



The Innovation Ecosystem in sub-Saharan Africa with a Case-Study on Uganda

A Systematic Desk Review

Overview:

Innovation Ecosystem Insights

The desk research report focused primarily on innovation in Uganda in which we presented: 1) a brief introduction to Uganda 2) an overview of the Global Innovation Index (GII) and the recommendation to adopt it as an overarching framework to analyze and categorize the research to assess the innovation ecosystem in Uganda 3) a survey of the innovation actors in Uganda's innovation ecosystem and 4) an initial review of the peer-reviewed literature on innovation in Uganda. The aim of this report was that it serve as a living document to be further reviewed and expanded with additional on the ground work. In addition, this report should serve as a model for desk and on the ground research with other RAN countries.

The results of the multi-pronged search were insightful; providing a solid foundation for more in depth and on-the-ground research as well as initiation of activities that would advance innovation. In the academic literature search, focused on Uganda, Macquarie University was a central node for the conduct of innovation training and research. The published work was often funded by the university, government, foundations outside of Uganda, and by USAID. Yet funding continues to be a top priority need. Published research focused on relevant content areas (health, agriculture, poverty) examined as well as urban and rural areas of the country.

Recommendations and Insights based on the report

Recommendation and insight 1: As an overarching recommendation for the RAN, we recommend the adoption of the Global Innovation Index (GII), its innovation input – output framework, most of its sub-indices and scoring mechanisms. The implication of this recommendation is that analysis similar to that performed in the report would be conducted for all RAN countries. Further, adoption of the GII would allow a standardized method of evaluation of change in innovation overtime in RAN countries. Finally and importantly, adoption of the GII does not preclude the development of RAN specific innovation measures that are more accurate and sensitive to local work.



Overall, Uganda ranks 89 out of 142 economies, with a GII score of 31.21 (out of a possible 100). Within the low income group of countries, Uganda is ranked number 1 on the overall GII score. Within the Sub-Saharan region it is ranked number 3. In addition, Uganda showed the largest overall shift in GII rankings from 2012 to 2013 (117 in 2012 and 89 in 2013). Other top improvers were Costa Rica, Bolivia, Cambodia, Mexico, Uruguay, Indonesia, and Ecuador. Uganda's high ranking relative to peer income and region countries and impressive improvement bodes well for future innovation.

Recommendation and insight 2: *Future RAN work should include working with the GII report and online accessible country specific data to build a RAN and Sub-Saharan African report. This report should focus on regional challenges and innovations. As important perhaps (but more challenging) is the building of a GII like report that distinguishes rural and urban needs, within a country and as a RAN region. Such a foundational report could serve many purposes: highlighting baseline performance for the overall RAN project, targeting of within and across-country "innovation" interventions, and tailoring of specific innovation training and participatory work to country, city and rural needs.*

Recommendation and insight 3: *Explore and develop crowdsource methods, such as in a MOOC, to establish the components of a RAN innovation ecosystem. In the desk report, we presented recent set of crowd sourced maps of the innovation ecosystem in all of Africa; technology hubs, business incubators, university tech labs and hacker spaces from February 2012 – May 2013 by Bongo Hive (<https://africahubs.crowdmap.com/>) (since our May report four additional hubs have been added to the site. While crowd-sourcing is not without challenges such as under representation, accuracy, and use of a common nomenclature to identify innovation components, the potential is great for both base-lining and assessment of growth.*

Recommendation and insight 4: *A detailed ecosystem map could display innovations in the micro-regions of a country. Population mobility, omni-presence of social media, and an overall focus on knowledge work and technology are indicators of the need, for example, of a Sub-Saharan Africa ecosystem map similar too but more refined than the crowd sourced maps used in Recommendation 3 above. A micro-region map of a country would allow the examination of networked interactions across regions and countries. This micro region map could be crowd sourced, supplemented by other methods and would include (but not limited to) the defined terms used by us; incubator, accelerator, innovation hub, and hubs. A MOOC framework has the potential to crowd source defined information as well as acquire more detailed information on the individuals and innovations themselves as in a participatory action project.*

Summary of key lessons learnt

Our Year I desk research maps future work to enhance our understanding of current innovation in Sub-Saharan Africa, to develop strategies for advancing the quantity and quality of innovations, and use those educational and outreach methods (such as MOOCs) to reach multiple audiences of innovations (students, women, workers, content professionals such as medical workers, high school students, individuals living in cities and rural areas etc.) and build tight and functional innovation networks.

We see four steps.

First, our current work needs to be expanded to all RAN countries to support both the work inside of countries as well as to find effective ways to tap and build a cross country and region innovation network (potentially advanced by online MOOC resources as well as face-to-face conferences).

Second, both the current work and future work would be significantly advanced by other information collection methods (such as online surveys, phone call interviews, and face-to-face interviews). These other methods would also allow conducting a “network” analysis of current innovations – studying both the breadth, depth and quality of networks. This network would both be a needs assessment but also a tool to reach into underserved regions, individuals and content areas. These additional query methods would also allow the identification of “innovation” sites not yet sufficiently established to have a notable online presence.

Third, these additional supplemental methods of information collection would allow a greater in depth analysis of on the ground need; such as physical space, funding, hardware such as computer, tablets, and phones, software, training such as programming, mentorship, and collaborative exchange for teamwork, feedback, and social support.

Finally, much of the web-based research was clouded by lack of clear definitions of innovation terms; it may be that local definitions exist or that a more elaborated ontology of innovation terms can be built and will support a deeper local understanding of innovation as well as a staging of innovation within regions and countries.

The Main Report

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INNOVATION ECOSYSTEM IN UGANDA: A SYSTEMATIC DESK REVIEW

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EXECUTIVE SUMMARY

As USAID's Resilient Africa Network (RAN) moves to implement a network of innovation labs across Africa, this report by the Stanford Peace Innovation Lab seeks to describe the innovation ecosystem in Uganda. We begin by suggesting the adoption and adaption of the Global Innovation Index (GII) as a framework for describing and analyzing the ecosystem of innovation in Uganda. The GII suggests that Uganda's innovation capabilities have drastically improved in recent years, shine relative to its income level, and are successful in its regional context, but appear lackluster on a global scale. After utilizing the GII to place Ugandan innovation in its global context, the rest of this report reviews the specific features of the Ugandan ecosystem: namely the actors and literature involved in innovation. Our research produced and profiled numerous innovation hubs, accelerators, and incubators making up a burgeoning ecosystem. The final piece of this report, a review of the peer-reviewed literature surrounding Ugandan innovation, followed an agreed-upon search protocol and found that the academic study focuses primarily on the role of the Ugandan government and of Makerere University in driving Ugandan innovation. This report should serve as a model for future review of RAN innovation and act as a living document which collaborating universities and partners can use to input more "on the ground" information, knowledge and experience.

COMMON ABBREVIATIONS

GII: Global Innovation Index 2013

HSTAR: Human-Sciences and
Technologies Advanced Research Institute

ICT: information and communication
technology

ILO: International Labor Organization

MakCHS: Makerere University College
of Health Sciences

MIC: Microsoft Innovation Centre

MSME: micro, small, and medium enterprises

MUST: Mbarara University of Science
and Technology

NGO: nongovernmental organization

RAN: Resilient Africa Network

SME: small and medium enterprises

STI: science, technology, innovation

UNIDO: United Nations Industrial
Development Organization

UIRI: Uganda Industrial Research Institute

USAID: United States Agency for
International Development

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INTRODUCTION

The specific aims of this report are to:

- (1) Describe the overarching ecosystem framework that we will use for analyzing and categorizing research, interview, and other information;
- (2) Using the ecosystem framework, integrate the data from the Global Innovation Index 2013 (just released in July, 2013) on Uganda and RAN countries with our own desk research to analyze needs, gaps, and challenges;
- (3) Conduct a desk review and analysis of the prevalence of innovation ecosystem input components in Uganda and Kampala such as hubs, labs, and incubators;
- (4) Examine the peer reviewed literature on innovation in Uganda;
- (5) Provide a future's framework that collaborating Universities and partners can use to input more "on the ground" information, knowledge and experience.

As part of United States Agency for International Development (USAID)'s Resilient Africa Network (RAN) program's preliminary needs, this desk review is an assessment of the state of innovation in Uganda from 2007 to the present. Contained in this report are 1) a brief introduction to Uganda 2) an overview of the Global Innovation Index (GII) and the recommendation to adopt it as an overarching framework to analyze and categorize the research to assess the innovation ecosystem in Uganda 3) a survey of the innovation actors in Uganda's innovation ecosystem and 4) an initial review of the peer-reviewed literature on innovation in Uganda. Due to the Stanford Peace Innovation Lab's removed research location and limited research time frame, this report will primarily serve as a living document that needs both further review of the actors contained herein and those that are not addressed. This further on-the-ground review could be an initial accomplishment of the newly established network of Resilience Innovation Labs or our counterparts at Makerere University.

THE RAN PROJECT INNOVATION ECOSYSTEM

With 35 million people, an endowment of natural resources, and advantageous climate Uganda's economy has grown rapidly since 2000¹. However, agriculture, Uganda's main industry, employs over 80% of the workforce and is not growing at a sufficient rate to keep up with Uganda's

population. Uganda faces a number of other challenges to building an innovation focused economy including high poverty rate (24.5%), the world's youngest population (over half the population is under the age of 15), the world's highest dependency ratio (1.12 dependents per worker), and climate change (Mutambi 2011 and Brar et al. 2011).

To combat these challenges, Uganda “has established a strong record of prudent macro-economic management and continues to undertake private sector oriented structural forms” (14 Mutambi 2011). These include creating a development vision, building capacity in science and technology, supporting micro, small, and medium scale enterprises (hereafter MSMEs, which account for 95% of the Uganda's industrial sector), ‘exploiting natural resources’ and developing a more service-oriented economy (14 Mutambi 2011). More generally, the Ugandan government has focused on promoting innovation as a solution to many of its problems.

Assessing the innovation ecosystem in Uganda poses an interesting challenge though: “Uganda, like many other African countries has not been developing primary science, technology and innovation indicators” (31 Mutambi 2011). Actually, as a sought-after but imprecise characteristic, innovation is difficult to track or grade on a large scale. Even among international organizations, there are significantly differing opinions on what counts as innovation, which the most innovative countries are in the world, and how to assess innovation infrastructure. To avoid this problem, this report suggests that the RAN project adopt the framework utilized by the Global Innovation Index (GII).

GLOBAL INNOVATION INDEX ADOPTION AND ANALYSIS

For the RAN project, we propose the systematic tracking and application, and perhaps adaptation of the (GII). Co-published by Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO), the GI is an annual report chronicling innovation at both the national and international levels. The development of innovation indicators has a long history and has undergone fundamental transitions over time: these transitions include scope (such as from R&D to Science, Technology, and Innovation to current innovation indices, type and quantity of data from standardized national and international economic, health and other indicators to business leader interviews, and most recently social media analysis (MEIDE, 2008). This new approach, acknowledged by the GI (2013), is a confluence of two factors. First is a research focus on local innovations referred to as clusters and focusing on enterprises, regions, cities or universities (often not linked to each other in a structured way) (citation 9 from the GI). The second factor has been brought about by the “new growth theory, which is centered on knowledge intensity (GI citation 12). As importantly, we note that the GE Global Innovation Barometer and the Bloomberg Innovation Quotient do not have Uganda specific information.

As an ambitious and multifaceted (over 80 indicators evaluating 142 economies) monitoring system combined with the inexact concept of innovation, the GI is not without its critics. A recent article in *The Economist* (July, 2011) highlights some of the challenges of the GI: for

example, some indicators such as GMAT scores are suspect in their face validity as a measure of innovation – GMAT is a standardized test by which a country’s citizens get into American Business schools.

The Economist article also questions the new inclusion of ecological sustainability as it pertains to validity. Two issues are raised in this regard – “the index is misnamed. It is meant to measure the ‘enabling environment’ for innovation, rather than the product itself” (Cukier 2012). Most importantly, the GII’s unit of measure is the nation-state rather than for example, regions within a nation or municipalities. This Economist article points to the work of the Organization for Economic Cooperation and Development (OECD) who looked beyond its 34 national members to consider innovation on a regional basis and found that as few as 10% of regions in OECD countries account for more than half of the research and development across the entire area. Cukier goes on to argue, “Comparing Nagoya against Stuttgart or Austin, Texas against Britain’s “Silicon Fen” might be the more relevant metric.”

Despite these criticisms, we argue that the transparency of the GII (with extensive definitions and interactive data tools) combined with the ability of policy makers and researchers to examine *individual* indicators allows the construction of a more appropriate, culturally relevant and region specific inspection of the innovation environment as well as for determining insightful comparisons (by economy in the GII). Examinations by region are challenging – finding indicators at regional levels, determining if for example, rural innovation environments should have the same measures as urban ones. The OECD has made interesting inroads in regional assessment, with even more advanced data tools than the GII. For this report, we use the GII reporting both the summative measures as well as a selected sample of individual indicators and using one country, Uganda, as a detailed example. Along the way we make recommendations for how RAN project researchers and experts can tailor and adapt the GII to meet RAN innovation needs. A final caveat, examination of the status quo of an innovation environment does not necessarily provide a road map of how to change environment indicators; having few business, science, & engineering university graduates may require multiple solutions depending on community (or region or country) and on an “on the ground” solution assessment. For example, solutions may include new programs, expanded communication efforts about programs, support to attend programs, satellite and online programs, faculty, facilities and more.

We propose to begin our analysis of innovation in Uganda by adopting (and likely later adapting) the GII. The GII incorporates sufficiently new and powerful techniques like multiple data set collection and aggregation analyses and combines them with older, more trusted demographic, economic, educational, and health indicators. Additionally, as an annual report, the GII constantly updates and sensitively tracks both national and international trends. We note however, that this more country level examination of innovation is subject to several challenges regarding in depth understanding of community, and regional level innovation input and outputs. Thus, we propose using the GII as one marker of current status of innovation in a country over time. We

also propose adapting and supplementing components of the GII to fit the current profiling and over time-assessment needs of the RAN project.

In the sections that follow we describe the overall GII conceptual framework for innovation enabling environment, examine the RAN countries in the major GII indices with a specific focus on Uganda, and finally select a few Innovation Input and Output specific indicators for each of the RAN countries.

