hardly surprising; since most African countries have embraced the developmental university paradigm since post-independence and universities were viewed as the citadels of enlightenment, development, and national pride (Ajayi et al 1996). In more recent decades, the higher education system is required to play an increasingly central role in the new knowledge-intensive economic landscape. The three country case studies in this report demonstrate this new reality.

In all the three countries, recent national development policy documents have embedded higher education and knowledge production into the core of economic planning and management with the aim of utilising knowledge to accelerate the

achievement of key national development priorities, including the Millennium Development Goals. In Ghana, the *National Development Planning Commission* (NDPC) is involved in the coordination of policy for the purposes of enhancing the production and utilization of research and innovative outcomes to drive socio-economic development. In 2007, Uganda launched the *Comprehensive National Development Planning Framework* (CNDPF) which provided for the development of a 30 year Vision to be implemented through a mixture of short-term and longer-term National Development Plans (NDPs) and Sector Investment Plans (SIPs) at local and national levels. The short term National Development Plan 2010/11 – 2014/15 clearly stipulates the role of research in economic development initiatives, and more specifically recognises universities and vocational institutions as centres of teaching and research excellence that are expected to generate relevant knowledge to address national development challenges (Government of Uganda, 2010). The country's Poverty Eradication Action Plan further emphasised university participation in national development either directly or indirectly through innovative teaching, research, and community engagement (Government of Uganda, 2004). The document states that 'education contributes to the accumulation of human capital, which is essential for higher income and a sustained economic growth' (ibid.).

Education and human capital development have been at the centre of Kenya's economic development thinking for many decades as well. Kenya's first National Development Plan 1964-1970 (Kenya, 1964) attached significant political and economic importance to promoting education and made recommendations for substantial public funding. In a similar spirit, the *Sessional Paper No.10 of 1965* (Kenya 1965) also affirmed the economic importance of education, stating that education should be viewed as much more of an economic than a social service (Kenya 1965, p.305). Like Uganda's recently launched *Vision 2040* and Ghana's *Vision 2020*, Kenya's own *Vision 2030* (Kenya, 2007) strongly emphasizes the importance of building local capacity for science, technology and innovation and integrating knowledge production and utilization into the overall national development strategy in order to achieve rapid economic growth, poverty reduction, and Millennium Development Goals. Overall, the series of development policy instruments produced by the three case study countries clearly emphasize the significance of higher education in driving the national agenda for economic growth and sustainable development.

Growing Convergence of Research, Innovation, and Development

Recent developments and initiatives within Africa's evolving education and development policy landscape suggest a clear trajectory towards greater emphasis on knowledge-based development as opposed to the traditional preoccupation with higher education for manpower development. This new development dispensation is firmly anchored on knowledge produced through research and innovation activities and

constructed broadly as Science Technology and Innovation. The launch of Africa's *Science Technology Innovation Consolidated Action Plan 2006–2010* (AU 2006) represents one of the unprecedented developments within the emerging terrain of capacity building for knowledge-based development and policymaking in African countries. The Consolidated Action Plan articulates Africa's overall vision for harnessing and applying science and technology in eradicating poverty, promoting sustainable growth and development, and strengthening Africa's fuller integration into the global knowledge and economic system (AU2006, 12). One of the key elements of the *Consolidated Action Plan* is the *African Science Technology and Innovation Indicators* (ASTII) Program (NEPAD 2010). Conceived in Johannesburg during the first African Ministerial Council on Science and Technology (NEPAD 2003), the ASTII Program, currently being successfully piloted in 19 African countries, aims to build the human and institutional capacities and systems needed to produce common internationally comparable indicators as tools for monitoring research and innovation programs at national and institutional levels across Africa (NEPAD 2010). The ASTII program represents a new trajectory of growing institutionalization and embedding of science and innovation in Africa's education and development policy. As widely discussed in the Africa Chapter in this series of reports, there is a wide range of other initiatives that demonstrate the increasing focus on building capacity and mainstreaming of knowledge (science-technology-innovation) into Africa's development.

The case studies of Uganda, Ghana and Kenya clearly capture this emerging pattern characterised by the increasing convergence between STI and national development policy. In the Ghana case study Goski Alabi illustrates the preponderance and centrality of the STI phenomenon in almost every recent vision and development planning document produced by the Ghana Government. Most recently the country launched the *National Science, Technology and Innovation Policy* (2010) as the key policy document that drives research and innovation programs in Ghana. The STI approach features prominently in earlier blueprints as well, particularly the Ghana Poverty Reduction Strategy Paper I (1996 – 2005), Ghana Growth and Poverty Reduction Strategy (GPRS II, 2006-2009), as well as Ghana Vision 2020. The NSTI Policy established the Science and Technology Research Endowment Fund (STREFund) to provide funding for research and innovation initiatives (NSTI Policy, 2010). As a result of these recent initiatives, the Innovation Index Report (2012) notes that Ghana made some significant gains by moving 24 notches up from position 114 in 2010 to position 90 (out of 141 countries) in 2012 (INSEAD/WIPO 2012).

