**Understanding knowledge systems and what works to promote science technology and innovation in Kenya, Tanzania and Rwanda – insights from the Knowledge Systems Innovation Project (KSI)**

# Project Brief

**PI and main Contact:**     **Professor Andy Frost          a.i.frost@gre.ac.uk**

**Natural Resources Institute, University of Greenwich**

**In collaboration with African Centre for Technology Studies (ACTS) Kenya, Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australia, Science Policy Research Unit (SPRU) - University of Sussex Business School and Science, Technology, Engineering and Public Policy (STEaPP) at University College London (UCL)**

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## Context

Science, Technology and Innovation (STI) could play a critical role in addressing the Sustainable Development Goals (SDGs). However, it will require an STI planning, investment and evaluation approach that in addition to economic growth, targets more explicitly, social inclusion and environmental sustainability to achieve balanced growth. This will entail a much closer alignment of STI policy with development priorities. It will also require patterns of governance, participation and cooperation, that encourage a wide set of stakeholders to steer the priorities for STI investment and capacity building, and the outcomes that these seek to achieve.

Such an approach needs to look beyond traditional science and technology providers – although it's essential to strengthen these too - to include the full range of knowledge production sources and innovation processes that society has to offer.  There is agreement that STI is a critical part of the way forward, but there is less clarity on how to proceed.

It is against this backdrop that a pilot study was funded by FCDO EARIH to develop a practical approach to capacity development and investment in knowledge systems, in three East African countries; Kenya, Rwanda and Tanzania.  The study was undertaken by the Natural Resources Institute (NRI) of the University of Greenwich in collaboration with African Centre for Technology Studies (ACTS) in Kenya, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, Science Policy Research Unit (SPRU) of the University of Sussex Business School and Science, Technology, Engineering and Public Policy (STEaPP) at University College London (UCL).  This brief provides an overview of the study and the practical concept developed, the key insights learnt and recommendations for potential investment options and for the further development of the practical concept proposed.  This document forms a companion to three other briefs, one for each of the countries championed by the respective country teams within this study.

The study reviewed existing concepts dealing with innovation and sustainable development, and placed extensive stakeholder engagement at the centre of a process in the three countries to guide evidence collection, concept development, concept testing and refinement.

## Reframing STI policy for sustainable development

Emerging from a review of literature is the need to build a much more comprehensive picture of the STI environment than that provided by current analyses and policy framings.  The sustainable development agenda reframes the sphere of STI policy ambitions beyond science excellence and economic growth, to also include making direct contributions to sustainable development.  There is also increasing recognition that STI policy has overlooked a significant arena of innovation activity relevant to the sustainable development agenda that takes place in the informal sector in emerging economies.

This study argues that while existing dominant research and innovation policy conceptual frameworks are important and useful, they can potentially skew analysis, data collection and investment strategies, and that this could impede efforts to bridge STI and national development goals in low- and medium-

income countries. A key issue is that important features of local contexts are regularly omitted from analysis, and that this omission steers and distorts investment in unproductive ways. Another issue is that standard metrics associated with those dominant STI frameworks, are focused only on inputs and outputs of the innovation process, providing limited diagnostics insights. A growing body of theory and evidence is arguing for the need to rethink STI policy frameworks so that low-and medium income countries can leverage STI investments to drive transformational innovation needed to achieve the SDGs. In this study, the overall intent was to build on this emerging body of insight and make a first attempt to develop a new STI policy conceptual framework to better align STI investments to development needs and goals.

## Development of a practical (KSI) conceptual framework

The study took as its starting point the idea of knowledge systems as a way of opening up STI analysis to consider the wide range of activities and agendas at play that constitute innovation capacity, and that standard approaches overlook or underestimate. Two practical insights arise from the need to develop a more comprehensive picture of STI activity and capacity. First, a need to use a range of different analytical diagnostic tools and perspectives to build and triangulate different pieces of evidence from micro to macro scales; this helps to reveal different domains of knowledge and innovation related activities that span both formal and informal sectors. Second, STI capacity cannot be viewed in a normative view, but there needs to be an embedded process of stakeholder engagement to ensure that new options are aligned with specific sustainable development challenges and ambitions in a particular country context.