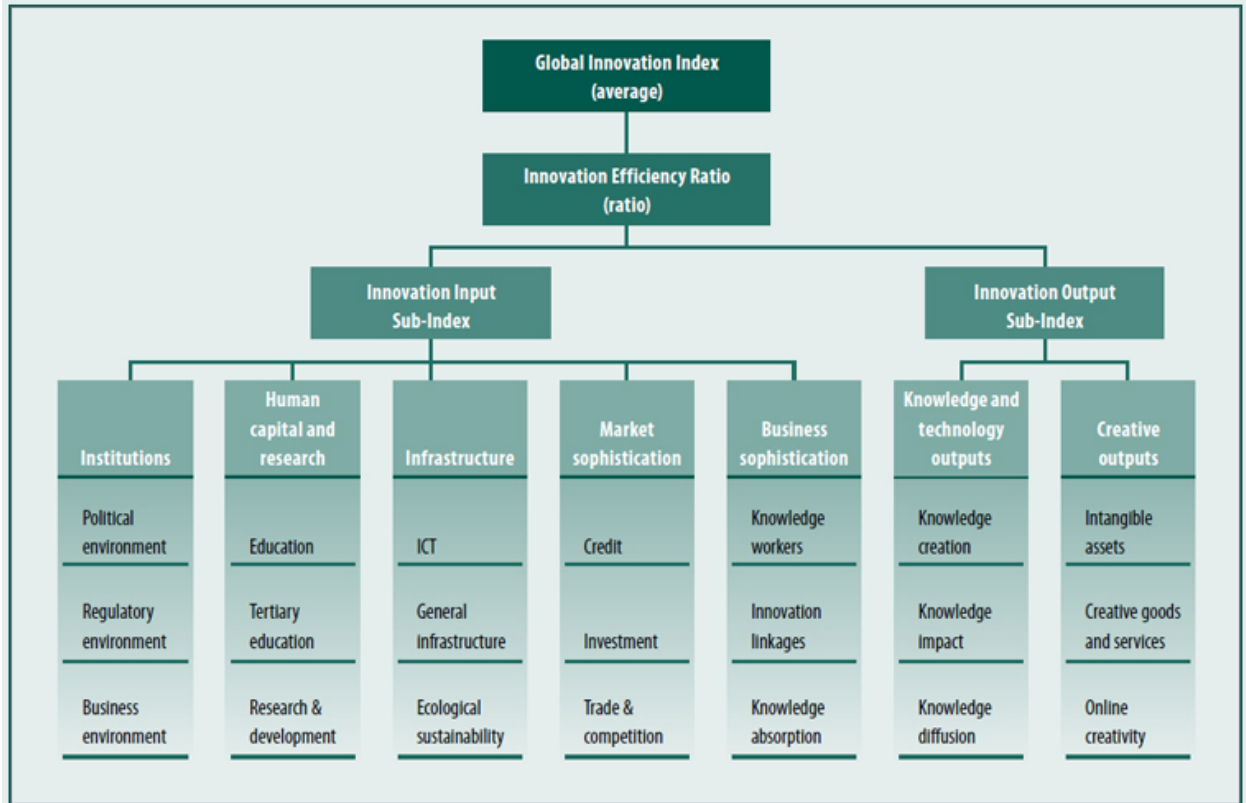
The GII Conceptual Framework. In the text and tables below, we have extracted Uganda and RAN country specific information from the GII report; relevant to these sections were Chapter I, Appendices 1, 2, & 3, and the data analysis link allowing construction of figures and tables on specified information (Global Innovation Index, 2013).

Four overarching indices are derived from the 21 single survey item and sub data inputs, most fundamental of which are an Innovation Input Index and an Innovation Output Index. The four indices vary by level of aggregation and calculation. The Innovation Input Index is composed of elements (called Pillars in the GII report) of the national economy that enables innovation activities:

- institutions (3 sub pillars and 10 indicators),
- human capital and research (3 sub pillars and 12 indicators),
- infrastructure (3 sub pillars and 11 indicators),
- market sophistication (3 sub pillars and 10 indicators) and
- Business sophistication (3 sub pillars and 15 indicators).

The Innovation Output Index is composed of the results of innovation within a country; knowledge and technology outputs and creative outputs, six sub-pillars and 27 indicators make up these two pillar indices. The overall GII score is the summed average of the Input and Output indices. The Innovation Input and Output scores are the summed average of the sub-pillar indices, resulting from the normalized average of the indicator scores. The Innovation Efficiency Ratio is the ration of the output sub-index over the input sub-index, a crude description of how much innovation output a country is getting for its inputs. In the reporting, country ranking is provided for these indices. However for our purposes, examination of baseline data, we analyze in depth only one country, Uganda. In the future, we recommend this report be extended to profile all RAN countries. The Stanford Peace Innovation Labbelieves this initial report will act as a model for future examinations. Figure 1 profiles the components of the GII conceptual framework.

FIGURE 1: THE GLOBAL INNOVATION INDEX FRAMEWORK



Uganda and RAN 2013 Global Innovation Scores. In Table 1 below we show the GII ranking, income ranking (within four income categories), regional rank, and efficiency ratio of the RAN countries. We focus most of our interpretation on Uganda.

Overall, Uganda ranks 89 out of 142 economies, with a GII score of 31.21 (out of a possible 100). Within the low income group of countries, Uganda is ranked number 1 on the overall GII score. Within the Sub-Saharan region it is ranked number 3. In addition, Uganda showed the largest overall shift in GII rankings from 2012 to 2013 (117 in 2012 and 89 in 2013). Other top improvers were Costa Rica, Bolivia, Cambodia, Mexico, Uruguay, Indonesia, and Ecuador. Uganda's high ranking relative to peer income and region countries and impressive improvement bodes well for future innovation performance.

Uganda's efficiency ratio, defined as the Innovation Output Score (Table 3 Below) divided by the Innovation Input Score (Table 2 below), is .95. This score places Uganda among 18 economies classified as *innovation learners*, all of whom appear 10% above a trend line of GII score and innovation efficiency. Overall, Uganda's efficiency ratio is ranked 19th; we can interpret that as Uganda is doing a significant job of maximizing innovation input to yield innovation output. However, actual levels of input and output are also important (see Tables 2 and 3 below). Table 4 describes the strengths and weakness identified by the GII in both Innovation Input and Innovation Output.

RAN country highlights include (See Table I below):

- A wide variety in international ranking with a high for South Africa (58 out of 142), a low for Ethiopia (129) and Uganda and Ghana with fairly close ranks (89 and 94 respectively).
- A wide variety of national income classification with South Africa in the upper middle category, Ghana in the lower middle and Uganda and Ethiopia both in the low income category.
- Notably, Uganda is number 1 in its income category with other RAN countries being 15 or 16 within their respective income categories.
- Ethiopia ranks relatively low 25th out of 32 countries in the Sub Saharan region in contrast with South Africa (2nd), Uganda (3rd), and Ghana (5th).
- Both Uganda and Ghana fare well in their efficiency ratio both scoring above the .78 median; however, Ghana only places 58th overall whereas Uganda is place 19th overall.

TABLE I: UGANDA AND RAN COUNTRY ANALYSIS ON THE OVERALL THE GII RANKINGS

Coun try	GII Score (0-100)	Rank (out of 147 countries)	Income (high, upper middle, lower middle, low)	Inco me categ ory rank	Regio n Sub-Sahar an Africa	Regi on Rank	Efficie ncy ratio (output /input)	Over all Rank	Median Compar ison (Overall median of .78)
South Africa	37.60	58	Upper Middle	16	SSF	2	.71	99	Below
Ugan da	31.21	89	Low Income	1	SSF	3	.95	19	Above
Ghan a	30.60	94	Lower Middle	15	SSF	5	.80	58	Above
Ethio pia	24.80	129	Low Income	16	SSF	25	.74	87	Below

Innovation Input Analysis from the GII. Uganda's overall Input Innovation Score (the averaged sum of the indicators making up the Innovation Input Index see Figure 1 above) is 31.97, rating a rank economy overall of 109 (out of 147) (See Table 2 below). Within the lower income category, Uganda has an Innovation Input rank of 4 and within region, an Innovation rank of 10. Within income and region rank, Uganda is performing well to moderately well. In the text and Table 4 below, we examine specific measures of Innovation Input and Uganda's performance on measures of input.

To provide a contextual analysis, we note that within the low income group, top performers in Innovation Input are Uganda, Kenya, Tajikistan, Cambodia, and Burkina Faso, all, with the exception of Kenya are in the low income top 10 on efficiency.

Highlight of RAN country comparisons include:

- A rank ordering from higher to lower include South Africa, Ghana, Uganda, and Ethiopia (51, 99, 109, & 126 respectively).
- Uganda is 4th in their income rank category whereas Ethiopia is 32.
- Within Sub-Saharan region, South Africa places 1st, Ghana is 8th, Uganda 10th and Ethiopia, 14th.

TABLE 2: UGANDA AND RAN COUNTRY INNOVATION INPUT ANALYSIS

Country	Innovation Input Score (0-100)	Overall Rank	Income	Income category rank	Region	Region Rank
South Africa	43.93	51	Upper Middle	9	SSF	1
Ghana	33.93	99	Lower Middle	18	SSF	8
Uganda	31.97	109	Low Income	4	SSF	10
Ethiopia	28.50	126	Low Income	14	SSF	21

Uganda's Output Innovation score (summed average of indicators from the two pillars making up the Innovation Output score, see Figure 1 above) is 30.45 with an overall rank of 75 (See Table 3 below). Within the lower income category, Uganda ranks number 2 and within region, number 5. Thus, for innovation output Uganda does well within income category and within region. In Table 4 below we examine the specific weakness and strengths for Uganda as compared to the 142 economies.

We point out that this comparison of low income countries to the sum of other income countries (all that is currently accessible in public data sets) is not perhaps most relevant for countries building innovation economies. Comparisons to similar others, likely build more probable productive exchanges as well as role models.

RAN country comparative highlights on Output Innovation analysis includes:

- *Despite significant differences in income category South Africa (upper middle income) and Uganda (lower middle) rank similarly (71 and 75 respectively).*
- *Ethiopia maintains a relatively low rank overall and compared to other RAN countries; 126 in Innovation Output, 126 in Innovation Input and 129 in the GII and within region, 23 (out of 32) Innovation Output, 21 in Innovation Input and 25 in GII.*
- *In Innovation Output for the region, South Africa, Uganda, and Ghana rank highly and similarly (2, 5, and 7 respectively).*

TABLE 3: UGANDA AND RAN COUNTRY OUTPUT INNOVATION OUTPUT ANALYSIS

Country	Innovation Output Score (0-100)	Overall Rank	Income	Income category Rank	SSF	Region Rank
South Africa	31.26	71	Upper Middle	25	SSF	2
Uganda	30.45	75	Lower Income	2	SSF	5

Ghana	27.26	95	Lower Middle	17	SSF	7
Ethiopia	21.09	126	Lower Income	15	SSF	23

Recommendation 1: Future RAN work should include working with the GII group to build a RAN and Sub-Saharan African report. This report should focus on regional challenges and innovations. As important perhaps (but more challenging) is the building of a GII like report that distinguishes rural and urban needs, within a country and as a RAN region. Such a foundational report could serve many purposes: highlighting baseline performance for the overall RAN project, targeting of within and across-country “innovation” interventions, and tailoring of specific innovation training and participatory work to country, city and rural needs.

TABLE 4: UGANDA INNOVATION INPUT AND OUTPUT STRENGTHS AND WEAKNESS
Strengths & Weaknesses

Uganda			Uganda		
Strengths (Economy's best percent ranks)			Weaknesses (Economy's worst percent ranks)		
Index	Pillar/Sub-Pillar/Indicator Name	Score	Index	Pillar/Sub-Pillar/Indicator Name	Score
1.2.3	Cost of redundancy dismissal	78.7	2.2.2	Graduates in science and engineering	5.0
2.2.3	Tertiary inbound mobility	72.4	2.2.4	Gross tertiary outbound enrolment	0.7
3.2	General infrastructure	78.0	2.3.1	Researchers	4.5
3.2.4	Gross capital formation	78.5	2.3.3	QS university ranking average score of top 3 universities	0.0
4.1.1	Ease of getting credit	65.2	5.1	Knowledge workers	2.1
4.1.3	Microfinance institutions' gross loan portfolio	72.2	5.1.1	Employment in knowledge-intensive services	2.8
4.2.4	Venture capital deals	69.5	5.1.5	GMAT mean score	4.2
4.3.2	Market access for non-agricultural exports	96.4	5.2.4	Joint venture/strategic alliance deals	0.0
5.2.3	GERD financed by abroad	88.5	5.2.5	Patent families filed in at least three offices	0.0
5.3.2	High-tech imports	65.5	6.1.2	Patent Cooperation Treaty resident applications	0.0
5.3.4	Foreign direct investment net inflows	67.3	7.3.3	Wikipedia monthly edits	1.4
6.3.1	Royalties and license fees receipts (% service exports)	78.7			
7.1	Intangible assets	78.2			

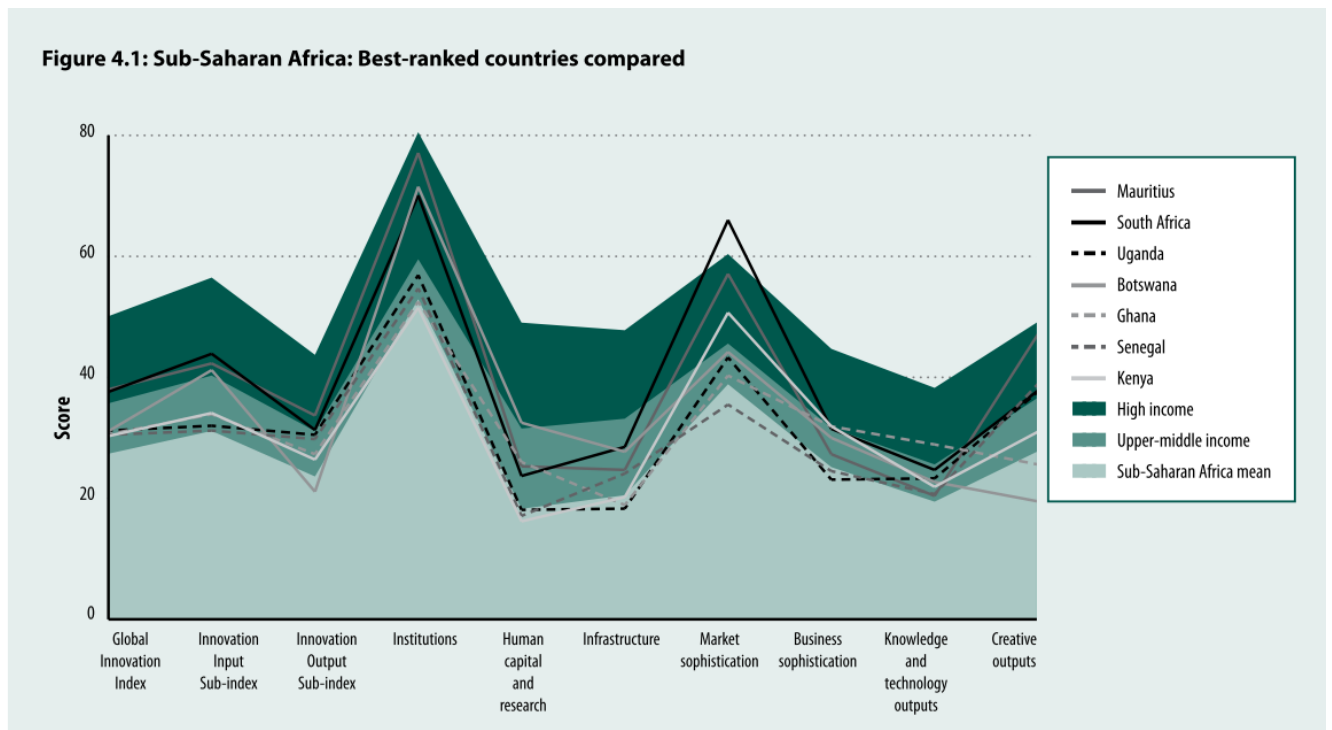
Recommendation 2: future RAN work should use regional rather than total country comparisons. In this section, we use the criteria of the GII to identify strengths and weaknesses. A regional comparison would be more informative for policy determination than national comparisons. Time and feasibility did not allow us to do that here.

In the Table above 1s,2s,3s, 4s, and 5s, make up Innovation Input, the 1's refer to Institutional factors (political, regulatory and business) , 2's to Human capital and research, education, tertiary education, and research and development, 3's refer to Infrastructure, Information and communication In the strengths arena, Uganda shows most strengths in the Innovation input sub-pillars and only two in the Output pillars; royalties and license fees receipts (% service exports)

and Intangible assets. Given that most Google searches reveal that Uganda has over 30 public and private universities, it is interesting to note that there are still significant weaknesses in the Human Capital & Research area (all of the 2's in the above table). Most notable and amenable to change are the number of science and engineering graduates, researchers, and gross tertiary outbound enrollment. The QS University ranking score of top 3 universities is an inappropriate index for all of the RAN countries except South Africa as no universities in other RAN countries are to date rated. The next category of innovation output weaknesses is in the area of knowledge workers; numbers of knowledge workers, employment in knowledge intensive services, patents, and venture/strategic alliance deals. The GII indicates that education is both an input and an output and is a serious weakness in Uganda's overall ranking.