A similar pattern of increasing institutionalisation and embedding of STI into the national development is replicated in the Kenyan case study as Obamba and Oanda discuss in this volume. A large and growing body of major recent policy blueprints in Kenya appears unanimous that the science-technology-innovation triad is critical for promoting economic growth, stimulating productivity, and improving people's livelihoods. The most important instrument within this new paradigm is the *Kenya Vision 2030* (Kenya 2007b), which is the country's national development blueprint

which provides a robust and comprehensive social and economic development framework based on the application of STI and advanced knowledge. Other major policy instruments that articulate the developmental significance of STI and higher education include the *Strategic Plan 2008-2012 of the Ministry Higher Education Science and Technology* (Kenya 2008) and the *National Science, Technology and Innovation Policy and Strategy* (Kenya, 2009). In 2008, Kenya also launched the *Research Technology and Innovation Sector* as a distinct and independent sectoral entity charged with the role of strengthening STI capacity and promoting STI production and utilisation in Kenya's development programs (Kenya 2010b). All these initiatives clearly demonstrate, at least on paper, that Kenya is firmly committed a nurturing a knowledge-driven development agenda. The question of whether there is sufficient capacity and financial commitment to these goals remains debatable as Obamba and Oanda have discussed in this volume.

Compared to Ghana and Kenya, Uganda appears to manifest a relatively weaker and less integrated policy and institutional framework for the mainstreaming of STI in its national development planning. The 2012 Global Innovation Index puts Uganda at position 117 with a score of 25.6 whereas Kenya and Ghana are ranked 96 and 92 with scores of 28.9 and 29.6 respectively (INSEAD/WIPO 2012). This suggests that Uganda's STI capacity is still less developed compared to Kenya and Ghana, although the recent *African Innovation Outlook* suggests that Uganda spends more on research and development compared to both Kenya and Ghana (NEPAD 2010). A recent report of the Uganda Council for Science and Technology (UCST) conceded that Uganda's capacity to innovate is still low as the precipitants of innovation (e.g. stock of scientists, engineers, and S&T institutions) are still low and fall far below international average due to inadequate research infrastructure, low quality of research institutions and the high levels of brain drain (UCST 2011, xi).

However, Uganda has also launched a comprehensive *National STI Policy* (2009) instrument similar to the Kenyan and Ghanaian policy blueprints, and STI features prominently across a wide range of separate national development policy documents. For instance, Uganda's *Comprehensive National Development Planning Framework* (CNDPF), *National Development Plans*, and *Uganda Vision 2040* all separately emphasize that the role of higher education in research and innovation is critical for promoting Uganda's economic transformation and competitiveness. In particular, the current *National Development Plan* demands that Ugandan universities must be involved in generating advanced knowledge and innovations through research and to be able to adopt such knowledge to the local Ugandan situation as well as promote the development of local scientific and technological capacity required to deal with the problems of development in Uganda (Government of Uganda 2010). The country also rolled out the *Uganda Millennium Science Initiative* in 2006 through USD 35 million financing provided by the World Bank (UCST 2011). The objective of the programme was to increase the number and quality of scientists produced by Uganda's universities and research centres, and to boost the country's technological productivity in industrial, agricultural and other sectors (Egwang, 2010).

National frameworks for research and innovation management

The effective management of research and innovation programs as well as their linkages with national development policy planning require coherent policy frameworks and strong governance structures. The national management matrix typically involves the production or reconfiguration of institutions, policies, stakeholders, capital resources, and the interrelationships among all of these factors. The scope and coherence of the national management framework for research and development planning is therefore a critical indicator of a country's STI capacity. In recent decades Africa has rolled out a growing variety of initiatives designed to strengthen the capacity for STI development, governance, and utilisation for development and economic competitiveness (Obamba 2013).

As we have already seen, the Africa STI Indicator program is one of the key initiatives in this regard and is meant to ensure that African countries gain and deepen their human and technical capacities to monitor, strengthen, and govern the various systems, structures, and processes that constitute their national innovation systems to promote global competitiveness (NEPAD, 2010). The ASTII program is aimed at creating internationally comparable indicators to act as tools for more efficient measurement and improvement of Africa's innovative competitiveness.

The governance landscape of knowledge-based development in Africa currently includes various other initiatives. The *Second Decade of Education Action Plan 2006–2015* (AU 2006) provides a comprehensive articulation of the African Union's policy on knowledge and multilateral partnership for Africa's development. The African Development Bank is another leading intergovernmental body that has recently taken significant steps to intensify its role in strengthening knowledge-based development policy in Africa through its *Higher Education Science and Technology Strategy* in 2008 (AfDB, 2008). However, the launch of *Africa's STI Consolidated Action Plan 2006–2010* (AU 2006b) represents the most audacious and unprecedented undertaking within the emerging terrain of knowledge and development policymaking in Africa. Formulated within the context of the flagship *Africa-Europe Joint Partnership* (European Council 2006), the STI Consolidated Action Plan articulates Africa's overall vision for harnessing and applying science and technology in eradicating poverty, promoting sustainable growth and development and strengthening Africa's fuller integration into the global knowledge and economic system (AU 2006, 12). Overall, the Consolidated Action Plan represents the current and most comprehensive governance framework for science and technology in Africa.

The three country case studies of Kenya, Ghana and Uganda illustrate varying extents and patterns in the production and reproduction of institutional and governance arrangements for research and innovation at various levels. National Innovation Systems normally consist of three components; the education system, the research

system, and the business system (OECD 1997). The case studies reported here focused on the education system and the research system in the three countries. The business system was outside the scope of the current studies. In Ghana, Goski Alabi discusses a set of recent agencies and policies created specifically to facilitate the governance of the country's research and innovation initiatives. A key policy instrument is the *Government White Paper* (1991) which established three agencies to streamline higher education policy and governance. These consist of the *National Council for Tertiary Education* (NCTE), the *National Accreditation Board* (NAB) and the *National Board for Professional and Technician Examinations* (NABPTEX). Similar constellations of agencies can be observed in the Kenya and Uganda cases.