Building on these insights the project developed a framework both for diagnostic assessment of existing STI capacity (broadly defined by a knowledge systems lens) as well as for defining planning processes and leverage points to help shape STI investment toward a transformational agenda. The framework, illustrated in the diagram below, is referred to as a knowledge systems innovation (KSI) conceptual framework. This reflects its ambition as an approach that could guide STI planning, investment and capacity building in a way that drives innovation of knowledge system to better aligned these to SDG agenda.
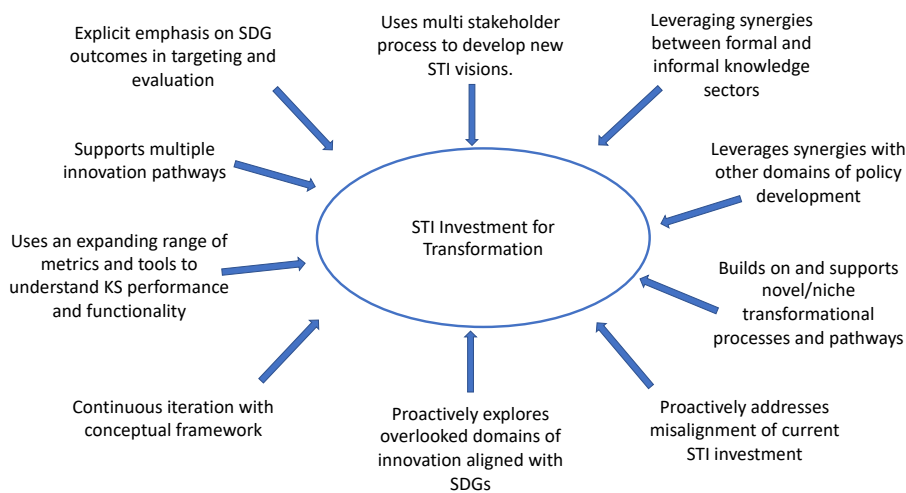
*Diagram to summarise some of the key aspects of STI investment for transformation that guide the KSI practical knowledge system concept*

## Concept testing and refinement in Kenya, Tanzania and Rwanda – what did it tell us?

***Mapping the current STI context:*** This study explored the current STI context in Kenya, Tanzania and Rwanda.  This helped develop a broad picture of the STI context and the policy perspectives that frame this. It was also useful in highlighting the importance of bridging gaps between knowledge production by research, and knowledge use by the private sector and others. However, current policy perspectives in the region, particularly the extensive use of national systems of innovation framing, mean that less attention is given to the purpose to which innovation is directed (other than economic growth), or the values that underpin decisions and goals.

While policy documents for the region are very broadly framed towards sustainable development, the line of sight between these broad ambitions and the formulation of national STI policy, remains unclear. This is one explanation of why STI investments are limited in contributing to achievement of the SDGs and national development goals. This study highlights a widespread lack of clarity about the purpose to which STI investments are being deployed. It also suggests that existing STI policy frameworks in the three countries, and the processes through which priorities and future directions are set, could be reframed to explicitly account for widening impact agenda implied by the SDGs and national development goals.

The mapping of the STI landscape in the three countries reveals important differences between them. These include: the role of state and non-state actors in knowledge production; the levels of research capacity; the level of sophistication of the private sector and its related capacity of knowledge use and innovation; different governance arrangements for STI policy and priority setting; different political and development histories including trajectories and priorities.  There are also similarities, for example challenges of translating research into innovation and impact; the existence of large informal sectors that receive limited attention from the STI policy; and distortions of research priorities arising from international research collaboration.  From the perspective of our KSI conceptual framework these differences are noteworthy because this underlines the need to approach STI investment planning in a context specific way. It also points to the need to explore in more detail the way STI investments are performing and the nature of new STI opportunities and view-points in these particular contexts.

This study exposes major gaps in the evidence base concerning STI investment performance in relation to development goals - and particularly with regard to - sustainable development.  Without systematic and long-term monitoring of the outcomes of specific interventions, it is extremely difficult to assess the impacts of contemporary patterns of STI investment in relation to the SDGs.

***What did examining STI investment in country contexts reveal?:*** A series of case studies were used to take an in-depth look at the context of the three countries, and to explore the diversity of different types of STI investment. This project also investigated what this can reveal about what is and isn't working, and why, and identifying promising areas of knowledge and innovation activity overlooked in current STI priorities.

Despite the lack of impact evidence, it is possible to identify a diverse set of STI interventions and knowledge related activities with SDG intent or value, and to develop a picture of how these interventions are playing out.  A number of important points emerge from assessing the diversity observed.  It appears that what can, and indeed what needs to be considered part of each of the countries' STI investment portfolio, is probably much wider than that reflected in standard STI policy reviews.  Clearly, many initiatives are underway that have relevance to the SDG agenda. These initiatives could be reinforced and could become a source of learning for a future facing STI agenda.  Our study reveals many of these initiatives have emerged "in context".  For example, in Rwanda, where research capability is still developing, the emphasis has been put on "home grown", "Made in Rwanda" as a way of tapping into a wide range of formal and informal knowledge sources.  In contrast, in Kenya with its strong ICT, research and private sector history, interventions are being made to build on these strengths and resources. Tanzania has an entirely different political and STI history and is pursuing options of state led industrialisation around SME development.  So, while the patterns of diversity that have been observed suggest the green shoots of a different sort of knowledge system emerging, novel approaches cannot simply be transferred across countries and regions, but need to be understood and supported *in-situ*.  Our knowledge systems concept also places value on creating the conditions for amplifying these promising initiatives as well as encouraging STI policy to enable the emergence of an expanding range of these types of experiments and to leverage them for SDG impacts.