Because the GII Sub-Saharan Region includes all 4 RAN countries, we include Figure 2 below that profiles all of the indices for Uganda, Ghana, and South Africa¹. Uganda, a low income economy, performs as an upper middle income economy on several indices; see the overall GII and Innovation Input and Output indices, institutions, market sophisticated and the two sub-indices of the Output index.

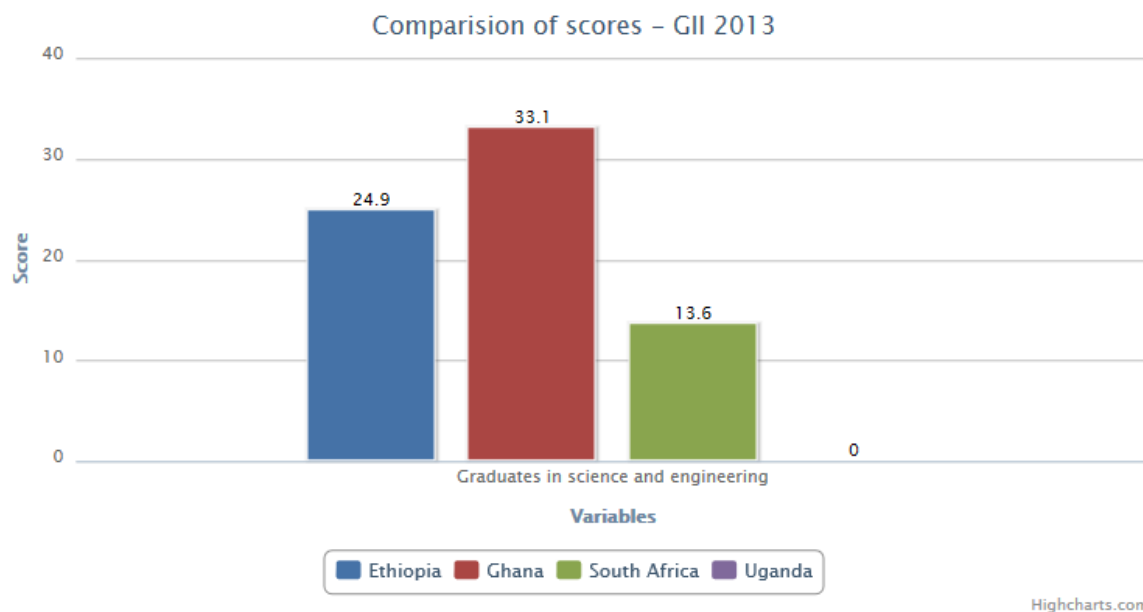
FIGURE 2: SUB-SAHARAN AFRICA: BEST-RANKED COUNTRIES COMPARED BY INDEX AND INCOME



¹Ethiopia is not included on Figure 2 because it does not qualify as a best ranked country

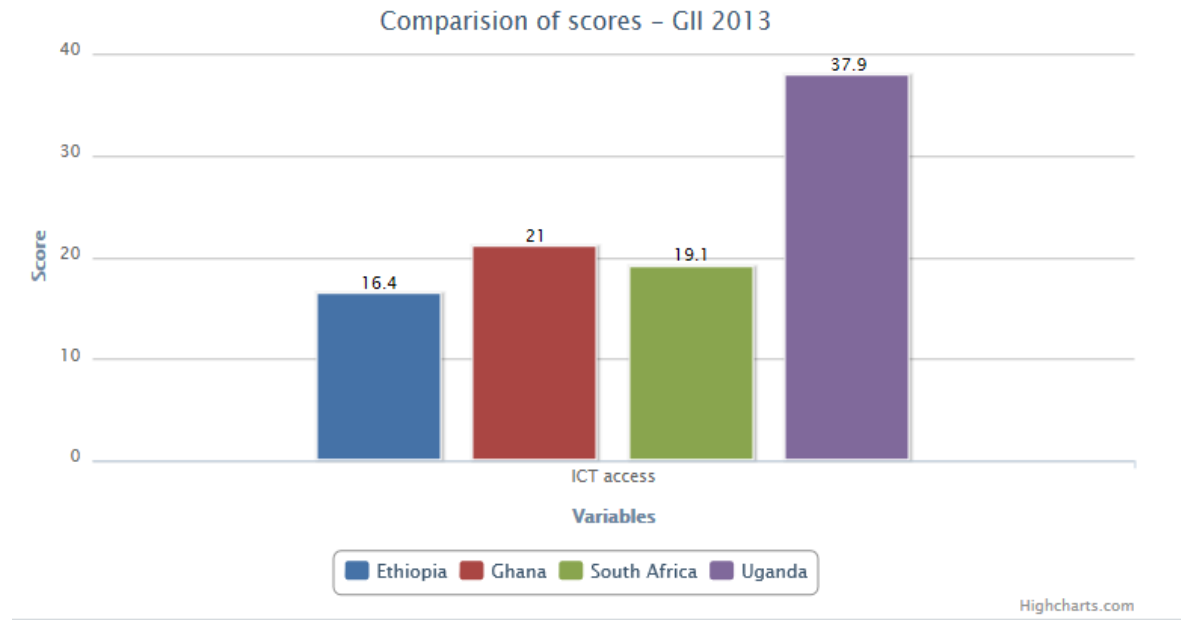
Individual indicator comparisons of RAN countries. The GII interactive data set allows examination of individual country scores on all indicators as well as country comparisons. We explore a select sample of those below; sample selection is based on our diffusion of innovation model. Within the Innovation Input category, we explore the Human capital and Research pillar, examining the percent of graduates in science and engineering. In Figure 3 below, we examine all four RAN countries profiles on this variable. First, we examine the indicator number of graduates in science and engineering (the scores are standardized 0-100); Ghana is showing the most graduates, followed by Ethiopia and South Africa. It is interesting to note that the GII's graduate data for Uganda comes from 2004 and has likely shifted considerably, pointing out the need for local verification and standardization. This indicator regards the number of tertiary graduates in engineering, manufacturing, and construction as a percent of total tertiary graduates in 2010. The data source for this indicator is UNESCO Institute for Statistics UIS online database 2003-11) (<http://stats.uis.unesco.org>).

FIGURE 3: RAN COUNTRY COMPARISON ON GRADUATES IN SCIENCE AND ENGINEERING AN INDICATOR IN THE HUMAN CAPITAL & RESEARCH PILLAR OF THE INNOVATION INPUT INDEX



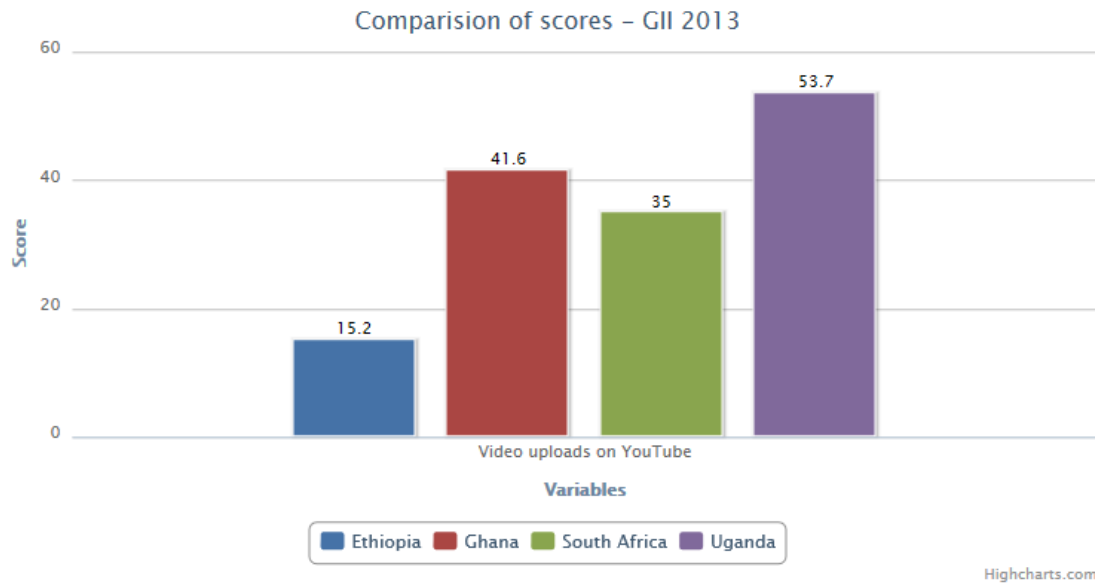
In Figure 4 below, we show the RAN country comparisons on ICT access; Uganda is significantly higher than the other three RAN countries. The ICT access is a composite indicator that gives weights to five ICT indicators (20% each): (1) Fixed Telephone lines per 100 inhabitants; (2) Mobile cellular telephone subscriptions per 100 inhabitants; (3) International Internet bandwidth (bits/s per internet user; (4) Percentage of households with a computer; and (5) Percentage of households with internet access. It is the first sub-index in the International Telecommunication Union's Development index (ITU, Measuring the information society 2012 ICT Development Index 2012 (2010-2011; <http://www.itu.int/ITU-D/ict/publications/idi/>).

FIGURE 4: RAN COUNTRY COMPARISON ON ICT ACCESS, AN INDICATOR INDEX IN THE INFRASTRUCTURE PILLAR OF THE INNOVATION INPUT INDEX



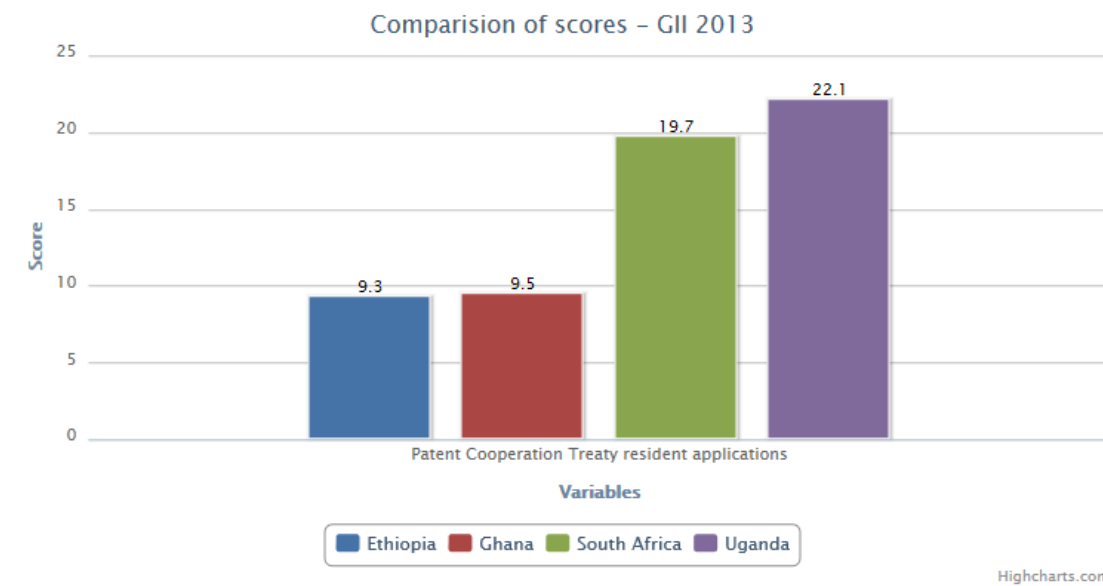
In Figure 5, we show the RAN countries YouTube video upload score, a creativity output pillar within the Innovation Output index. As in ICT access, Uganda receives a higher YouTube upload score, followed by Ghana, South Africa and then Ethiopia. Video uploads on YouTube is the total number of video uploads on YouTube, per country, scaled by population aged 15-69 years old. The raw data are survey based: the country of affiliation is chosen by each user on the basis of a multi-choice selection. This metric counts all video upload events by users. For confidentiality reasons, only normalized values are reported; while relative positions are preserved, magnitudes are not (GII).

FIGURE 5: RAN COUNTRIES ON VIDEO UPLOADS ON YOUTUBE AN INDICATOR IN THE CREATIVE OUTPUTS PILLAR OF THE INNOVATION OUTPUT INDEX



The Patent Cooperation Treaty Resident applications indicator (Figure 6) is the number of patent applications filed by residents at the Patent Cooperation Treaty (per billion PPP\$ GCP/2012) (GII). Uganda, again scores the highest of the four countries, followed closely by South Africa, then Ghana and Ethiopia. It is important to note that these are standardized scores so the actual numbers of patents is not knowable from this figure.

FIGURE 6: RAN COUNTRY PATENT COOPERATION TREATY RESIDENT APPLICATIONS AN INDICATOR WITHIN THE KNOWLEDGE AND TECHNOLOGY OUTPUTS PILLAR IN THE INNOVATION OUTPUT INDEX



INNOVATION ECOSYSTEM RESOURCES

THE INNOVATION INPUT ECOSYSTEM MAP: AFRICA

The work described below is more localized than that of the GII report – which focuses on measures that cut across all economies. The information in the following tables could be both input – i.e. innovation resources as well as output, the development, conduct and maintenance of innovation resources. Further, additional outputs could be derived from these resources, businesses initiated, social networks (measure via hashtags, etc.) and other communications – such as YouTube uploads.

While in the innovation ecosystem work described below is focused on solely on Uganda – we show a recent set of crowd sourced maps of the innovation ecosystem in all of Africa; technology hubs, business incubators, university tech labs and hacker spaces from February 2012 – May 2013 by BongoHive (<https://africahubs.crowdmap.com/>) (See Figure 7 and 8 below). Our own research (See Table 5 below) would find that this crowd sourced map under represents the numbers of innovation activities especially in Uganda. A recent article by the BBC reports that there are over 50 innovation hubs in Africa, making up a burgeoning ecosystem (Hersman 2012).

FIGURE 7: MAY 2013 CROWD SOURCED INNOVATION ECOSYSTEM: HUBS, INCUBATORS, TECH LABS, AND HACKER SPACES.