In Kenya, the higher education sector is regulated through the *Commission for University Education* and the *Universities Act* (2011). The Ugandan higher education system is steered through the *National Council for Higher Education* (NCHE) while the overarching legal framework is provided by *Universities and Other Tertiary Institutions Act of 2001* (Government of Uganda, 2001). These regulatory agencies appear to have similar roles and autonomous status despite being located in diverse national and historical contexts. All the agencies are involved with accreditation and registration of universities; monitor and regulate universities; set standards and coordinate admission of students into universities, and to provide policy advice on matters.

The research systems in the three countries and the prevailing governance arrangements manifested different levels of maturity and sophistication. A common feature, however, is that there is strong but relatively recent government focus across the three countries on promoting STI governance through sets of policy instruments. In Ghana, the major institutions relating to the coordination of policy for the purposes of enhancing production and utilization of research and innovative outcomes are the *National Development Planning Commission* (NDPC), *Ministry of Environment, Science and Technology* (MOEST), the *Ministry of Education* (MOE), and the *Council for Scientific and Industrial Research* (CSIR). Significantly, the CSIR is responsible for coordinating and promoting research and innovation among research institutes in Ghana whereas the *National STI Policy* (2010) provides the overarching policy framework. In addition, Ghana has technology support and regulatory agencies, and standardized intellectual property (IP) legislation (UNCTAD NSTI Policy Review, 2011).

In the Kenyan context, an important dimension of the increasing institutionalization of STI is the establishment of the *National Economic and Social Council* (NESC) within the Office of the President to provide an integrated think-tank with the mandate and resources to strengthen the development, coordination, mainstreaming, and implementation of government policy and programs on Science Technology and Innovation for enhanced economic growth, international competitiveness, and achieving Millennium Development Goals (NESC, 2008). Another similar institutional development is the *National Council for Science and Technology* (NCST) whose mission is "to effectively co-ordinate research, promote and provide evidence based policy

advice on matters of Science, Technology and Innovation in Kenya for national social-economic development” (NCST 2009, p.5). However, the most significant indicator of the Kenya Government’s commitment to the mainstreaming of STI and knowledge in its development policy management is embodied in the establishment of the fully-fledged flagship *Research Innovation and Technology (RIT) Sector* during 2008/09 (Kenya 2010).

The Ugandan innovation governance landscape is much less dense and elaborated compared to the Ghanaian and the Kenyan systems outlined above. In Uganda, the recognized national agency with the responsibility for regulation, coordination and policymaking on national research policy is the *Uganda National Council for Science and Technology (UNCST)* established 1990 (UCST, 2011). UCST has a national mandate to formulate policies and coordinate STI programmes and this statutory function entails collection and analysis of scientific and technological statistics and indicators to facilitate measurement and provision of policy advice to Government on results of Uganda’s efforts towards STI development (UCST 2011). Clearly, all the three case study countries currently manifest an independent ‘Council’ with a mandate for STI coordination and strengthening at the national level. These structures are all relatively recent, have identical functions, and are anchored on specific legislative instruments that provide for their existence, viability and stability. All three countries also have a coherent policy framework dominated by “National STI Policy” blueprints established between 2009 and 2010. A striking and rather strange difference is that Uganda’s UCST is located within the Uganda’s Ministry of Finance Planning and Economic Development whereas in Kenya and Ghana the corresponding structures are domesticated variously with the ministries in charge of education science and technology. Kenya is also distinctive for its recent move to set up an independent and well-resourced *Research Innovation and Technology (RIT) Sector* which has a clear mandate that focuses on strengthening, promoting, and expanding Kenya’s STI capacity and the utilisation of STI is stimulating economic productivity and sustainable development (Kenya 2010).

Funding education, research, and innovation

Establishing and maintaining a vibrant national research infrastructure can be a complex and costly undertaking for any country, but developing countries can encounter even more complex financial and structural constraints. The Gross Expenditure on Research and Development (GERD) is one of the key indicators of how much money a country dedicates to research and development activity as a percentage of its GDP. The OECD’s *Frascati Manual* (OECD, 2002) suggests that the appropriate expenditure data for computing GERD can be collected for four sectors: the business sector (BERD), government sector (GOVERD), higher education sector (HERD), and

private non-profit organizations (PNP). The expenditures are measured in local currency and thereafter converted into Purchasing Power Parities (\$PPP) to allow for international comparisons (OECD 2002).

African Union adopted a resolution that commits each African country to spend targeted 1 per cent of its GDP on Research and Development (African Union 2006). Africa is still lagging far behind other world regions in terms of gross domestic expenditure on research and development (GERD) as well as the percentage of gross domestic product devoted to R&D activities (UNESCO 2011). In terms of expenditure, Africa as a whole spends an average of 0.4% of its gross domestic product on research and development, whereas industrialized countries spend approximately six times that amount (UNESCO 2011). Research and development expenditure for sub-Saharan African drops to a mere 0.3% without South Africa, which spent nearly 1% of its GDP on Research and development in 2009 (UNESCO 2011). Generally, the funding of research and innovation programs remains a major challenge for most African countries and universities and this could remain the same for the foreseeable future unless particularly dramatic measures are taken (NEPAD 2010).

In large part, higher education research and innovation in African countries are funded mainly from the diminishing government resources, which lead to high levels of dependency on multilateral or bilateral donor funding. Private funding drawn from businesses and philanthropic sources are quite rare in Africa (NEPAD 2010). Similarly, there is a chronic lack of competitive research funding at the national level that university researchers can bid for to promote their internal resource mobilisation. Reliable comparative data on sources of funding and expenditure patterns in most African countries are difficult to find due to data incompleteness, inconsistencies, and differences in computational approaches.