Despite stressing the importance of context in the emergence of these initiatives, there are also some cross-country patterns in investment and interventions that are apparent:

- **Linking research to the private sector.**  Initiatives that seek to develop partnership between universities and other public research organisations in order to "commercialise" research and/or to establish new business offerings.
- **Bridging informal and formal sectors**.  These take many forms including:  searching for solutions in informal sector innovation, particularly because of the ability of the informal sector to tap into the needs of poor communities; or extending training and regulation to the informal sector to upgrade skills and practice.
- **Enterprise development.**  These can take the form of business incubation hubs to help develop ideas into business opportunities. In countries where the private sector has limited capacity, this might for example, involve developing SMEs through capability or technology upgrading.
- **Knowledge sharing platforms and networks**.  There is considerable diversity of these initiatives. They range from long established civil society networks, to purposeful interventions targeting 'missing knowledge brokering mechanisms', in particular domains of knowledge production and use.

***What can we say about why STI investments are not delivering to the national development agenda?*** While clearly it is not universally true that STI investments are not contributing to the national development and SDG agendas, there are causes for concern.  The evidence and analysis generated by this project suggests that there is not one single explanation of STI's under delivery.  Rather there is a clutch of systemic problems that play out at different scales in the three countries in remarkably similar ways.

1. The explicit and implicit use of national systems of innovation as the dominant framing of the policy narrative in the three countries – at a time when the performance criteria are expanding

beyond typical STI investment rationales of economic growth. Therefore, it should not be surprising that STI investments of the past are no longer delivering, now that the goal posts have been moved;

2. The lack of evaluation of STI performance, for example, our economics work highlights the difficulty in judging the impacts of STI investments as there are both methodological challenges and substantial data gaps;

3. Concerns of distortion and perverse outcomes of STI investments, for example, our bibliometric analysis clearly illustrates how international collaboration dominates and skews research effort away from SDG relevant topics, and more generally away from local development agendas;

4. A range of capacity issues, for example, our case studies show weak links between research and research users; underdeveloped research capacity, lack of knowledge brokering functions etc.

***Identifying opportunities for amplifying SDG relevant and overlooked STI approaches***: One of the key findings of this pilot study in each of the three countries, was the plentiful supply of promising activities in both the informal sector and in domains outside the usual STI policy sphere of interest. Across the board we found a  significant informal sector knowledge activity of high relevance to local communities and the SDGs.  These tended not to currently be part of the mainstream STI conversation which means in terms of STI planning and investment, they run the risk of being overlooked as an integral part of wider transformative change. Our study provides evidence that there are a significant number of novel initiatives, some of which are covered within our case studies, that drive social innovation but also product and service innovation.  These might contain disruptive models of innovation.  Importantly, they can include the potential to strengthen key knowledge system interactions and nurture a wider STI landscape that is conducive to SDG aligned outcomes.

***Did the stakeholder processes work?*** Great enthusiasm was encountered during the stakeholder engagements in all three countries which generated much insight, and challenged the conceptual approach, allowing the findings to be grounded.  This project deliberately set up structures – specifically the communities of practice - that could provide a foundation for further work in the revisioning of future STI investment strategies.  This pilot study has created an appetite and social capital for a different type of STI-related discussion that could be built upon.

## Recommendations

It is important to stress here that significant STI analysis in the target countries has already been undertaken, and that these point to many issues related to the thematic focus and prioritisation of STI investments, as well as issues related to the functionality of innovation systems.  This study does not repeat the findings of these studies (patterns of R&D investment etc) but focuses on novel investment opportunities that arise from the additionality of the KSI conceptual approach.  These include potential starting points under the following:

- **Strengthen and prioritise STI investments in knowledge generation, translation and brokerage by intermediary institutions and platforms e.g. innovation hubs and communities of practice in addition to governance and accountability frameworks that ensure STI investments are aligned to SDGs and broader national commitments**.

- **Ensure that future investments leverage better linkages and actively promote partnerships between formal and informal sectors**.

- **Work to make sure that STI investment choices are inclusive and incorporate broader views and perspectives, and leverage a range of diagnostic tools/approaches when making policy and investment decisions**.

This pilot study has identified the potential of a practical knowledge system approach, and also the limitations in terms of what can be done with current data sets. The following recommendations aim to provide practical steps in taking this concept forward and/or addressing limitations observed during this study.

- **Further testing the approach in strategic planning exercises** – our study has been a successful pilot which forms the basis that could be rolled out and could help build and support for example FCDO innovation hubs and Science Granting Council Initiatives;
- **Build on the social capital created by this pilot study** – our study established communities of practice that could form promising focal points for further work;
- **Invest in research on STI metrics –** our study highlights major limitations regarding the findings that can be derived from existing datasets (the same datasets that are clearly being used to inform current decision making) and offers a number of practical steps to address these dataset limitations;
- **Invest in robust and continuous impact evaluation of STI investment and use this to guide investments and policy decisions** – our study highlights significant gaps in the data available and expresses caution on the limits to the existing macro analytical tools as a means to inform decision-making. We provide a number of practical next steps to set the foundation for moving forward.