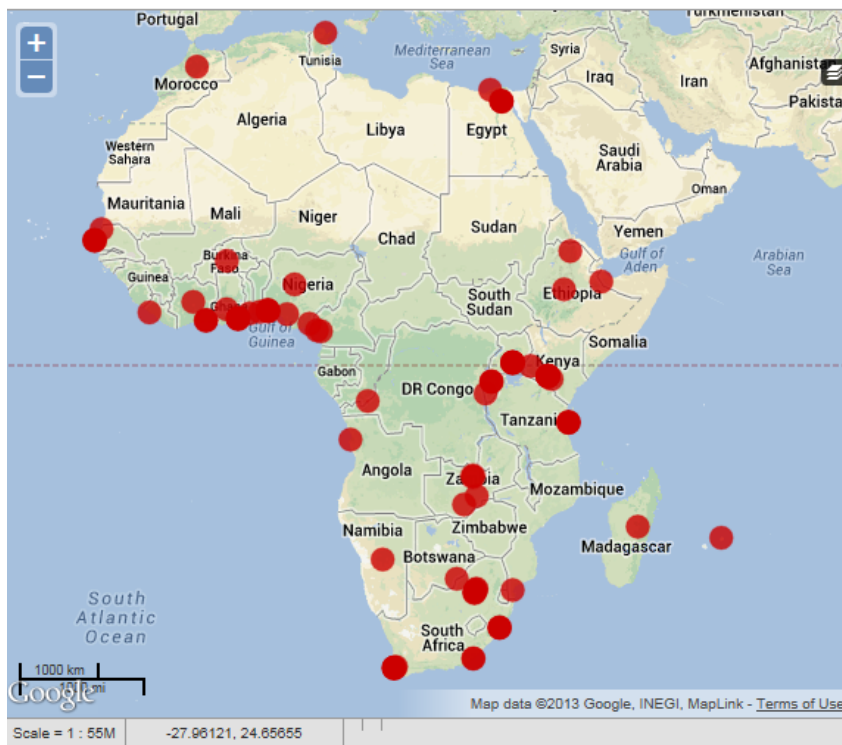
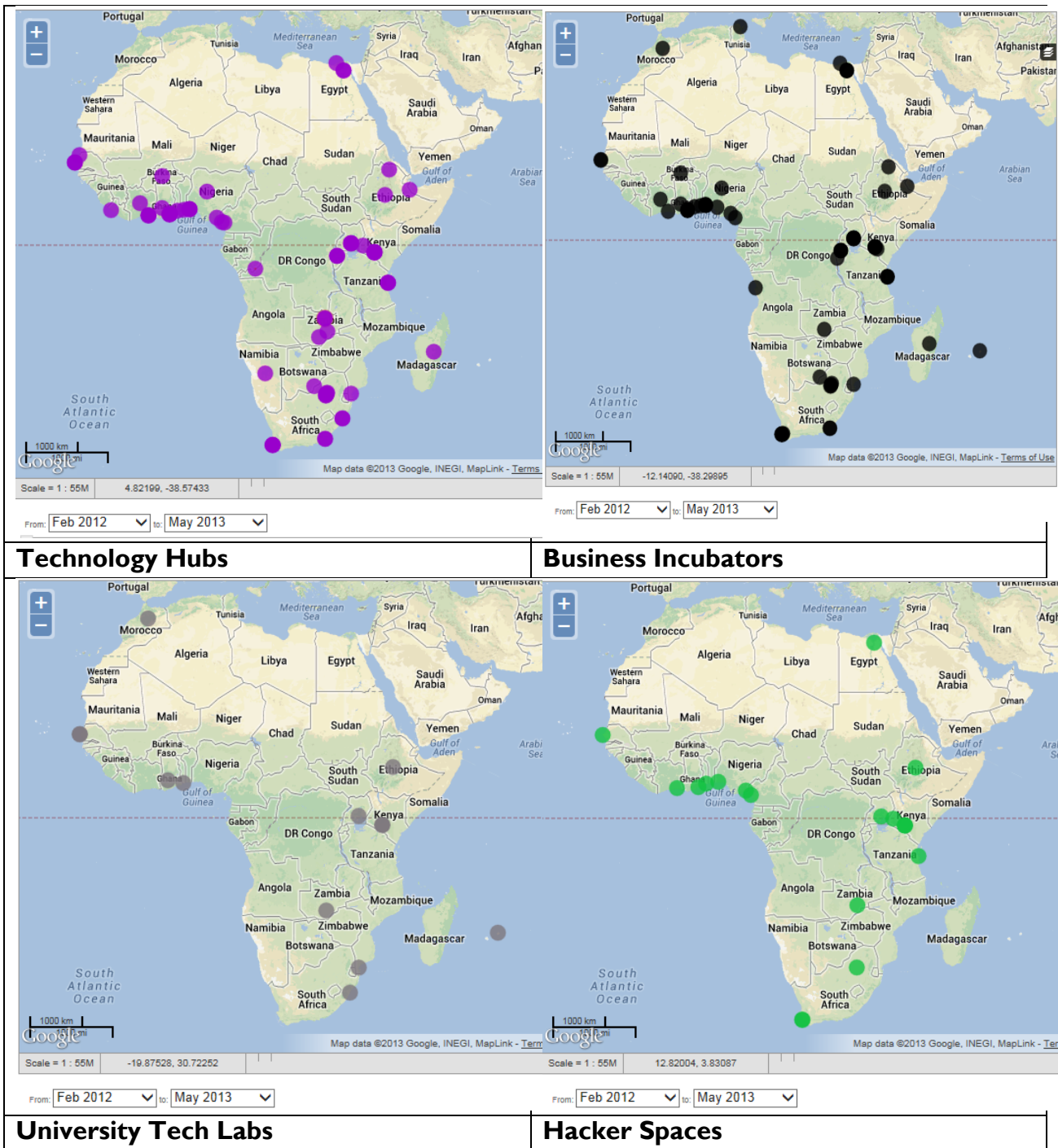


FIGURE 8: MAPPED COMPONENTS OF AN AFRICAN INNOVATION SYSTEM



INNOVATION ECOSYSTEM IN UGANDA

Next, we present Table 5 below as an example of how innovation ecosystem components can be profiled, within a country, region city or community. As an American university distant from the

focal country and universities, we do not have access to nuanced and timely field knowledge, however, as the RAN project moves forward and collaborations and networks extend and solidify, ecosystems that are germane to local communities for example, will be possible. At this time, we do not know for example, if accelerators and incubators are continuing to function optimally or how join rates compare to completion rates, or the nature of participant satisfaction and business impact.

For now, we limit the research to key word searches in internet search engines, such as Google and Google Scholar. In the case of keywords, we employed four key terms and strategies:

- (1) Incubators,
- (2) Accelerators,
- (3) Innovation labs, and
- (4) Hubs

Each term was searched with innovation, Uganda and Kampala. Thus, all of the entries in Table 5 below are physically or virtually located in Uganda and Kampala, with Nailab being the sole exception. Nailab was included on request and because of its exceptional potential as a model for Uganda. Search strategies included following up on threads within websites such as cross program references.

Based on the literature and the sites we have reviewed (Tables 5-9); we offer the following general definition of innovation: “innovation is a change that creates and /or offers value to the community and provides a competitive advantage here and now.” (EU Union Smartguide to Innovation 2010).

Many terms we used as search terms are *co-located* with innovation and frequently within the context of stimulating innovation but are not well defined and differentiated. We attempt to find and use distinct definitions of the terms accelerator, incubator, innovation hub and lab.

An *incubator* program manages innovative ideas that have been developed either internally or externally and provide services to bring those ideas to commercial fruition. Incubators often have a longer timelines for participants and make take a larger amount of equity compared to accelerators. Incubator programs often consider three stages of incubation: pre-incubations are the set of activities need to support the potential entrepreneur in developing business ideas, plans and increase the chance of effective start-up (See Figure 9 below from Smart guide to innovation incubators, 2010). Most university based programs fit into this pre-incubation stage. Incubation and post-incubation support the entrepreneur from the start up to maturity phases, access to finance, mentoring, training, advanced business planning, innovation diagnostics, preparing a company to leave the incubator.

FIGURE 9: THE INCUBATION PROCESS FROM THE SMART GUIDE TO INNOVATION-BASE INCUBATORS (IBI)

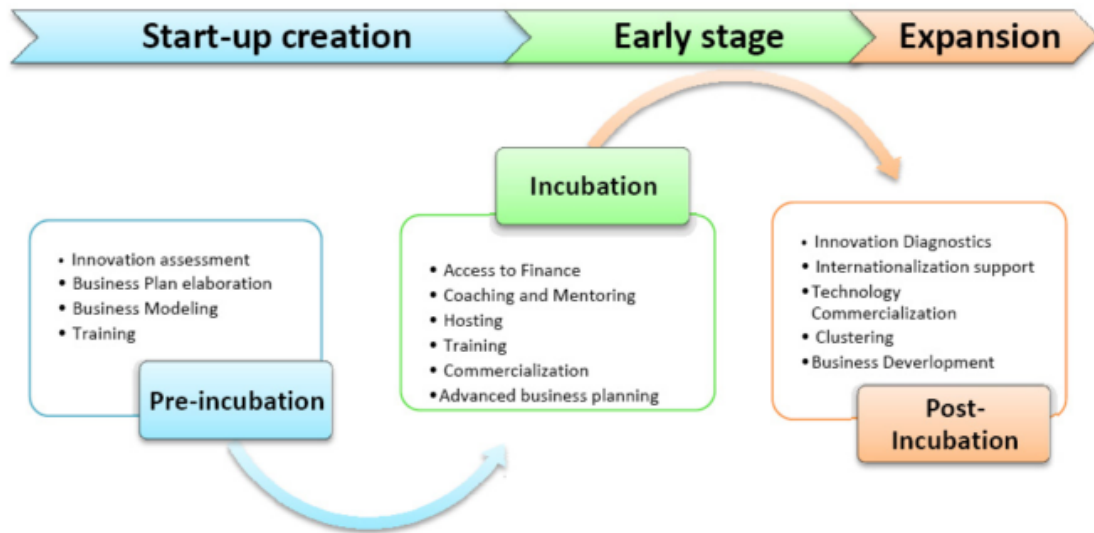


Figure 1: the incubation process

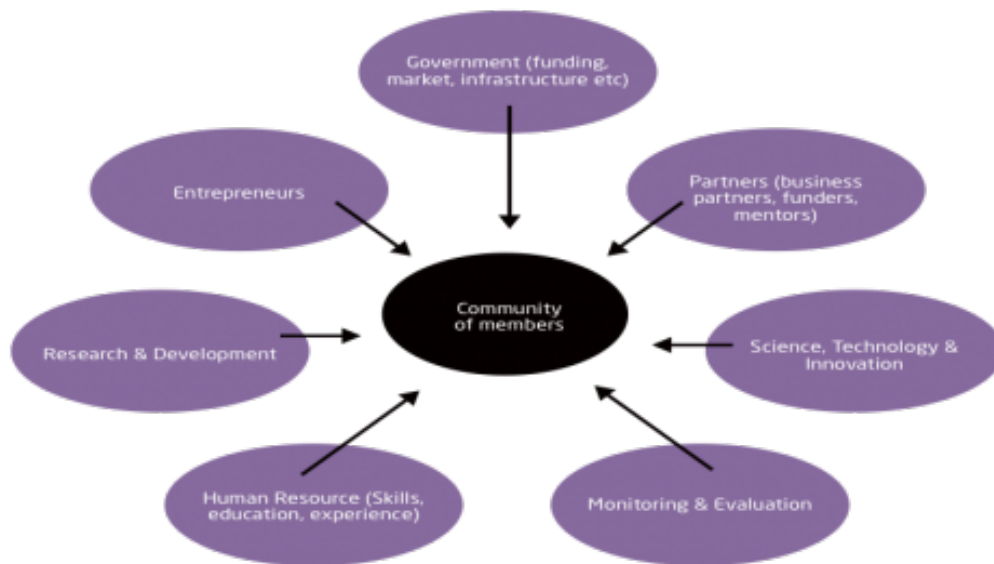
An *accelerator* program often offers small amounts of capital and mentorship. Thus, an accelerator takes in mostly external ideas, offers a small range of services and it is shorter in duration than an incubator.

An *innovation lab* is perhaps the most broadly defined term; innovation lab can describe an open living lab, an open-innovation lab or an innovation lab. These terms general coincide with this type of definition: a user-centered, [open-innovation](#), research focused ecosystem, often operating in a limited territorial context (e.g. city, neighborhood, and region) that integrates concurrent research and innovation processes within a public-private-people partnership. Definitions often include co-creation, exploration, experimentation and evaluation of innovative ideas, scenarios, concepts and related technology in real life use cases. Such use cases involve user communities, not only as observed subjects but also as a source of creation. This approach allows all involved stakeholders to concurrently consider both the global performance of a product or service and its potential adoption by users (Kusiak 2006).

An *innovation hub* is best defined as inter-organizational network concepts; it may be a tightly or loosely connected set of organizations dedicated to fostering innovation, technology and knowledge transfer, differentiating itself from for example finance or trade. At its most basic, a hub is a central point or main part of an innovation activity or interest. An innovation hub could be a physical space, as some science parks, or a completely virtual online entity like an open innovation website or a mix of a set of online and offline activities as in Chesbrough's open innovation model (Chesbrough, 2003; Ruiz, 2010). Relevant examples of its use are the nine regional innovation hubs created by the UK HHS between 2004-2005 (www.ubbivatuib.nhs.uk), South Africa's innovation hub and Science Park in Pretoria (www.theinnovationhub.com).

Recently, iHub research (April, 2013) examined 7 hubs in Sub-Saharan Africa aiming to understand the unique factors that make up ICT Hub models across Africa (<http://bongohive.co.zm/blog/comparative-study-on-innovation-hubs-across-africa/#more-929>). The report was to act as a benchmark for existing and new hubs and their implementation of their hub model. All hubs in the seven-hub report all had open spaces, driving community members, membership tiers, and skills events. In addition, an interdisciplinary approach greatly contributed to the ethos of their work. Critical success factors of a strong hub are laid out in Figure 10 below (iHub Research, 2013). Critical success factors for a hub include: government support; strategic partners; community members; a strong science, technology, and innovation focus; human capital; and research and development.

FIGURE 10: IHUB RESEARCH: IDENTIFIED CRITICAL SUCCESS FACTORS.



The examined hubs are faced with significant challenges; slow connectivity, limited staff capacity, inadequate funding, limited space, limited investment, lack of strategic partners, quality assurance of their products, infrastructure challenges, inadequate seed capital and inadequate skills and exposures.

Characteristics of definitions. It is interesting to note the small differences in programs and concepts that do not differentiate programs; such as sources of initial funding, equity taken, location, and physical space. In addition, it is often the case that all three entities (incubators, accelerators, and labs) have a single content focus such as nutrition (including one sponsored directly by USAID) or Rlabs throughout Africa focus on community development through technology such as mobile phone use) or health or agriculture. Others however offer multiple

content programs. Still others offer a general innovation approach, not singling out any particular content area. As an exception, hubs typically are all technology oriented.

We also find evidence of interactions among entities – either staged or mutually interactive; note the quote from the NaiLab website regarding their close proximity to iHub (both in Kenya).

“The lhub was and is a groundbreaking establishment in the tech arena. iHub and NaiLab are largely symbiotic although we may compete. Nailab sees itself as less of a competitor and more of a value add to what lhub does, the lhub is an open tech space where you can benchmark your skills, meet new people, get contacts, network and collaborate on projects as soon as you are ready with a product and need incubation and acceleration the NaiLab takes over and moves you from that level to the point where you build your idea into an actual viable business (<http://www.nailab.co.ke/>).”

Recommendation 3: A detailed ecosystem map could display innovations in the micro-regions of a country. Population mobility, onmi-presence of social media, and an overall focus on knowledge work and technology are indicators of the need, for example, of a Sub-Saharan Africa ecosystem map similar too but more refined than the crowd sourced maps presented above. A micro-region map of a country would allow the examination of networked interactions across regions and countries.

Using the keywords above, we found 26 innovation accelerators, incubators, innovation labs and hubs all (except Nailab) located in Uganda or Kampala. For each innovation entity, we describe the programs offered like hackathons and skills programs events or services provided such as mentorship, investment, legal, and tech lab assistance. Further, we describe their business model, the size of the group in terms of participants and start-up numbers. Finally, we profile the length of programs, audience for programs, the external or internal investment in incubated start-up and the program sponsors.

Of the 26 organizations making the innovation ecosystem: we categorize five (# 4, 9, 14, 20,& 24) as start-up incubators; five as accelerators (#3, 5, 11, 21, & 22); two as Hackathons (#6 & 10); five as Innovation labs (#7, 8, 13, 15, & 25); five as Innovation Hubs (# 1, 12, 14, 18, & 23) one as a virtual innovation network (#2); two of the organizations #16 and 17 seem to have all aspects of an ecosystem available online. While we have attempted to distinguish the groups based on definitions in the literature to make up an ecosystem, there is, however, much overlap.

We find a well-populated innovation ecosystem in Uganda; most of the ecosystem seems to be located in Kampala. If universities are involved then that university is often Makerere or in one case Mbarara University of Science and Technology (some distance from Kampala). Yet desk research shows more than 30 public and private universities in Uganda (Wikipedia – universities in Uganda). We note however that most are located within Kampala.

More in depth research is needed in the future. The ihub research on Hive Colab (in Appendix C) provides a model for that further research as it distills components of the programs and reviews innovation output and challenges. For example: all organizations could be profiled by the entry and participation process alone; Hive Colab has virtual member (up to 1,000) as well as members who pay to participate over time (monthly fee), drop in (\$5), free memberships for women, and membership categories for guests. Resources lists of agencies, entry criteria and processes distributed to high schools and universities may enhance student interest in participating.