In Ghana, education is funded from four main sources. Recent data for 2008 indicate that 72% of research and education funding came from the Ministry of Education; the Ghana Education Trust Fund (9.5%), institutions generated 9% internally; while international donors provided 9.5% of the sector funding (MOESS, 2008). In 2011, education expenditure as a percentage of Government of Ghana (GoG) expenditure was 25.8% making it the largest government expenditure. Unfortunately, these estimates do not say anything about the country's expenditure on science and technology research. Funding for research in Ghana can be obtained from the Science and Technology Trust Fund (STREFund), however both the UNCTAD Policy Review (2011) and Ghana's National STI Policy (2010) have widely dismissed the STREFund as not being well-resourced. Another funding source is the Ghana Education Trust Fund (GETFund). The GETFund was established by the Ghana Education Trust Fund Act 2000 and is funded through raising Value-added Tax (VAT) from 10% to 12.5% in 2000 (Effahetal. 2009). Ghana's expenditure on Research and Development was about 0.3per cent of its gross domestic product (GDP) in 2008, nearly all of which comes from government outlays

equivalent to around \$49 million or 1.1 per cent of the budget. This dismal expenditure levels show inadequate support for research and innovation development.

Uganda provides better estimates. A recent STI Status Report published by Uganda’s UCST indicates a 30% increment in government expenditures on science and technology between 2008 (Ushs. 367 billion) and 2009 (Ushs. 479 billion). Total government expenditure on S&T as a percentage of Gross Domestic Product (GDP) increased from 1.9% in 2008 to 2.3% in 2009. More broadly, Government Research and Development expenditure (GOVERD) increased from Ushs. 61.1 billion in 2008 to Ushs. 79.7 billion in 2009. GOVERD as a percentage of GDP also increased from 0.31% to 0.39% during the reference period. The R&D intensity (GERD/GDP) was 0.6 per cent in 2009, which was still below the AU recommended 1% of GDP for African countries (UCST 2011).

In the Kenya case, the Medium Term Expenditure Framework Report (Kenya 2010) provides a useful but more specific breakdown of the actual expenditures attributed to the Research Innovation and Technology Sector. The estimates show that total recurrent expenditure by the RIT sector increased from nearly KSh. 22.5 billion in 2007/08 to approximately KSh 38 billion in 2009/2010 Financial Year; representing a growth of 69% in sectoral expenditure. For the FY 2011/12 the RIT Sector was allocated a total of KShs 44.2 Billion to finance recurrent and development expenditures. The Ministry of Higher Education Science and Technology (MoHEST), which is the parent ministry for all public universities, saw its recurrent expenditure rise from KSH 15.7 billion to over KSh 23 billion during the same period. While it is not clear how much of this money actually went into funding universities it suggests that funding to the higher education sub-sector has continued to increase. The table 1 below shows the GERD and GERD/GDP for five selected African countries in 2007/08.

Table 1: Gross Expenditure on Research and innovation for selected African countries 2007/08

Country	Year	GERD (Millions)	\$PPP	GERD as % GDP
Ghana	2008	120		0.38
Kenya	2007	277.8		0.48
Uganda	2007	359.8		1.10
Zambia	2008	55.3		0.37
S. Africa	2007	4976.6		1.05

Source: Compiled from Africa Innovation Outlook (2010)

Internationally comparable and more reliable expenditure estimates can be found in the recently published Africa Innovation Outlook (NEPAD 2010) depicted in table 1 above. Fortunately, Kenya, Uganda, and Ghana are all participants in the Africa STI Indicator program hence all three countries have been collecting baseline data across all the four components of STI capacity. The 2010 *African Innovation Outlook* (NEPAD,

2010) shows that Kenya's gross expenditure on research and innovation exceeded KSh 7.6 billion during 2007/2008. If converted into comparable Purchasing Power Parity, the expenditure levels translates into a GERD of PPP\$ 277.8 million (approx. US\$90 Million), which means that Kenya spent 0.48% of its GDP on Research and Development. The Outlook shows that Uganda and Ghana had Gross Expenditures on R&D (GERD) of \$PPP 359.8 and \$PPP 120 respectively; which represented 1.1% of GDP for Uganda and 0.38% of GDP for Ghana. These expenditure profiles clearly show that Uganda had the highest expenditure on research and development and the highest GERD as a percentage of the GDP while Ghana had the least. To put this into perspective, this gross expenditure on R&D should be viewed in the context of the overall African target of 1 per cent of the GDP. South Africa, for example, spent PPP\$ 4976.6 representing 1.05% of its GDP (NEPAD 2010).

As noted above the Gross Expenditure on R&D can be allocated to any of the four different sectors of the national innovation system; namely business sector, government sector, higher education sector, and Private and Non-Profit sector. Apart from disparities in GERD levels, the three countries also differed in terms of allocation of funds to the four innovative sectors. The table 2 below illustrates the sectoral allocations for some African countries including Ghana, Kenya, and Uganda.