Recommendation 4:improving networks and access. Most organizations seem to offer periodic events, presentations, workshops, courses etc. Creating and distributing an online guide for these activities could increase attendance, spread knowledge, build cross agency networks, and improve the ability of journalists to discover, promote, and cover these events.

*Recommendation 5: improving outreach to more administrative districts.*The slow network access available in Uganda (particularly in rural areas) is a serious problem. Creating an off-line experience of these events, distributed either in video tape form, CD or flash drive content, or through instructor travel, would be highly beneficial.

We include below the recommendations to ecosystem input from the iHub review of seven hubs across Africa including Hive Colab in Uganda (report in Appendix C):

RECOMMENDATIONS TO CHALLENGES OF SEVEN STUDIED ICT HUBS ACROSS AFRICA

The study suggests the following recommendations but not limited to:

- (1) In the short term, Hubs should partner with local Internet providers who can provide a subsidized Internet basket for faster acceleration of the innovations being developed by their members;
- (2) They should also train their staff in order to build sufficient in-house capacity to manage, administer and deliver efficiency and value-add programs.
- (3) Limited capacity issue can be addressed by adoption of tier system where they have physical and virtual members or expanding their space into 2 location sites e.g. such as what ActivSpaces has done in Cameroon.
- (4) Due to limited investment capacity, it is recommended that hubs need to hire coordinators to do financial outreach and also who can understand what investors are looking for and aligning with the needs of the startups in the Hub.
- (5) Monitoring and evaluation mechanisms should be put in place to ensure products/services and planned activities are measured against a set of indicators and an associated feedback loop to ensure high standards and delivery are met on a continuous level to address quality assurance issues.

- (6) Introduction of investor education programs to address the challenge of seed capital. This program should entail development of human capital, technological capital and financial capital.
- (7) Lack of exposure and inadequate skills should be addressed by hubs hiring qualified trainers, employees, technical experts and mentors to train the members who can double up as in-house capacity.
- (8) Sustainability model of most hubs are in the short-term. Long-term models can be developed but not limited to working on commissioned projects together with their member companies, corporate partnerships and events, offering services to external community and social entrepreneurs through initiatives that add value and addresses their needs.
- (9) Hubs housing information centres by providing access to high level resource services e.g. business planning, legal and talent recruitment can form part of potential sustainability models.

The study concludes that although these ICT hubs are in nascent stages of development, they can be a nexus point for economic growth and 'techpreneurship' development in Africa. In addition, these innovation spaces can be viewed as a catalyst for socio-economic development through creation of technology-led entrepreneurs. Indeed, Innovation hubs can be effective when they harness the idea of openness and community-driven approaches through collaborative events, sharing knowledge and encouraging development of innovations that have a positive impact in the society as a whole.

- See more at: <http://bongohive.co.zm/blog/comparative-study-on-innovation-hubs-africa/#more-929>

TABLE 5: ORGANIZATIONS MAKING UP THE INNOVATION INPUT ECOSYSTEM IN UGANDA AND KAMPALA

Actor	Programs Offered	Services Provided	Business Model	Size	Length	Audience	Investment	Sponsors
1. AfriLabs	Innovation hub	Hive Colab, Apps4Africa support	Non-profit	16 African hubs and labs	Long term	Entrepreneurs		Hivos, Google, Omidyar Network, InfoDev
2. Agri-Hub	Online network of agricultural stakeholders	Networking, innovation implementation, collaboration		1600 members	Long term	Farmers, NGOs, researchers, developers		Agri-ProFocus (12 countries)
3. Angel Ventures	Accelerator and mentorship program	Managerial support, business, training, investment	For-profit; 10% equity	25 entrepreneurs	6 week program twice a year	Entrepreneurs	Invests 5000-20000 initially	Angels Finance Cooperation
4. Appfrica	Investment and consulting firm	Offers program design, market research, and technical solutions	For-profit	Support in 16 sub-Saharan Africa countries	Long term (Founded in 2008)	Entrepreneurs		U.S. Department of State, Apps4Africa

Actor	Programs Offered	Services Provided	Business Model	Size	Length	Audience	Investment	Sponsors
5. Apps4 Africa	Funding, accelerator, app competition	Investment		15 different countries	Long term (founded in 2008)	Entrepreneurs	~\$75,000 in funding	Appfrica, AfriLabs, U.S. State Dept, World Bank
6. Garage 48 Event Series	Hackathon	Mentors, Internet, workspace		12-15 teams	48 hours	Entrepreneurs		Google, Nokia, MTN Uganda
7. Grameen Foundation AppLab	Innovation lab	Community Knowledge Worker program, mobile-based solutions	Non-profit	Labs in 5 different countries	Long term	Poor communities	Micro loans	Google, Qualcomm, Gates Foundation
8. Hive Colab	Advisory services, Hackathon	Office space, Internet access	Potential NGO	2 full-time employees	Long term	Startups, entrepreneurs	None	Appfrica, AfriLabs, Indigo Trust, SpotOne, Hivos, Everlytic
9. infoDev	Business incubator, massive	Knowledge products	For-profit	Global network of over 40	Long term	Startups, entrepreneurs		World Bank, African Incubat

Actor	Programs Offered	Services Provided	Business Model	Size	Length	Audience	Investment	Sponsors
	network, investor	, financial support		incubators				or Network
10. Kampa la StartUp Weekend	Hackathon			36 ideas pitched, 16 chosen	54 hours	Entrepreneurs		MTN Uganda
11. Mara Foundation	Social enterprise	Business mentorship, office space offering, venture capital, charity	Non-profit		Long term (founded in 2009)	Entrepreneurs, schools, business leaders		
12. Mara Launch pad	Innovation hub; capital, mentorship, and speaker program	Office space, networking, Internet access			Long term	Entrepreneurs		Mara Foundation, Angels Finance Cooperation
13. Microsoft Innovation Centre	Microsoft Uganda Imagine Cup, programs focusing on skills building	High-tech equipment, test laboratory, advising		N/A	Long term	Students, faculty	None	Microsoft, Makerere UNID O, National Information Technology

Actor	Programs Offered	Services Provided	Business Model	Size	Length	Audience	Investment	Sponsors
								Authority Uganda
14. Millennium Science Initiative	Joint Development Project by World Bank and Ugandan Government	STI support, funding, government focus	Non-profit, Collaborative project		7 years (ended on June 30th, 2013)	Universities and research institutes	US\$30 million as a loan to the country on credit terms and US\$3.35 million	World Bank, Uganda govt, UNCS T
15. MUST Innovation Café	Advisory services, Prototype development	Identify partners, resources, funding		N/A	Long term	Students, faculty		Mbarara U., Consortium for Affordable Medical Technologies
16. NaiLab	Hackathon, accelerator, incubator	Business advice, technical training, professional	For-profit: 7-10% equity	Teams of 2-30 startups annually	3-12 month programs	Business startup	None	Microsoft Bizspark, Rlabs, Afrilab

Actor	Programs Offered	Services Provided	Business Model	Size	Length	Audience	Investment	Sponsors
		mentors hip, investment networking						s, accent ure, VC4A, I%Club
17. Nutrition Innovation Lab Africa	Innovation Lab	Research, Policy analysis, Capacity building, UCC project	Gov't		5 year grant	Pregnant women and new mothers, undernourished communities, infants		USAID , Tufts U., Makerere U., National Planning Authority of Uganda
18. Outbox Hub	Accelerator, Innovation hub, mentorship	Co-working space, innovation competitions facilitation, industry workshops networking and investors	Paid membership	3-5 businesses	3-6 months	Developers, designers, investors		Google , Deloitte, Everlytic

Actor	Programs Offered	Services Provided	Business Model	Size	Length	Audience	Investment	Sponsors
19. Pearl Capital Partners	Agricultural investment firm	Investment, management strategies, consulting	For-profit: 15% annual compounded return	Offices in Kampala and Nairobi ; managing over 50 million in investment	Long term (active since 2006)	Small agriculture companies	Investments between \$250,000 and \$2.5 million (USD);	USAID, J.P. Morgan, Gates Foundation, etc.
20. Presidential Support to Scientists Fund	Government Funding initiative	STI development and research, incubation, support, and	Gov't	5 scientists in 2010	Long term	Scientists, Universities, research centers	Budget of \$4.2 million USD	Uganda government
21. Renewable Energy Incubator	Incubation services, support services, mentorship	Office space, networking, limited investment	Non-profit		2 years (ending in Sept 2013)	Focused on entrepreneurs in renewables		Makerere U, Nordic Dev Fund, Nordic Environment Finance Corporation
22. Savannah Fund	Accelerator	Investment, legal assistance	For-profit:	5 startups	3 months	Business startup	\$250,000 - \$500	

Actor	Programs Offered	Services Provided	Business Model	Size	Length	Audience	Investment	Sponsors
	program, seed fund	e, advising, networking	15% equity		programs		000 loan	
23. ThoughtWorks	Software development firm	Software design, creation, and delivery; training; consulting; and workshops	For-profit:	2000 employees in 28 offices / 11 countries	Long term	Startups		
24. Uganda Industrial Research Institute	Research and development lab and incubator	Shared space and technology, skills business training, R&D	Government Institute	30 startups	Long term	Industrial sector?		Chinese gov't, Uganda gov't
25. UNICEF Uganda Innovation Department	DevTrac, UReport, Digital Drum, mHealth, mTrac,				Long term	Gov't		UNICEF
26. The Hub K Kampala	Innovation hub	Cafe, meeting space, utilities, support, networking	For-profit: membership dues based		Long term	Entrepreneurs		

UGANDA – FOCUSED INNOVATION LITERATURE REVIEW

The literature referring to innovation within a country provides one potential indicator of the innovation taking place in that country. Using the search protocol outlined in the June 21 Deliverable Literature Review Protocol the innovation literature of Uganda was surveyed.

Unfortunately, several impediments exist when attempting to retrieve current innovation literature. First, there is an inevitable lag when dealing with peer reviewed pieces and this undermines our attempt to reveal Uganda's innovation landscape; the majority of our articles are at least two years old and most come from less established journals. Second, a considerable amount of innovation occurs in the private sector and is rarely documented in peer-reviewed studies. Third, the results of this literature review were heavily dependent on the databases used. Some databases, notably Google, tailor results depending on the researcher's temporal and spatial setting. This will skew the reliability of the results of this literature review. Finally, terms like innovation, accelerator, hub, etc. are marketing words which appear in many articles that do not deal with the innovation landscape. To counter the first two impediments, the Peace Innovation Lab supplemented the below literature review with the desk review component above (Table 5). Each provides a survey of a different part of the Uganda's innovation ecosystem.

PEER-REVIEWED LITERATURE

For the purposes of this report, Uganda's peer-reviewed literature is divided into four distinct categories: agriculture, health, governance, and business. Although the protocol calls for further distinctions (between say health and medicine or a section devoted to mobile), the protocol's search terms did not yield enough results to justify separating these fields. A more detailed summary of each article is included in Appendix A. When performing future innovation reviews, a larger temporal frame (this report only covers articles published since 2007), a larger spatial frame (beyond Uganda), larger set of databases, or different search terms may enable the original literature breakdowns.

These articles do not represent a survey of the innovations occurring in Uganda; Jeannie Stamberger of Makerere University will submit that compilation separately. The following articles serve instead as an initial examination and analysis of the peer-reviewed literature found using research protocol consensually with USAID, Makerere University, and Stanford University and show the location and deployment of the contributions each describe. A short synthesis of each article is available in Appendix A.

Description of Articles. Given the focus of the USAID –RAN project it is logical to begin with business – this will cover ICT, apps and special technologies as well as other innovations that are interpersonal and program oriented.

There are 10 articles from 2007-2013 that met the key word and database search. In the Table below, we list the article’s authors, date, title, primary focus, specific innovation or other contribution of the articles, locus of development of the innovation, locus of deployment or study of the article, and the focal audience of the article. All articles are generated from and focus all or in part on, business in Uganda. Interestingly, these articles cover many of the elements of innovations: entrepreneurship, start-ups, business incubators, networks, and the prevalent technology, including two papers on mobile phone innovation.

Here we describe the “landscape” of innovations research in Uganda but needed is a careful delineation of the insights, gaps, and recommendations of these articles in each category. Also needed is a critique of the quality of research, status of the journal and citation analysis of the individual articles to understand the international impact of work done in and on Uganda.

TABLE 6: BUSINESS/MISCELLANEOUS INNOVATION UGANDA FOCUSED- ARTICLES 2007-2013

Business/MIS C Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(73 Cameron, Hugh 2012)	A Software Business Incubation Model Using Icts For Sustainable Economic Development In Uganda	Business incubation	Software Business Incubation Program	Makere re University	Uganda	Entrepreneurs, startups, Makerere University
(75 Abyabashaij, Warren 2011)	The Impact Of College Entrepreneurial Education On Entrepreneurial Attitudes And Intention To Start A Business In Uganda	Entrepreneur education	Policy Analysis	Uganda universities	Uganda /International	Policy makers
(34 Mutambi, Joshua 2011)	Stimulating Industrial Development In Uganda Through Open Innovation Business Incubators	Business incubation	Policy Analysis	Uganda	Uganda	MSMEs, startups
(65 Mutambi, Joshua 2010)	Research The State Of Business Incubation Systems In Different Countries: Lessons For Uganda	Business incubation	Policy Analysis	Uganda	Uganda	business incubators

Business/MIS C Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(48 Paina, Ligia 2013)	How Does Investment In Research Training Affect The Development Of Research Networks And Collaborations?	Research network	Policy Analysis	Makere re University, University of Nairobi	International	Researchers, research networks /programs
(74 Tushabomwe-Kazooba, Charles 2006)	Causes Of Small Business Failure In Uganda: A Case Study From Bushenyi And Mbarara Towns	Small business failure	Policy Analysis	Uganda	Uganda	Startups, SMEs
(42 Rooks, Gerrit 2012)	Network Structure And Innovative Performance Of African Entrepreneurs: The Case Of Uganda	Entrepreneurs	Network structure	Uganda	Uganda	Entrepreneurs, private sector
(69 Hersman, Erik, 2012)	Mobilizing Tech Entrepreneurs In Africa	Tech environment	Case Innovation narrative: Hub	Kenya	Kenya, Africa	Entrepreneurs, SMEs
(72 Hinman, Rachel 2010)	Opportunities And Challenges For Mobile-Based Financial Services In Rural Uganda	Mobile financial services	Financial Tracking app	Uganda	Uganda	Mobile-based financial services

Business/MIS C Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(50 Heimerl, Kashif Ali, Joshua Blumenstock, Brian Gawalt, Eric Brewer 2013)	Expanding Rural Cellular Networks With Virtual Coverage	Rural Cellular coverage	Virtual coverage	USA	Indonesia, potentially Uganda	Cellular carriers

Nine articles were found that pertain to governance. This is a set of articles focused on national policy regarding innovation. Most all topical areas regarding innovation are here; ICT overall and specifically such as mobile, economic development, political structure and priorities, tertiary education (and STEM education). It is clear that researchers, local and international, are focused on building an innovation economy but pathways are not always clearly defined.

TABLE 7: GOVERNANCE INNOVATION ARTICLES FOCUSED ON UGANDA FROM 2007-2013

Governance Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(23 Bowman, Warigia Margaret 2009)	Digital Development: Technology, Governance And The Quest For Modernity In East Africa	ICT policy	Policy Analysis	Uganda, Kenya, Tanzania, Rwanda	--	Policy makers
(22 de Vries, WT 2011)	Discretionary Space As A Concept Review Innovation In Land Administration In Africa	Government structure	Policy Analysis	Namibia, Rwanda, Uganda	--	Policy makers
(70 Kulabako, Faridah 2012)	Government Urged On Competitiveness	Economic development	Policy Analysis	Uganda	--	Policy makers, Ugandan government
(78 Ecuru, Julius 2011)	Integrating Science, Technology And Innovation In The National Development Planning Process: The Case Of Uganda	National development planning process	Policy Analysis	Uganda	Uganda	Policy makers

Governance Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(81 Kunstler, Barton 2007)	State Foresight, Innovation And Entrepreneurship: The Case Of Economic Development, E-Learning And Outsourcing Industry In Uganda	Economic development	Policy Analysis	Uganda	International	Policy makers
(3 Jones, Ben 2009)	Beyond The State In Rural Uganda	The Rural	Government structure	Uganda	Uganda	Ugandan government, policy makers
(68 Asifiwe, Collins 2011)	The Contribution Of Higher Education To Socio-Economic Development Of The Local Community: A Case Study Of Makerere University, Kampala	Tertiary Education	Policy Analysis	Makerere University	Uganda	Makerere University
(4 Brar, Sukhdeep 2011)	Science, Technology, And Innovation In Uganda: Recommendations For Policy And Action	STI development	Policy Analysis	Uganda	Uganda	Policy makers

Governance Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(79 Ecuru, Julius, Trojer, Lena, Ziraba N., Lating, Peter O., 2012)	Structure And Dynamics Uganda's Technological Innovation System: Research Note	And Of Govern ment structu re	Policy Analysis	Uganda	Uganda	Policy makers , private compa nies

In Table 8 below we profile the twelve articles regarding health innovation in Uganda. Interestingly, three of the articles are generated from Makerere University in Uganda, two are policy focused and one is focused on the use of a mobile app. Malaria, HIV/AIDs, pre-natal care and pregnancy and general health are covered in this set of twelve. Audiences range from hospital staff and health workers to university administrators and researchers, policy makers and other intermediaries. Only one article focuses on the community members.

One observation could be that as innovations are developed, audiences (consumers) need to be carefully articulated. For example, if an innovation is for health workers, then innovators need to examine if the innovators reaches and is used by the health worker (the gate keeper) and if the innovation improves health care outcomes of mothers and children.

TABLE 8: HEALTH ARTICLES FROM 2007-2013

Health articles	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(77 Anonymou s 2011)	UTAS UgandaProject Seeks Microscopes And Dollars: (77 Anonymous 2011)	Malaria Diagn osis	Microscop e Use	Universi ty of Tasmani a	Uganda	Hospital Staff
(29 Ssenoba,	Research Translation To Inform	Policy Analys is	Policy Analysis	Makerere	Internat ional	University admins

Health articles	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
Freddie (2011)	National Health Policies: Learning From Multiple Perspectives In Uganda			University		
(19 Rosiello, Alessandro, Smith, James, 2008)	A Sociological Economy Of HIV/AIDS Vaccine Partnerships : Case Studies From Africa And India	HIV/AIDS	IAVI Initiative structure	International	Uganda, Kenya, Rwanda, India	Organizers
(32 Pariyo, G. 2011)	A Grander Challenge: The Case Of How Makerere University College Of Health Sciences (Makchs) Contributes To Health Outcomes In Africa	Makerere University	Policy Analysis	Makerere University	African Universities	University admins
(30 Nakibin)	Community Engagement In Health	HIV/AIDS	Policy Analysis	Unspecified Rural Uganda	Unspecified Rural Uganda	AIDS Research Community

Health articles	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
ge, S. (2009)	Research: Two Decades Of Experience From A Research Project On HIV In Rural Uganda					
(47 Ackers, L. (2013)	International Volunteering To Promote Maternal And Newborn Health: Optimising Impact	Maternal and infant mortality	Clinical volunteer placement/ model	Uganda, UK	Uganda, UK	English medical staff and Ugandan policy makers
(33 Al-Bader, Sara (2010)	Science-Based Health Innovation In Sub-Saharan Africa	General Health innovation	Policy Analysis	Uganda, Rwanda, Tanzania, and Ghana	International	Policy Makers
(2 De Souza, Roger-Mark (2008)	Using Innovation To Address HIV, AIDS, And Environment Links: Intervention Case Studies From Zimbabwe,	HIV/AIDS	Policy Analysis	Uganda, Zimbabwe, Malawi	International	Policy Makers

Health articles	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
	Uganda, And Malawi					
(21 Fonn, Sharon, Ray, Sunanda, Blaauw, Duane, 2011)	Innovation To Improve Health Care Provision And Health Systems In Sub-Saharan Africa—Promoting Agency In Mid-Level Workers And District Managers	Mid-level health workers	Policy Analysis	Uganda, Kenya, Nigeria, South Africa	International	Policy Makers
(40 Anonymous 2013)	Impact Of An Innovative Approach To Prevent Mother-To-Child Transmission Of HIV—Malawi	HIV/AIDS	Option B+ approach	Malawi	Uganda, Rwanda, Malawi, Haiti	HIV positive pregnant women and new mothers
(15 Abay, Fetien, Waters-Bayer, Ann, Bjørnstad,	Health Research Agenda For East Africa: The New Millennium: Looking Ahead	Health research agenda	Policy Analysis	East Africa	East Africa	East African governments/policy makers

Health articles	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
Åsmund, 2008; 28 Kitua, A Y. 2007)						
(31 Kamun yori, S. 2010)	Science-Based Health Innovation In Uganda: Creative Strategies For Applying Research To Development	Health innovation	Policy Analysis	Uganda	Uganda	Policy makers
(25 McLymont, Rosalind 2012)	Foot Soldiers	Prenatal care	WinSenga Mobile App	Makerere University	Uganda	Pregnant women and nurses
(82 Chib A, Wilkin H, Ling LX, Hoefman B, Van Biejma H, 2012)	You Have An Important Message! Evaluating The Effectiveness Of A Text Message HIV/AIDS Campaign In Northwest Uganda	HIV/AIDS	Mobile health assessment	Nanyang Institute of Technology – Singapore	Uganda	Healthcare providers and Policy Makers

Ten articles on Agriculture were found using the key words and search strategies described above (See Table 9 below). Several articles focus on land and natural resources management, three focus on specific farming innovations such as potato production, one on climate change.

As in health above, gatekeepers and intermediaries – policy makers, researchers, NGOs – are more often the focus audience than end-users, in this case farmers (# 3, 4, 5, 7). Finally, similar to health research above, roughly half of the articles focus specifically on Uganda.

TABLE 9: AGRICULTURE-BASED ARTICLES FROM 2007 - 2013

Agriculture Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
(20 Birungi, P. B., Hassan, R.M., 2007)	Impact Of Alternative Land Management Options On Soil Fertility And Erosion In Uganda	Land management	Policy Analysis	Uganda	Uganda	Policy makers
(24 Friis-Hansen, Esbern 2008)	Impact Assessment Of Farmer Institutional Development And Agricultural Change: Soroti District, Uganda	Agricultural development	Policy Analysis	Soroti district, Uganda	Uganda	Policy makers, farmers, private sector
(7 Gildemacher, Peter R., Wagoire, William W., Kinyae,	Improving Potato Production In Kenya, Uganda And Ethiopia: A System Diagnosis	Potato production	Policy Analysis	Kenya, Uganda, Ethiopia	Kenya, Uganda, Ethiopia	Farmers

Agriculture Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
Peter M., Struik, Paul C., Leeuwis, Cees, (2009)						
(I Hauser, Michael 2010)	Farmer Participatory Research: An Approach To Fostering Community-Led Innovation In Smallholder Agriculture	Agricultural innovation	Participatory approach	Uganda	Uganda	Farmers, researchers
(45 Oirere, Shem 2012)	University Innovation Aids Farming In Uganda	Agricultural innovation	Water pump technology	Makere University	Uganda	Farmers
(5 Ortiz, O., Orrego, R., Pradel, W., Gildemacher, P., Castillo, R., Otiniano, R., Gabriel, J., Vallejo, J., Torres, O.,	Insights Into Potato Innovation Systems In Bolivia, Ethiopia, Peru And Uganda	Innovation landscape	Policy Analysis	Bolivia, Ethiopia, Peru, Uganda	Bolivia, Ethiopia, Peru, Uganda	NGOs, government organizations, private companies, farmers

Agriculture Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
<p>Woldegiorgis, G., Damene, B., Kakuhenzi, R., Kasahija, I., Kahi, I., (2013)</p>						
<p>(44 Osbahr, H. (2011)</p>	<p>Supporting Agricultural Innovation In Uganda To Respond To Climate Risk: Linking Climate Change And Variability With Farmer Perceptions</p>	<p>Climate Change</p>	<p>Opinion polling</p>	<p>Uganda</p>	<p>Uganda</p>	<p>Farmers</p>
<p>(46 Smale, M. 2007)</p>	<p>An Economic Assessment Of Banana Genetic Improvement And Innovation In The Lake Victoria Region Of</p>	<p>Natural Resource management</p>	<p>Policy Analysis</p>	<p>Uganda, Tanzania</p>	<p>Uganda, Tanzania</p>	<p>Policy makers</p>

Agriculture Citation	Title	Topic	Specific Contribution	Innovation Locus	Innovation Deployment	Audience
	UgandaAnd Tanzania					
(26 Kaaria, Susan 2008)	Assessment Of The Enabling Rural Innovation (ERI) Approach: Case Studies From MalawiAnd Uganda	Natural Resource management	ERI approach	Malawi, Uganda	Malawi, Uganda	Policy makers
(70 Kulabako, Faridah 2012)	Government Urged On Competitiveness	Economic development	Policy Analysis	Uganda	--	Policy makers,

This initial literature review suggests that the available literature covering innovation in Uganda documents the role of two main actors: the Ugandan government and our colleagues at Makerere University.

In general, the peer-reviewed literature positively appraises the Ugandan government's policy on innovation: "Uganda has had two decades of success in building capacity in science and technology" (Brar et al 2011). It seems that Uganda is not content to subsist off its natural resources and has made achieving innovation across a variety of fields a priority. While Jones (2009) claims that national government reforms have little impact on "ordinary Ugandan villages" (xiv) with changes instead coming at the local levels and Kamunyori et Al (2010) claim that the absence of a ministry responsible for STI (instead, the Ministry for Finance, Planning and Economic Development oversees a council level supervisor, UNCST) causes a lack of consolidated STI policy, Uganda's innovation policy seems remarkably developed and foresighted. UNCST may have addressed the lack of STI policy: UNCST's National Science, Technology, and Innovation Plan presents the developmental vision of using science and technology to serve specific social needs, like the growing young population (Brar et al. 2011). President Yoweri Museveni has been

credited with several presidential initiatives driving innovation including a movement on online education and a funding program for Ugandan scientists. Recently, Uganda has begun “promoting universities in fostering entrepreneurial activities” (105 Mutambi 2011) which may be partially responsible for the high level of interest surrounding Makerere University. Exploring the depth of the presidential initiative for online education and its relevance to any massive online open course generated by Stanford University (in coordination with USAID and Makerere) would be highly useful future research.

While “the involvement of academia in industry business relationships can contribute greatly” (105 Mutambi 2011) to innovation, Uganda’s academic community seems extremely centralized. Makerere University dominates the university domain of available peer-reviewed published innovation literature; there is extremely limited mention of the other 29 universities in Uganda. The articles above are almost all connected to Makerere in some way: the innovation they describe occurred at Makerere, they are written by Makerere staff or students, or they describe Makerere’s role within the various landscapes. This overarching dominance is likely caused by Makerere’s 1) relatively long history of both existence and research—it was the only university in Uganda until 1987) 2) interconnected relationship with other international universities and stakeholders 3) emphasis on academic research 4) Makerere’s focus on the science, technology, and innovation 5) general self-replicating success.

SUMMARY

Overall, Uganda, mostly within Kampala and the surrounding urban area, is poised to be early adopter of innovation as it pertains to technology innovations alone and technology infused into areas of health and agriculture. These innovation infrastructures are stimulated and maintained by significant funds from external groups such as foundations, UNICEF, World Bank, USAID and the Ugandan government. Despite these funding sources, financing continues to be a major concern. Technology infrastructure, with slow internet access, continues to be a barrier especially in more rural areas. It appears from the GII report that there are significant differences among countries in terms of innovation. Desk research such as that conducted here for Uganda and Kampala (perhaps combined with the interview approach by iHub research) could be adopted for other RAN countries. Our own desk work would have benefited greatly from field interviews and discussions (such as focus groups) with participants as it would generate more detailed and current status information. This work may be ideal for university students in RAN countries.

Much of innovation stems from work within universities and business/university collaborations. From afar we were unable to adequately tap the unique position of universities in innovation (except Makerere) or be informed regarding cross university networks and collaborations. This too would be beneficial to RAN countries. The GII report’s tertiary education markers (business schools graduates, entrepreneurship programs, support for advanced degrees, and specific

numbers of STEM programs and students) are particularly weak for African nations and require supplementary data.

For future work, we recommend developing a within country regional framework for measuring innovation infrastructure, activity, and stage of activity. In addition, we recommend finding “markers” of social networks across regions and countries. The “markers” could be individual surveys, Twitter, LinkedIn, or other social media markers. If, for example, Innovation MOOCs are deployed the participant base offers a rich sample of potential entrepreneurs for surveying and recruitment to new MOOCs.

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Uganda

Country/Economy Profiles

Key Indicators	
Population (millions)	35.7
GDP (US\$ billions)	20.5
GDP per capita, PPP\$	1,419.2
Income group	Low income
Region	Sub-Saharan Africa

	Score (0–100) or rate (best data)	Rank
Global Innovation Index (out of 142)	31.2	89
Innovation Output Sub-Index	30.5	75
Innovation Input Sub-Index	32.0	109
Innovation Efficiency Ratio	1.0	79
Global Innovation Index 2012 (based on GII 2012 framework)	25.6	117

1 Institutions	56.9	85
1.1 Political environment	44.0	110
1.1.1 Political stability*	39.2	122
1.1.2 Government effectiveness*	24.5	99
1.1.3 Press freedom*	68.3	82
1.2 Regulatory environment	70.0	53
1.2.1 Regulatory quality*	46.7	81
1.2.2 Rule of law*	36.0	82
1.2.3 Cost of redundancy dismissal, salary weeks	8.7	25
1.3 Business environment	56.8	91
1.3.1 Ease of starting a business*	59.3	131
1.3.2 Ease of resolving insolvency*	41.8	62
1.3.3 Ease of paying taxes*	69.4	71

2 Human capital & research	18.1	115
2.1 Education	34.5	116
2.1.1 Current expenditure on education, % GNI	2.9	95
2.1.2 Public expenditure/pupil, % GDP/cap.	10.6	103
2.1.3 School life expectancy, years	11.1	103
2.1.4 PISA scales in reading, maths, & science	n/a	n/a
2.1.5 Pupil-teacher ratio, secondary	17.9	89
2.2 Tertiary education	16.8	112
2.2.1 Tertiary enrolment, % gross	9.1	111
2.2.2 Graduates in science & engineering, %	9.5	95
2.2.3 Tertiary inbound mobility, %	5.2	31
2.2.4 Gross tertiary outbound enrolment, %	0.1	139
2.3 Research & development (R&D)	3.1	90
2.3.1 Researchers, headcounts/mn pop.	52.6	105
2.3.2 Gross expenditure on R&D, % GDP	0.4	67
2.3.3 QS university ranking, average score top 3*	0.0	68

3 Infrastructure	18.3	128
3.1 Information & communication technologies (ICTs)	14.6	126
3.1.1 ICT access*	19.1	123
3.1.2 ICT use*	2.2	123
3.1.3 Government's online service*	29.4	122
3.1.4 E-participation*	7.9	99
3.2 General infrastructure	38.4	32
3.2.1 Electricity output, kWh/cap.	n/a	n/a
3.2.2 Electricity consumption, kWh/cap.	n/a	n/a
3.2.3 Logistics performance*	45.5	72
3.2.4 Gross capital formation, % GDP	26.9	31
3.3 Ecological sustainability	2.0	131
3.3.1 GDP/unit of energy use, 2000 PPP\$/kg oil eq.	n/a	n/a
3.3.2 Environmental performance*	n/a	n/a
3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP	0.3	98