Table 2: Gross domestic expenditure on R&D (GERD) by sector of performance (million PPP\$)

Country	GERD\$PPP (millions)	Business PPP BERD	Government GOVERD	Higher Education HERD	Private & Non-Profit
Ghana	120.1	5.9	114.4	2.8	*
Kenya	277.8	6.8	193.3	41.9	35.8
Uganda	359.8	14.8	165.5	179.5	*
S. Africa	4976.6	2871.5	1079.9	965.5	59.7
Malawi	55.3	1.1	10.7	43.3	0.3

Source: Compiled from Africa Innovation Outlook (2010)

The expenditure pattern in the table 2 above shows that the largest proportion of R&D expenditure was consumed by the government in Kenya and Ghana, except Uganda where more resources were spent on the Higher Education sector (\$PPP 179.5 million) than on Government (\$PPP 165.5 million). Uganda also had the highest expenditure on R&D gross as well as across all the sectors for which data was available. For example, Uganda's expenditure on Business R&D is more than twice Kenya's expenditure and nearly thrice that of Ghana; whereas for the higher education sector expenditure Uganda's spending (\$PPP 179.5) is nearly 60 times that of Ghana (\$PPP 2.8) and four times larger than Kenya's expenditure of \$PPP 41.9. Overall, Ghana has the worst expenditure record on both gross and sectoral R&D among the three case study countries.

Cross-cutting deficits and challenges

The three countries of Ghana, Kenya and Uganda continue to face the same challenges that affect other sub-Saharan African countries. The research and innovation systems of the three countries face considerable financial deficits resulting from national economic constraints as well as the low priority attached to research and knowledge production in the eyes of the custodians of political power and national resources in most African countries. In Ghana, for example, funding for research remains a serious constraint. Government allocations to research are not adequate as indicated in the section above. Institutions supplement limited government funds by competing for research grants and also through joint research initiatives with other universities and through various kinds of partnerships. Some universities such as University of Ghana have allocated part of its internally generated funds to set up funding schemes which are accessible to members of the University community for research. But all these put together are, however, not adequate to support a robust R& D infrastructure.

Ugandan universities experience acute shortage of research funding. Every year, public universities prepare and submit a budget for research to the government for funding but eventual government funding allocations for research often fall far below 50% of the university budgets. Furthermore, according to a study by World Bank, less than 15% of the Ministry of education budget is allocated for higher education (World Bank, 2000).

Respective universities also set aside small funding packages for research; however the bulk of university research funds originate from development partners and the private sector through contract research, joint ventures, licensing and trademarks (Makerere, 2008: 9). The Uganda country study further highlights the funding deficits for research and the tendency for research funding coming predominantly from international sources through collaborations. The lack of domestic funding for research has resulted in low research productivity across the sector (Ecuru 2008). Similar effects of dependency on external funding are highlighted by Goski Alabi in her paper on Ghana where reliance on donor funding has deeply undermined the development of an internally-driven national research agenda and the ability to tailor coherent research focusing on national development priorities. The tales of research funding deficits are replicated in Kenya as well. Based on the actual financial requirements for the Research Technology and Innovation sector the funding provided by the government in 2007/08 and 2008/09 financial periods implied budget deficits of KShs 56 billion and 60 billion respectively (Kenya 2010, ix). In FY 2011/12 the Sector required a total of KShs. 104.2 Billion yet the Sector was allocated a total of KShs 44.2 Billion, implying a gaping financial deficit of KShs 60 Billion (ibid, p. ix). These staggering budget deficits suggest that Kenya faces significant challenges and weaknesses in its efforts to fund its RIT programs (Kenya 2010, p.30).

Poor coordination and articulation between the higher education and research subsystem and the development and business subsystems is one of the greatest weaknesses of National Innovation systems across the three case study countries and other sub-Saharan countries. The role of universities in national development is now strongly emerging and widely recognised across African countries (Bailey et al., 2012 p.104; Obamba 2013); but there is a widening disjoint between university-level policymaking and policymaking at the national level. Despite showing a strong development orientation, this awareness has not been institutionalized into policies and structures that can operationalize this new knowledge-based development orientation at the institutional levels within African universities. Bailey et al. (2012) assert that 'most institutions are still in the traditional mode of producing skills for the civil service' (p.104).

In the case of Ghana, the UNCTAD Policy Review report notes that Ghana's policies and institutions for science, technology and innovation have not been modernized, nor have they been aligned to the country's economic growth and human development goals. The report further notes that a key feature of Ghana's institutional landscape is the weak links and poor positive feedback between and among institutions, including the higher education and research institutes and the private sector. The Director General of Ghana's Council for Science Innovation Research observed that one of the major challenges facing Ghana is the problem of weak coordination and collaboration between the research institutions and universities as well as civil society and industry. Consequently the need for a systematic and concerted approach to integrate the STI Policy into Ghana's national development strategy is crucial. Such a process should lay particular emphasis on cascading of the national strategic goals into actions that will improve business and the quality of life for all Ghanaians in a sustained manner.

Kenya faces similar structural inconsistencies in its education and development policy. Recent official papers in Kenya have highlighted the poor coordination, weak governance, and poor utilization of research outcomes in Kenya as well as the severe lack of cooperation and synergy between university and industry and between university and national development priorities (Kenya, 2005; 2007; 2012). Cooperation and networking among Kenyan universities at the national level is either negligible or altogether non-existent since most universities are often preoccupied with pursuing short-term and mostly unequal linkages with universities in the industrialized countries (Obamba, Mwema, and Riechi, 2012). A national study commissioned by the Commission for Higher Education (Gichanga, 2005) reported that there was limited collaboration between Kenyan universities and industry. The *Wandiga Report* observed that research enterprise in Kenya is constrained by the poor coordination and harmonization between researchers and research institutes, and the limited funding allocated to research (Kenya 2007, p.159).

To remedy this deficit, both the *Wandiga Task Force report* (Kenya 2007a) and Vision 2030 (Kenya 2007b) strongly recommended the development of strategic linkages and

partnerships between universities and industry to enhance mutual knowledge exchange, collaborative research, and innovation transfers. The Uganda case study also highlights similar weaknesses in the articulation and synergies between universities on the one hand and industry, private sector, and local communities on the other. The policymaking processes at the national and in institutional levels are also deeply disjointed and incoherent. The report recommends that Ugandan universities should strive to generate and domesticate knowledge by diffusing it into the economy through linkages with the private sector. To play this role effectively, the universities need focus not only on the production of graduates for the job market but also to drive community development by working directly with their host communities to address critical development problems such as unemployment, poverty, hunger, food insecurity, and to carry out social renewal.

Table 3: National level Policies, Governance structures, and STI Landscape for 3 African countries

Elements	Kenya	Ghana	Uganda
National policies on R&I	<ul style="list-style-type: none"> - Kenya Vision 2030 (2007) articulates a knowledge-based development agenda to transform Kenya into a modern knowledge economy -Government set up Research Technology and Innovation Sector Report (2008) - National STI Policy and Strategy Paper launched 2009 - National STI Bill (2010) anchors the STI policy in law - Ministry of Education Science & Technology Strategic Plan 2008-2012 - Research Technology and Innovation Sector launched to coordinate STI programs -Universities Act (2011) spells out new aims, governance 	<ul style="list-style-type: none"> -Government White Paper (1991) -Ministry of Environment, Science and Technology Ministry of Education Council for Scientific and Industrial Research (CSIR) The National Science, Technology and Innovation (STI) Policy (2010) -Vision 2020/Vision 2015 -Ghana’s Growth and Poverty Reduction Strategy (GPRS, 2006-09) emphasize STI in development -The University of Ghana developed an Intellectual Property Policy, Ethics Policy and a 	<ul style="list-style-type: none"> Universities and Other Tertiary Institutions Act of 2001 -Education Sector Investment Program 1998 -Comprehensive National Development Planning Framework (CNDPF) -Government White Paper (1992) requires universities to generate and diffuse knowledge and STI research for development -National Development Plan 2010/11 –15 clearly stipulates the role of research in development -Comprehensive National

	<p>structure, policy framework for university sector</p> <ul style="list-style-type: none"> -Taking part in the Africa STI Indicators (ASTII) Program run by NEPAD. Country conducts periodic national STI surveys. 	<p>Research Policy</p> <ul style="list-style-type: none"> -Taking part in the Africa STI Indicators (ASTII) Program run by NEPAD. Country conducts periodic national STI surveys. 	<p>Development Planning Framework (CNDPF)</p> <ul style="list-style-type: none"> - Uganda Vision 2040 launched to transform Uganda economy -National STI Policy Paper launched 2009 -Taking part in the Africa STI Indicators (ASTII) Program run by NEPAD. Country conducts periodic national STI surveys.
Governance of R&I	<ul style="list-style-type: none"> - National Council for Science and Technology revamped to strengthen STI programs -National Economic & Social Council established to advise government on STI policy and development programs -Commission for University Education in charge of accreditations and oversight of all universities -The Research Technology Innovation steers and funds national innovation system 	<ul style="list-style-type: none"> -National council for Tertiary Education -National Accreditation Board (NAB) -National Development Planning Commission 	<ul style="list-style-type: none"> -National Council for Higher Education (NCHE) -Makerere University Strategic Plan 2008/09 – 2018/19 underscores the importance of research and innovations in driving national economies
Human resource development in R&I	<ul style="list-style-type: none"> -Kenya Vision 2030 promotes scientific subjects -STI Policy Paper (2009) set up <i>STI Training Assessment Project</i> and <i>STI</i> 	<ul style="list-style-type: none"> -Ministry of Environment, Science and Technology launched Mathematics, Science and 	<ul style="list-style-type: none"> -5-year Millennium Science Initiative funded by World Bank to support research, STI education and training

	<p><i>Curriculum Review</i> in Kenyan universities to mainstream science study</p> <ul style="list-style-type: none"> -National Council for Science and Technology provides funds for researchers - African Innovation Outlook (2010) reported that Kenya had 6799 research staff of which 3794 were researchers. Hence 100 researcher per million inhabitants 	<p>Technology Scholarship Scheme (MASTESS).</p> <ul style="list-style-type: none"> -African Innovation Outlook (2010) reported that Ghana had 2115 research staff of which 636 were researchers. Hence country has 28 researchers per million inhabitants 	<ul style="list-style-type: none"> -Government Support to Scientists(GSS) program -Funding to strengthen Uganda Industrial Research Institute; Joint Clinical Research Centre (JCRC) and Economic Policy Research Centre (EPRC). -African Innovation Outlook (2010) reported that Uganda had 1768 research staff of which 785 were researchers. Hence 26 researchers per million inhabitants
<p>Funding mechanisms for R&I</p>	<ul style="list-style-type: none"> -Funding is mainly from Government appropriations And private sector -Donors also fund research and other STI programs -Funding to universities is channelled through MoHEST. -Research funding for STI administered through the RIT Sector vote for the entire national innovation system -National Council for Science & Technology also disburses research funding for STI -STI Policy seeking new funding source: Venture Capital Fund, Innovation Trust Fund, and National 	<ul style="list-style-type: none"> -Funding from Ministry of Education (72%), GETFund (9.5%), internal institution funds (9% in 2008) and donor funds(9.5%) - Research funding can be obtained from the Science and Technology Trust Fund (STREFund) 	<ul style="list-style-type: none"> -Funding is mainly from Government appropriations And private sector -International donors also fund research and STI programs

	Research Foundation. No reported progress or funding estimates available		
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The role of internationalisation

While internationalisation is not a new phenomenon, in recent years, its complexity has grown, especially due to its varied interpretations, impacts, rationales, activities and consequences. It has thus emerged as one of the defining issues in higher education globally, making it a formidable force that is gaining increasing attention from universities worldwide (IAU, 2010). Internationalisation is one of the major forces shaping Africa's higher education sector in the 21st century (Jowi, 2010), whose impacts include several opportunities for African universities and societies and even some potential risks.