4 Market sophistication	43.3	88
4.1 Credit	33.3	84
4.1.1 Ease of getting credit*	75.0	38
4.1.2 Domestic credit to private sector, % GDP	17.9	124
4.1.3 Microfinance gross loans, % GDP	1.7	26

4.2 Investment	23.2	83
4.2.1 Ease of protecting investors*	41.9	116
4.2.2 Market capitalization, % GDP	46.0	40
4.2.3 Total value of stocks traded, % GDP	0.1	102
4.2.4 Venture capital deals/tr PPP\$ GDP	0.0	44
4.3 Trade & competition	73.4	93
4.3.1 Applied tariff rate, weighted mean, %	8.2	108
4.3.2 Non-agricultural mkt access weighted tariff, %	0.0	6
4.3.3 Intensity of local competition†	62.1	76

5 Business sophistication	23.1	121
5.1 Knowledge workers	18.2	139
5.1.1 Knowledge-intensive employment, %	4.3	102
5.1.2 Firms offering formal training, % firms	35.0	52
5.1.3 R&D performed by business, % GDP	0.0	71
5.1.4 R&D financed by business, %	8.2	73
5.1.5 GMAT mean score	377.7	135
5.1.6 GMAT test takers/mn pop. 20–34	10.8	125
5.2 Innovation linkages	27.0	66
5.2.1 University/industry research collaboration†	43.0	67
5.2.2 State of cluster development†	37.8	101
5.2.3 R&D financed by abroad, %	26.1	11
5.2.4 JV-strategic alliance deals/tr PPP\$ GDP	0.0	114
5.2.5 Patent families filed in 3+ offices/bn PPP\$ GDP	0.0	69
5.3 Knowledge absorption	24.2	86
5.3.1 Royalty & license fees payments, % service imports	0.4	106
5.3.2 High-tech imports less re-imports, %	10.5	43
5.3.3 Comm., computer & info. services imports, %	3.2	82
5.3.4 FDI net inflows, % GDP	4.7	47

6 Knowledge & technology outputs	23.3	85
6.1 Knowledge creation	7.9	80
6.1.1 Domestic resident patent ap/bn PPP\$ GDP	0.2	98
6.1.2 PCT resident patent ap/bn PPP\$ GDP	0.0	92
6.1.3 Domestic res utility model ap/bn PPP\$ GDP	n/a	n/a
6.1.4 Scientific & technical articles/bn PPP\$ GDP	13.4	62
6.1.5 Citable documents H index	90.0	66
6.2 Knowledge impact	29.7	84
6.2.1 Growth rate of PPP\$ GDP/worker, %	2.3	47
6.2.2 New businesses/th pop. 15–64	0.7	76
6.2.3 Computer software spending, % GDP	n/a	n/a
6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP	1.3	111
6.2.5 High- & medium-high-tech manufactures, %	n/a	n/a
6.3 Knowledge diffusion	24.6	77
6.3.1 Royalty & license fees receipts, % service exports	2.0	25
6.3.2 High-tech exports less re-exports, %	0.6	87
6.3.3 Comm., computer & info. services exports, %	5.2	79
6.3.4 FDI net outflows, % GDP	-0.0	113

7 Creative outputs	37.6	70
7.1 Intangible assets	53.2	31
7.1.1 Domestic res trademark reg/bn PPP\$ GDP	n/a	n/a
7.1.2 Madrid trademark registrations/bn PPP\$ GDP	n/a	n/a
7.1.3 ICT & business model creation†	56.0	73
7.1.4 ICT & organizational model creation†	50.5	80
7.2 Creative goods & services	34.5	68
7.2.1 Audio-visual & related services exports, %	0.3	32
7.2.2 National feature films/mn pop. 15–69	n/a	n/a
7.2.3 Paid-for dailies, circulation, % pop. 15–69	0.6	123
7.2.4 Printing & publishing manufactures, %	n/a	n/a
7.2.5 Creative goods exports, %	0.4	72
7.3 Online creativity	9.5	128
7.3.1 Generic top-level domains (TLDs)/th pop. 15–69	0.4	122
7.3.2 Country-code TLDs/th pop. 15–69	2.5	120
7.3.3 Wikipedia monthly edits/mn pop. 15–69	18.6	133
7.3.4 Video uploads on YouTube/pop. 15–69	35.0	127

NOTE: ● Indicates a strength; ○ a weakness; * an Index; † a survey question.

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The following articles were used in the creation of Tables 6-9. A full citation and brief synthesis created from the abstract or main body of each body is included to allow readers to ascertain the source of the information. Overall, these articles provide a synthesis of the innovation literature about Uganda.

Ackers, L., Macleod, K., Lewis, E., & Ackers-Johnson, J. (2013). PM.63 international volunteering to promote maternal and newborn health: Optimizing impact. *Archives of Disease in Childhood - Fetal and Neonatal Edition*, 98(Suppl 1), A43-A43. doi:10.1136/archdischild-2013-303966.145

This paper presents the results of an interim evaluation of the 'Sustainable Volunteering Project', a 2012 initiative responsible for the recruitment, deployment and evaluation of professional volunteers in Uganda. It aims to reduce Ugandan maternal and newborn mortality through volunteer placement and develop and promote a model for sustainable and effective professional volunteerism. It describes the role of clinical volunteers in promoting sustainable change and thus could be useful in describing the health-innovation landscape.

Al-Bader, S., Masum, H., Simiyu, K., Daar, A., & Singer, P. (2010). Science-based health innovation in sub-Saharan Africa. *BMC International Health and Human Rights*, 10, S1.

This report seeks to address the gap in understanding of the capability of African countries have in science-based health innovation. It uses four country case studies (Ghana, Rwanda, Tanzania, and Uganda) to make a number of findings: 1) Despite challenges, components of health innovation exist, 2) Though limited, diverse activity in health innovation is occurring 3) Despite the relatively large amount of health research, very little has resulted in new products or technologies to address local disease 4) All countries put strong emphasis on plant medicine as a local asset for innovation 5) Local, regional and global dynamics are affecting health innovation 6) Institutions used innovative financing mechanisms and partnerships to their benefit 7) Linkages between groups are sparse to date, but hold potential for building stronger health innovation systems. For African nations, health innovation represents an opportunity to increase domestic capacity to solve health challenges; for international funders, it is an opportunity to move beyond foreign aid and dependency.

Asifiwe, C. (2011). The contribution of higher education to socio-economic development of the local community: A case study of Makerere University, Kampala. University Of Oslo). University of Oslo.

This study considered the perceptions of both internal and external university actors on the Makerere University's socio-economic contribution to the community, specifically within which

the university is located. A questionnaire sent through emails to respondents was used for data collection. Findings suggest that Makerere University is increasingly becoming relevant through its teaching and research functions, which work to form a “third role” of the university - community service.

Birungi, P. B., Hassan, R.M., (2007). Impact of alternative land management options on soil fertility and erosion in Uganda. *Agrekon*, 46(3), 410-424.

Using a data set collected in eight districts of Uganda, this study investigates how investment in soil fertility management (SFM) and conservation practices may affect natural resource outcomes, particularly the extent and level of soil erosion and soil nutrient loss. The study used ordered probit models and the results suggest that investment in SFM and conservation practices greatly improves soil fertility and reduces soil erosion. From a policy perspective, public investment to encourage use of SFM and conservation technologies would help the country achieve sustainable agricultural production. This study does not fit the Uganda innovation criteria specifically; instead, this article is useful in its discussion of Ugandan agriculture and its ability to put new practices into use.

Bowman, W. Digital development: Technology, governance and the quest for modernity in east Africa. Dissertation Abstracts International, A: The Humanities and Social Sciences. (prod.academic_MSTAR_60518601; 201017531).

This dissertation discusses the Uganda, Kenya, Tanzania, and Rwanda governments and the extent to which they are involved in Information and Communications Technology (ICT) policy setting and implementation. Despite their geographical proximity, economical similarity, similar colonial history, and extensive interaction, the Ugandan government was found to distribute resources more broadly than one would predict based on regime type and made faster progress towards objectives outcomes in ICT policy implementation than its more democratic and more stable neighbors.

Brar, S., Farley, S. E., Hawkins, R., & Wagner, C. S. (2011). *Science, technology, and innovation in Uganda: Recommendations for policy and action*. International Bank for Reconstruction and Development.

Part of a larger World Bank Studies series chronicling innovation around the globe, this report provides a set of cases studies drawn from a diverse range of experiences across the Ugandan private sector and offers concrete policy recommendations on how to support broader development of STI in Uganda. The study finds that of all the STI challenges facing firms, universities, and public research organizations in Uganda, the barriers to collaboration and

communication are the most urgent in terms of STI priorities to address in the coming years. This large report details science, technology, and innovation strategies and actors in Uganda, makes policy recommendations, and supports those findings with five case studies from different industries.

BYABASHAIJA, W., & KATONO, I. (2011). The impact of college entrepreneurial education on entrepreneurial attitudes and intention to start a business in Uganda. *Journal of Developmental Entrepreneurship*, 16(01), 127-144. Doi:10.1142/S1084946711001768

This paper reports results of a longitudinal quasi-experimental study that focused on the impact of entrepreneurial education and societal subjective norms on entrepreneurial attitudes and intentions of university students in Uganda to start a business. Data were collected before and after a four month entrepreneurship course. This article may be useful as informative about both the attitudes of Ugandan college students towards entrepreneurship and innovation and the effect entrepreneurship courses can have on those attitudes but it may also be of limited usefulness.

Cameron, H., Kanagwa, B., & Niyitegeka, M. (2012). A software business incubation model using ICTs for sustainable economic development in Uganda. *E-infrastructure and e-services for developing countries* (pp. 156-166) Springer.

A report prepared by the College of Computing and Information Sciences department of Makerere University which details the recurring challenge in the use of mobile and web-based services to foster development of ensuring the economic sustainability of those new services after their initial launch in low-income countries. It details the successful 'venture-capital like management discipline' of the Makerere University Software Business Incubation program which resulted in six new business startups over the past 3 years. This article should be useful for examining the challenges faced, some services created, and potential solutions.

Chib A, Wilkin H, Ling LX, Hoefman B, Van Biejma H,. (2012). You have an important message! Evaluating the effectiveness of a text message HIV/AIDS campaign in northwest Uganda. *Journal of Health Communication*, 17, 146-57.

This pilot study assessed the effect of using mobile phones, specifically short message service (SMS) in healthcare (mHealth) service delivery. The study used SMS as a platform to disseminate and measure HIV/AIDS knowledge, and to promote HIV/AIDS testing at clinics in rural Uganda. The study reported limited success in increasing knowledge levels and poor response to the questions. This survey recognizes the potential of mHealth tools, suggests 'it is important

to be conservative when considering the potential overall effect of SMS-based programs'(1), and suggests potential improvements to program designs to increase efficacy.

De Souza, R., Heinrich, G., Senefeld, S., Coon, K., Sebanja, P., Ogden, J., Oglethorpe, J. (2008). Using innovation to address HIV, AIDS, and environment links: Intervention case studies from Zimbabwe, Uganda, and Malawi. *Population and Environment*, 29(3-5), 219-246. Doi: <http://dx.doi.org/10.1007/s11111-008-0070-0>

This article presents three intervention case studies that address HIV, AIDS, and natural resource management through innovative programming in Zimbabwe, Uganda, and Malawi. In Uganda, the article outlines how various government agencies and NGO actors work together to improve the food security of HIV-affected households at the national, district, sub-district, and village levels. It provides lessons for expanding interventions and partnerships.

De Vries, W., & Zevenbergen, J. (2011). Discretionary space as a concept to review innovation in land administration in Africa. *Survey Review*, 43(323), 638-652. Doi: <http://dx.doi.org/10.1179/003962611X13117748892399>

This article reviews the role of 'discretionary space', the degree of freedom that strategic managers and land administration professionals have to utilize their personal judgment, in land administration innovations. It compares the legal land reform in Uganda with its more flexible counterparts in Namibia and Rwanda and finds that, since the Land Act of 1998 (and its amending in 2001 and 2004); Ugandan reform has been top down and fairly centralized. While some power has devolved to local districts, it has not increased the discretionary space of local servants which adversely affected urban administration revenues.

Ecuru, Julius, Trojer, Lena, Yasin, Ziraba N., Lating, Peter O., (2012). Structure and dynamics of Uganda's technological innovation system: Research note. *Aa_ajstid African Journal of Science, Technology, Innovation and Development: Building Technological Capabilities in Solar Energy in Africa*, 4(4), 255-274.

This paper presents the Ugandan innovation system as a function of financing, governance, human capital and the strength of interactions within and across the function spheres. It outlines the major role played by universities and public research organizations in building Uganda's innovation system and the need for more development of the private sector and more collaboration between the public sector and universities.

Fonn, Sharon, Ray, Sunanda, Blaauw, Duane, (2011). Innovation to improve health care provision and health systems in sub-Saharan Africa - promoting agency in mid-level workers and district managers. *Global Public Health*, 6(6), 657-668.

This article reviews the human resource challenges facing mid-level workers (MLWs) in African health systems. MLWs are 'the backbone of many health systems' but often they are demotivated, of low status, receive poor recognition, poorly managed, and lacking in quality of care education. This article offers policy suggestions to adopt new practices based on interventions in Kenya, Nigeria, South Africa, and Uganda. This article has proven difficult to find in its entirety and requires offline access.

Friis-Hansen, E. (2008). Impact assessment of farmer institutional development and agricultural change: Soroti district, Uganda. *Development in Practice*, 18(4-5), 506-523. Doi: <http://dx.doi.org/10.1080/09614520802181236>

Aimed at assessing the impact of agricultural development among poor farmers, this article argues that a combination of farmer empowerment and innovation through experiential learning in farmer field groups, changes in the opportunity structure through transformation of local government staff, establishment of new farmer-governed local institutions, and emergence of a private service provider has been successful in reducing rural poverty. It details an empirical study of successful adaptation and impact of agricultural tech development in the Soroti district. The study concludes that market-based spread of pro-poor agricultural technology requires an institutional setting that combines farmer empowerment with an enabling policy environment.

Gildemacher, Peter R., Wagoire, William W., Kinyae, Peter M., Struik, Paul C., Leeuwis, Cees., (2009). Improving potato production in Kenya, Uganda and Ethiopia: A system diagnosis. *Potato Research*, 52(2), 173-205.

This article diagnoses the potato systems in Kenya, Uganda, and Ethiopia and finds an increased demand and a need for innovation across a series of agricultural issues. It outlines the challenges facing the potato innovation system and suggests options for improvement.

Kulabako, F. (2012). Government urged on competitiveness. *Monitor*, (News)

A short newspaper article which outlines Uganda's global economy ranking: 123rd out of 144 countries by the World Economic Forum 2012 Global Competitiveness report and 120th out of 185 economies for the World Bank's "Doing Business" report. Professor Ricardo Hausman, the director of the Ugandan Center for International Development argues that Uganda needs to incentivize a shift by Ugandan citizens out of the agriculture sector and into services and

tradeables in order to maintain one of the fastest growing labor forces in the world. In comparison, the Stanbic Bank, one of the largest financial institutions in Uganda, argued instead that agriculture provides a strong source of employment for Ugandans and is Uganda's comparative advantage. He recommended strategically placing government incubators to teach modern farming techniques and ease farmer access to financial institution funds.

Hauser, M., Chowdhury, A. H., Peloschek, F. A., & Singh, S. J. (2010). Farmer participatory research: An approach to fostering community-led innovation in smallholder agriculture. *Journal Fur Entwicklungspolitik*, 26(4).