Even though internationalisation is not an entirely new phenomenon in African higher education, Africa is viewed as a relative late comer to the arena of contemporary internationalisation. Thus internationalisation has been part of Africa's higher education sector since the formative years, reflected in Africa's colonial legacy (Teferra, 2008) and the development trajectories of African higher education in recent years. The dynamic nature of internationalisation and the equally dynamic global context in which it operates hold particular implications for African countries. The complexity of the phenomenon makes it difficult for individual countries, let alone institutions, to adequately respond to its many challenges, opportunities and even risks. Institutions, countries and even regions pursue internationalisation with different motivations. The main motivations for African universities to embrace internationalisation are research outputs, knowledge production and the strengthening of institutional capacity (Jowi, 2010).

The turn of the 21st century has witnessed attempts at revitalising higher education in Africa, with growing interest in the sector from internal and external stakeholders and partners (Oyewole, 2010). Some of the main outcomes of internationalisation and globalisation are the growth in interdependence, interconnectedness, partnerships, and mobility across global communities. These new developments enable global challenges and achievements to transcend national boundaries (Koehn & Rosenau, 2010; Koehn and Obamba, 2012) and require sustainable solutions which need to be addressed collectively. Partnerships across national and disciplinary boundaries are thus rapidly emerging (King, 2008; Obamba and Mwema 2009; Obamba 2013). This trend was succinctly affirmed at the 2009 UNESCO World Conference on Higher Education which stressed the role of higher education and research in the future growth of Africa and recommended international partnerships as a priority area for the mobilisation of resources to revitalise African universities (UNESCO, 2009).

As a result, partnerships between universities, already an important aspect of internationalisation, were recognised as being crucial, leading to new forms of collaboration in research, knowledge generation, and institutional strengthening, among other things (Shabani, 2010). Through internationalisation, universities are becoming increasingly strategic actors in Africa's development (King, 2008). Recent key African policy publications illustrate the importance of transnational knowledge partnerships (AfDB, 2008), such as North-South and South-South research collaborations to boost local knowledge production. Internationalisation thus supports Africa in harnessing the power of science, technology and innovation to transform its societies (Obamba, 2013).

Research has become a major driver of internationalisation, especially in Africa where academic research activity remains weak due to quality challenges, weak institutional capacity for research, and inadequate funding, among other factors. Internationalisation and transnational partnerships provide opportunities for researchers to participate in international research networks which can significantly improve the quality of the research environment, funding, research infrastructure, and incentives in African universities (Sehoole, 2008). Through collaborative research activities, universities have, and can continue to develop effective and sustainable interventions. This is evident in the activities of the Regional Universities Forum on Agriculture (RUFORUM) based at Makerere University in Uganda and in the AMPATH program based at Moi University, Kenya. Support programmes such as the Global Fund to fight HIV/AIDS, Tuberculosis and Malaria have provided resources for universities in Kenya, Uganda and Ghana among others to work collaboratively with other international universities on health issues. The three country cases demonstrate how internationalization has contributed to the strengthening of research in different knowledge areas. In Kenya, there are inspiring examples at Moi University and University of Nairobi on the essence of international partnerships in strengthening institutional capacities for research (Obamba, Mwema and Riechi 2013).

Internationalisation also has the potential to strengthen the curriculum in many African universities and thus also contribute to the quality of the learning outcomes. Enhancement of the curriculum through internationalisation could contribute to designing higher quality programmes and infusing new and relevant knowledge appropriate for enhanced research and innovations. The Kenyan case demonstrates clearly how international collaborations has enabled the universities to strengthen their curriculum and make them more responsive and innovative. Ghana and Uganda cases have not delved much on the potentials of internationalization for research and curriculum strengthening.

Most African universities suffer from weak internal governance and management (Mohamedbhai, 2008) which negates potential progress towards internationalisation. Building institutional governance and management capacity is essential for fostering

partnerships and collaborations, and implementing internationalisation activities. Through internationalisation, African universities can adapt and develop more effective and efficient management practices in order to optimise their potentials for research and innovations. Internationalisation is also important in strengthening human resource capacity in African universities. Kenya, Uganda and Ghana have all benefited in different ways through staff development in international universities. This has even been much more crucial in specialised knowledge areas where these countries still do not have adequate capacities. Then need to enhance human capacities has made African countries send most of their young people abroad to gain these useful skills. As such Kenya is the second leading African country sending students to the United States of America.

Internationalisation has already made an enormous contribution to the development of Africa's skilled expertise, and holds the potential to alleviate Africa's skills deficit. Many African scholars have attained at least one of their academic qualifications abroad (Oyewole, 2010). The situation is further negatively impacted upon by the significant impacts of the brain drain (Hayward, 2010) at a time when postgraduate enrolments are not growing commensurately (Tettey, 2009) with the need to replace the ageing cohort of pioneer African academics. This presents an urgent need for African universities to invest in the development of the new generation of scholars, including improved quality of teaching and research (Hayward, 2010). Most of the universities in the countries included in the cases discussed have established international offices to coordinate internationalization activities. In all the cases it is noted that these offices are poorly staffed and do not have adequate finances for their activities.

The new initiatives towards enhanced academic exchanges, harmonisation of academic programmes, strengthening intra-Africa co-operation, and the realisation of African Higher Education and Research Space (AHERS) afford increased capacity for African universities to address Africa's challenges in different areas. One flagship development is the establishment of the Pan African University (PAU), with centres spread across Africa. This is an attempt to enhance collaboration and co-operation between African countries, while at the same time developing the next generation of African scholars through research and postgraduate training (AU, 2008) in fundamental and development-oriented areas. In addition, the promulgation of the Accra Declaration and its quest for increased opportunities for academic cooperation in Africa (AAU, 2004) led to the establishment of the Mwalimu Nyerere Student Mobility Programme in 2007 to promote internal student mobility.

Universities in the three countries demonstrate that they have a number of international partnerships and collaborations that have contributed immensely to their developments. It is notable that in the recent years, more collaborative arrangements are being witnessed even between African Universities themselves. A case in point is the close links between Kenyan and Ugandan universities that can be traced to the pre-independence days when Makerere University was the only one in the East African region. For Kenya and Uganda, institutional collaborations are further coordinated and facilitated by the Inter-University Council for East Africa (IUCEA) and other regional research networks.

Despite these opportunities and developments from internationalization, the scale of the educational divide that separates Africa and other world regions is almost inestimable, and the gap can only be bridged by the effects of collective action. Internationalization provides more opportunities for collective action to reduce these gaps. Some of the barriers can be addressed through partnerships and enhanced international cooperation that can create new opportunities. African universities recognise a number of risks associated with internationalisation (IAU, 2010) including brain drain which continues to weaken the already meagre human resource capacity in African universities. Other risks include the commercialisation of higher education and the imposition of foreign or irrelevant curriculum and policies in African higher education systems (Jowi, 2009).

Apart from the risks, there are also a number of challenges and drawbacks. Due to weak local capacity, Africa's scholarship continues to be shaped largely by Euro-American intellectual paradigms, and theoretical, epistemic, and methodological orientations that are likely to reproduce and reinforce Western knowledge. This lopsided global knowledge and innovation system, with its centre in the industrialised world, is not desirable for Africa's future (Jowi and Obamba, 2013). In this context, another challenge confronting African universities is how to maintain local relevance while simultaneously responding adequately to the demands of increasing internationalisation. All in all, internationalization presents a number of opportunities that could strengthen capacities for research and innovation in Africa

Results of the case studies

The case studies of Ghana, Kenya and Uganda show that:

- Recent development policy frameworks and program initiatives in the three countries demonstrate a clear focus on the interconnectedness between STI (science technology, and innovation) and development planning. However, the level of coherence within and among the existing policies, programs, and institutions still remains relatively weak. Policymakers require greater awareness and capacity building to ensure that national STI policies and programs capture the national development priorities and are internally and externally consistent in order to promote policy complementarity, coherence, and effectiveness.
- Notwithstanding the increasing mainstreaming of STI at the national development policy level, and despite the growing emphasis on the instrumentality of universities in promoting economic competitiveness and sustainable development, higher education institutions across the three countries remain poorly integrated into the emerging knowledge-based development paradigm and discourse. Higher education institutions still lack the required vision, resources, capacity, and leadership to embrace science technology and innovation as a guiding principle for their strategic planning and academic programs. The disjoint between national-level policies and institutional realities represent a devastating challenge to the realisation of knowledge-based economies in African countries. Senior leadership within universities and research institutions therefore require skills and capacity strengthening to be able to embed

knowledge, enterprise, and innovation into their own strategic plans and research programs in order to discharge their mandate as catalysts of development;

- The three countries demonstrate impressive but varying levels of sophistication with respect to recent policy frameworks and governance arrangements for the management of their national research and innovation systems. Ghana and Kenya represent more elaborate and dynamic governance landscapes than Uganda; but all three countries clearly demonstrate an unmistakable emphasis on developing more effective national institutional arrangements and policies to promote research governance and nurture knowledge economies. The key and most persistent weakness is the lack of national and institutional policies and programs that stimulate collaboration and knowledge exchange between research subsystems and the industrial and business subsystems.
- Inadequate and undiversified funding regimes remain a major challenge to the development of more vibrant research and innovation infrastructure in the three countries and across the sub-Saharan region. In the absence of private-sector funding and competitive grants, public universities and research institutes in the Sub-Saharan region predominantly depend on dwindling public subsidies as well as unpredictable international donor support. This narrow funding base suggests that research and innovation systems in the three countries face severe financial deficits and lack the capacity to formulate and drive their own domestic research agendas. National policymakers and university leadership need to be encouraged to work in closer partnership and to prioritize the strategic importance of research and innovation in national economic growth and competitiveness by investing more significantly in strengthening research capacity, infrastructure, and research opportunities in universities.
- The three country case studies demonstrate that internationalisation, particularly through transnational and transdisciplinary partnerships among universities; represent one of the most effective options for strengthening research capacity and governance arrangements for research and innovation in sub-Saharan countries.
- The studies demonstrate the need for systematic and coherent approaches to integrating STI Policy into national economic and development strategy. This embedding process should accord particular emphasis on the coherent translation and cascading of national development goals and STI policies into clear action plans and intervention programs that are directly connected to promoting economic growth and improving people's real livelihoods.

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