This article suggests the use of farmer participatory research, a process of designing and implementing on-farm trials to test and improve agricultural technologies practices, as an approach to promoting community-led innovation in smallholder agriculture, which would address the problem of uneven development in Uganda at the local level. Farmer participatory research is particularly useful for smallholder farmers who lack access to formal research and support. This paper claims that this system allows farmers to identify sustainable livelihoods and use innovation to solve agricultural problems.

Hersman, E.,. (2012). Mobilizing tech entrepreneurs in Africa (innovations case narrative: Hub). *Innovations: Technology, Governance, Globalization* *Innovations: Technology, Governance, Globalization*, 7(4), 59-67.

This paper focuses on the tech environment in East Africa, more specifically Kenya, and the various projects, such as iHub and the m:lab, that leverage the strengths of Africa and aim to address the weaknesses. Nairobi (Kenya) has several advantages which make it the right growth environment for tech, and opportunities and challenges for both Kenya and Africa as a whole. This paper may be useful in comparing Kenya's tech environment and advantages to Uganda or other African countries.

Hinman, R., & Matovu, J. (2010). Opportunities and challenges for mobile-based financial services in rural Uganda. *Chi Ea '10*.

This paper outlines key research findings on the use of mobile-based financial services in rural Uganda. It also includes insights into behaviors and attitudes towards finances that may impact the widespread uptake of mobile financial services in rural Uganda. This paper provides actionable insight into the opportunities and challenges for these services as well recommendations for future research.

Impact of an innovative approach to prevent mother-to-child transmission of HIV--Malawi, July 2011–September 2012. (2013). *MMWR. Morbidity and Mortality Weekly Report*, 62(8), 148–51.

This article discusses the use of an innovative approach, Option B+, to prevent mother-to-child transmission (PMTCT) of HIV. Option B+ allows all HIV-infected pregnant and breastfeeding women to be eligible for lifelong antiretroviral therapy (ART) regardless of CD4 cell count. While this approach was initially tested and used in Malawi, Uganda has adopted the policy. This article may be useful when looking at the state of innovation in the health sector for Uganda.

Mutambi, J. (2011). *Stimulating industrial development in Uganda through open innovation business incubators*. Blekinge Institute of Technology). (10) (Blekinge Institute of Technology Licentiate Dissertation Series)

Given that most firms in developing countries start too small to compete, especially in international markets, business incubation has gained large interest in the research community. This Licentiate thesis discusses and reviews the initiatives and programs aimed at supporting the development of micro, small, and medium enterprises (MSMEs) with a view to stimulate industrial development in Uganda. From the findings, it was revealed among MSMEs that due to their sizes, limited managerial and technological skills, and inadequate functional business support services have had adverse effects on their upgrading and growth.

Ecuru, J., Lating, P. O., Ziraba, Y. N. & Trojer, L. (2011). Integrating science, technology and innovation in the national development planning process: The case of Uganda. Retrieved

This paper discusses the implicit integration of science, technology, and innovation (STI) into Uganda's national development planning process. Both the Poverty Eradication Action Plan (1997-2008/09) and the National Development Plan (2008/09-2014/5), or NDP, are part of this comprehensive development framework and use STI as a vehicle for economic growth. However, strategies to use STI to bring about economic growth were lacking. STI was recently designated as a sector that provides both infrastructural and institutional support to the production of services and goods. For the author, this means that theoretically, the integration of STI in development planning could be achieved through endogenous efforts, but that the inclusion of STI should still be seen as a process, not just an end, and that the implementation should be done within the context of the national innovation system. While this paper is mainly theoretical, it provides an excellent background of Ugandan governmental policies relating to innovation.

Jones, B. (2009). *Beyond the state in rural Uganda* Columbia University Press.

This book reviews the role of the Ugandan state in creating change and innovation throughout the country, and argues that the state and Western development agencies have had a marginal impact on Uganda; instead, based on extensive ethnographic fieldwork, churches, the village court, and family/community organizations represent the most significant sites of innovation and social transformation in Uganda.

Kaaria, S., Njuki, J., Abenakyo, A., Delve, R., & Sanginga, P. (2008). Assessment of the enabling rural innovation (ERI) approach: Case studies from Malawi and Uganda. *Natural Resources Forum, UN*, 32(1), 53-63. Doi:<http://dx.doi.org/10.1111/j.1477-8947.2008.00174.x>

This paper presents lessons from applying the Enabling Rural Innovation (ERI) approach, which aims to strengthen social organization and entrepreneurial capacity, to rural communities in Malawi and Uganda. The paper assesses ERI's outcomes and finds: household income benefiting significantly from linkages to markets; increased accumulating assets; increased skills in analyzing markets; increased smallholder farmer negotiation with traders; a more inclusive and shared gender decision-making process at the household and community level; and that women show a lower level of skills acquisition in these two case studies than their male counterparts. Farmer participatory research has increased also investments in improved technologies such as fertilizer applications for soil fertility management.

Kamunyori, S., Al-Bader, S., Sewankambo, N., Singer, P., & Daar, A. (2010). Science-based health innovation in Uganda: Creative strategies for applying research to development. *BMC Int Health Hum Rights*, 10 Suppl 1, S5-S5. Doi: <http://www.biomedcentral.com/1472-698X/10/S1/S5>

*Undertaken at the invitation of then-Vice President of Uganda, Professor Gilbert Bukenya, this article describes Uganda's science-based health innovation system in terms of its actors. It concludes that significant political will exists for science and technology innovation (STI) but that such innovation is in its early stages in Uganda.

Kitua, A. Y. (2007). Health research agenda for east Africa in the new millennium: Looking ahead. *Tanzania Health Research Bulletin*, 9(3), 147-53.

The first East African Health and Scientific Conference, held in Kampala in March 2007, presented the Regional East African Health Research Agenda. It proposed to establish a joint mechanism for research coordination, promotion and regulation; establish stronger collaborative mechanisms for research and training; create a joint Regional East African Community health research and development fund; create joint intellectual property rights protection mechanism; enhance industry patenting and link research; create a mechanism to enhance translation of research to policy and practice; strengthen clinical research capacities; and strengthen innovation

and discovery research capacities. Effective implementation would have greatly raised the profile and quality of research in the region and improve the health status of the East African populations.

Kunstler, B., & Tita, W. (2007). State foresight, innovation and entrepreneurship: The case of economic development, E-learning and outsourcing industry in Uganda. *Journal of Futures Studies*, 12(2), 37-51. Doi: <http://www.jfs.tku.edu.tw/12-2/037-052.pdf>

The article describes Uganda's successful engagement with the global economic system and credits Uganda's President Museveni for establishing a creative online global education network which provided training to college graduates-based initiative responsible for the success. It considers the convergence of two individual sources of government foresight and generalizes it into a method for future cultivating of foresight in institutional settings.

Kurtis Heimerl, Kashif Ali, Joshua Blumenstock, Brian Gawalt, Eric Brewer. (2013). Expanding rural cellular networks with virtual coverage. *Nsd'13*

This article discusses the creation of an innovative cellular network that relies on virtual coverage, or coverage that is only present when requested, rather than constant coverage. Uganda was a use case that helped the researchers accurately assess the obstacles cellular networks would have to face, and was considered to be a potential target for the virtual coverage network. Furthermore, the researchers simulated a sub-Saharan Africa cellular carrier in order to test their network.

McKerrow, J. H. (2008). Developing drugs for parasitic diseases in an academic incubator. 2008 Keystone Symposia on Translating New Technologies to Improve Public Health in Africa (EI)

This conference paper was added by one of our contributors but has so far evaded our attempts to access it. Identifying the contributor is our next step to determine source usefulness.

McLymont, R. (2012). Foot soldiers. *Network Journal*, 19(5), 22.

This article covers the development of WinSenga, a mobile application created by Makerere University students that monitors the movements and heartbeats of unborn babies. It provides greater accuracy on the baby's position, heartbeat, and breathing pattern, is easy to use, and is about 80% cheaper than a typical ultrasound scanner (which normally costs 3,000 USD). Additionally, the students who created the application went on to win the 2012 Microsoft East and Southern Africa Imagine Cup.

Mutambi, J., Byaruhanga, J. K., Trojer, L., & Buhwezi, K. B. (2010). Research on the state of business incubation systems in different countries: Lessons for Uganda. *African Journal of Science, Technology, Innovation & Development*, 2

This article discusses the theoretical conceptualization and objectives of business incubators as a whole and continues by focusing on existing incubators in Uganda. It takes a look at the challenges Ugandan incubators face, and gives recommendations on strengthening incubators.

Nakibinge, S., Maher, D., Katende, J., Kamali, A., Grosskurth, H., & Seeley, J. (2009). Community engagement in health research: Two decades of experience from a research project on HIV in rural Uganda. *Tropical Medicine & International Health*, 14(2), 190-195. doi:10.1111/j.1365-3156.2008.02207.x

This review details the authors' experience with a two decade healthcare project in rural Uganda including the activities, opportunity and challenges that have arisen. The project focuses on health care and promotion, HIV prevention and care, and community development aimed at poverty reduction and could provide a case study for future healthcare implementations.

Oirere, S. (2012). University innovation aids farming in Uganda. *World Pumps*, 2012(7), 12.

A new, low-cost pump technology developed by Makerere University is opening the way for small-scale Ugandan farmers to afford irrigation in poorer, drought-stricken areas. The pump uses 2 horsepower and can deliver up to 100 litres of water per minute up to a height of 20 metres. It is hoped this innovation will help reverse the conditions caused by climate change and spur the government to fulfill its pledge to address issues of land ownership currently prohibiting further irrigation.

Ortiz, O., Orrego, R., Pradel, W., Gildemacher, P., Castillo, R., Otiniano, R., Gabriel, J., Vallejo, J., Torres, O., Woldegiorgis, G., Damene, B., Kakuhenzire, R., Kasahija, I., Kahi, I., (2013). Insights into potato innovation systems in Bolivia, Ethiopia, Peru and Uganda. *Agricultural Systems*, 114, 73-83.

This paper discusses the results of potato innovation systems in Uganda. State and local government and NGOs played major roles in putting these systems into place, as did the International Potato Center. Farmer organizations played an increasingly important part as well. Additionally, the results found that enhancing interactions and coordination among government organizations, NGOs, farmer organizations, and private companies would be needed to improve farmer access to quality planting material and to markets.

Osbahr, H., Dorward, P., Stern, R., & Cooper, S. (2011). Supporting agricultural innovation in Uganda to respond to climate risk: Linking climate change and variability with farmer perceptions. *Experimental Agriculture*, 47, 293-316.

This paper focuses on southwest Ugandan farmers' perceptions of climate change and variability and demonstrates that farmers believe there to be a difference in climate, with temperature increasing and seasonality/variability changing. The authors explore the differences between the climate data and the farmers' perceptions which could affect the way the farmers cope with uncertainty, agricultural innovation, and livelihood adaptability.

Paina, L., Ssenooba, F., Waswa, D., M'Imunya, J., & Bennett, S. (2013). How does investment in research training affect the development of research networks and collaborations? *Health Research Policy and Systems*, 11(1), 18. Doi: <http://www.health-policy-systems.com/content/11/1/18>

Using Makerere University and Kenya's University of Nairobi as case studies, this paper describes the results of 53 semi-structured interviews and nine focus group discussions regarding the success of the Fogarty International Center (FIC)'s support of overseas research programs over two decades. The authors observed the development of local research networks when funding from research training programs, such as FIC's, was available to sustain networking activities. A critical mass of trainees working in a particular research area or at a particular institution helps to grow these networks and produce positive results.

Pariyo, G., Serwadda, D., Sewankambo, N., Groves, S., Bollinger, R., & Peters, D. (2011). A grander challenge: The case of how Makerere University College of health sciences (MakCHS) contributes to health outcomes in Africa. *BMC Int Health Hum Rights*, 11 Suppl 1, S2-S2.

This article focuses on how Makerere University's College of Health Science (MakCHS) can contribute to health improvement in Uganda, and internationally, through its leadership in training, research, and services. The authors consider this opportunity to be a "Grand Challenge", similar to the Grand Challenges in Global Health initiative that was launched to promote the scientific or technological innovation in health. MakCHS has a strong and continuing history of making significant contributions to improving health in Uganda, and that it also shows potential to increase this by taking on its role and becoming a model for other universities.

Rooks, G., Szirmai, A., & Sserwanga, A. (2012). Network structure and innovative performance of African entrepreneurs: The case of Uganda. *Journal of African Economies*, 21(4), 609-636. doi:10.1093/jae/ejs011

This study takes a look at the effect of social capital on entrepreneurial innovativeness in Uganda. It focuses on two views of the relation between network structure and entrepreneurial

performance: one that argues closed networks are beneficial, and another that contends that closed networks constrain entrepreneurs. Based on these arguments, the authors tested a hypothesis that claims overlap between personal and business networks will hamper innovative performance of entrepreneurs because information will be less diverse and heterogeneous, and because re-distributive kinship obligations may act as a drain on entrepreneurial resources.

Rosiello, Alessandro, Smith, James. (2008). A sociological economy of HIV/AIDS vaccine partnerships: Case studies from Africa and India. *International Review of Sociology*, 18(2), 283-299.

Using partnerships from Kenya, Uganda, Rwanda, and India, this article details how public-private partnerships are becoming increasingly important when developing innovations in health and describes the International Aids Vaccine Initiative's development, structure, and role as a 'learning' and 'contextualising' institution. It argues that the confluence of policy thinking and new more complex science and technology necessitated new ways of providing funding, organizing expertise and defraying costs and risks.

Smale, M., & Tushemereirwe, W. K. (2007). An economic assessment of banana genetic improvement and innovation in the Lake Victoria region of Uganda and Tanzania. *Research Report - International Food Policy Research Institute Issue:(155)*, xvi + 188 pp.

This research report outlines a set of studies undertaken by the International Food Policy Research Institute assessing the economic impact of implementing improved banana cultivation and management practices in the Lake Victoria Region of Uganda and Tanzania. One of the questions this report seeks to address is the "focal role of farmers in developing and promoting planting material systems and the influence of social capital on technology adoption.... with implications for the design of extension systems" (10). It should be useful for policy decisions in the region.

Ssengooba, F., Atuyambe, L., Kiwanuka, S., Puvanachandra, P., Glass, N., & Hyder, A. (2011). Research translation to inform national health policies: Learning from multiple perspectives in Uganda. *BMC International Health and Human Rights*, 11, S13.

This paper covers the way universities, more specifically Makerere University in Uganda, translate the substantial amount of research evidence they generate into policies that could then guide the strategic direction of Makerere University College of Health Sciences (MakCHS) and similar institutions' goals to influence health outcomes nationally and internationally. The study analyzed

the research-to-policy discourses for prevention of mother-to-child transmission (PMTCT) and safe male circumcision (SMC). This paper indicates that MakCHS ought to prioritize implementation research to guide policy processes about the feasibility of applying new and effective innovations over just research evidence.

Tushabomwe-Kazooba, C. (2006). Causes of small business failure in Uganda: A case study from Bushenyi and Mbarara towns. *African Studies Quarterly*, 8(4), 27-35.

*This article analyzes the results of a study done on the causes of small business failure in Uganda. Due to reforms and the privatization drive, a number of startups sprang up after 2002, but many failed for a diverse range of reasons. The results revealed that startup factors were a greater threat to small businesses than those encountered after the business was established. At the end of the article, a few practical suggestions against business failure are offered.

UTAS Uganda project seeks microscopes and dollars. (2011). *Advocate: Newsletter of the National Tertiary Education Union*, 18(3), 29.

This magazine article discusses the health projects University of Tasmania (UTAS) students are implementing in Uganda, more specifically an innovative project concerning accurate diagnosis of malaria. They plan to use microscopes to more successfully determine who has malaria so that the drug reservoirs at hospitals aren't depleted.

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Please note, in the interest of conciseness, we have elected not to relist the citations of each of the articles listed in Appendix B.

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