

Baseline Analysis of 3 Innovation Ecosystems in East Africa

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Abstract— The potential impact of technology innovation supporting social and economic development in developing countries is very dependent on the level of maturity of National Innovation Ecosystems (including policy environment, infrastructure and socio-economic diversification). Kenya, Tanzania and Uganda have recently experienced considerable technological entrepreneurial growth, facilitated by Innovation friendly regulatory environments, evolution of National Research Education Networks (NRENs) and rollout of fibre optic backbones. However, while it is clear that ICT, Job Creation and developing a Knowledge Economy are common policy priorities, the Innovation Ecosystems in Nairobi, Dar es Salaam and Kampala are still fragmented. Innovation Spaces are insufficiently differentiated and have sustainability challenges with their business models and there is a limited funding and entrepreneurship support as well as insufficient collaboration and coordination between Stakeholders. This paper analyses these Innovation Ecosystems and provides some recommendations about how these challenges can be addressed.

Keywords— Collaborative Open Innovation, National Innovation Ecosystem, ICT4D

I. INTRODUCTION

Globalization and technological and social innovations has expanded the universe of contributing Innovation Stakeholders to include Public, Private, Education and Research, Societal, International Development and Funding Sectors, End-user Communities and Innovation Spaces (i.e. Pre-Incubators, Incubators, Innovation Centres, Entrepreneurship Centres, Accelerators) inside and outside national borders. In this context, understanding the dynamics and characteristics of Innovation Ecosystems in developing countries is essential for successful development engagement. The potential impact of computing innovations supporting social and economic development depends on critical success factors including infrastructure, policy environment, level of ICT adoption and effective National Innovation Ecosystem.

Other critical factors include: coordination (and implementation) of public policy; level of socio-economic diversification and technology adoption; and engagement of Innovation Stakeholders (Public, Private, Education and Research, Societal, International Development and Funding Sectors, Communities). According to [11] “interactions among the actors involved in technology development are as important as investments in research and development”.

In a Developing Country context, additional challenges include: size, maturity and growth potential of the Research and Innovation Ecosystem and Formal Economy; access to

education and skills training meeting the needs of employers and entrepreneurs; and availability of leadership and resources to effectively align interventions with public policy.

East Africa has experienced significant growth of ICT enabled innovation in recent years (e.g. mobile applications, mobile finance). Open Data offers significant potential to develop innovative public & private sector services. The NRENs in Kenya, Tanzania and Kampala are members of UbuntuNet Alliance and beneficiaries of AfricaConnect.

Multinational Corporations (MNC) are engaging with Innovation Spaces in Africa, while some have established local Research Centres to better address local market needs.

While various models addressing entrepreneurship in developing countries have been proposed (e.g. [13], [6], [21], [2]), these are quite generic and do not sufficiently address adaptation to local circumstances which can vary enormously

This paper addresses this issue under very specific, albeit varied settings. It presents the results of a comprehensive baseline survey of the Innovation Ecosystems in Nairobi, Dar es Salaam and Kampala. We also suggest some recommendations to improve the situation, providing the basis for a future model to strengthen Innovation Ecosystems in emerging economies addressing necessary adaptation.

Below, some basic definitions are provided as well as a description of the methodology used. Sections 4, 5 and 6 analyse some key characteristics of the Innovation Ecosystems in these cities, including key actors, policy factors, infrastructure and funding. The article is concluded by some derived recommendations from our findings.

II. NATIONAL INNOVATION SYSTEMS

For discussion of innovation ecosystems to be meaningful we need first to define the concepts regarding the various structures around innovations systems. These can, of course, be considered from a variety of perspectives. For instance, definitions of a National Innovation System include “set of institutions whose interactions determine the innovative performance ... of national firms” [9] and “set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process.” [7].

Likewise, there are many definitions of the concept of innovation in itself, e.g., [12] defines it as the “implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations”.

III. METHODOLOGY

The results presented in this paper were informed by (a) Focus Group engagement at Stakeholder workshops (2011 - 2014) hosted by IST-Africa Partners, (b) face to face semi-structured interviews with senior representatives of key Innovation Stakeholders in Nairobi, Dar es Salaam and Kampala (Q4 '12 – Q1 '13), and (c) annual IST-Africa surveys of Research and Innovation capacities [3] and ICT/STI related Bilateral and Multilateral Cooperation [2]. This was supplemented by desk research, e-mails and telephone interviews, to reflect developments up to July 2014.

The primary rationale for interviewing a cross-section of senior Innovation Stakeholders was (a) to access intelligence that is highly fragmented or not publicly available; (b) gain insight into decision making processes influencing policy and implementation; and (c) receive informed feedback on proposed solutions. Interviews were up to two hours in duration, carried out by two interviewers, one asking semi-structured questions, the other making detailed notes and clarifying responses. Interviewees were invited to share insight into other issues they felt were important.

IV. NAIROBI INNOVATION ECOSYSTEM

A. Innovation Stakeholders

Fig. 1 contextualizes key Innovation stakeholders supporting Innovation and Entrepreneurship in Nairobi.



Fig. 1 Nairobi Innovation Ecosystem

Education and Research stakeholders hosting Innovation Spaces include: **University of Nairobi** – **FabLab**, Department of Mechanical Engineering and Science and Technology Park since 2009 (focused on rapid/3D prototyping) and Computing for Development Lab (**C4DLab**) at School of Computing and Informatics since 2013, which is incubating start-ups and exploring virtual incubation; **University of Strathmore** (@iLabAfrica – established January 2011 as a Centre of Excellence in ICT Innovation, Entrepreneurship and Incubation, offering a MSc. and @iBizAfrica incubation program); **Kenyatta University** (**Chandaria Business Innovation & Incubation Centre** – **BIIC** established July 2011 aims to support 100 innovators

per year (including 30% non-KU students), blending research with entrepreneurship training, with 40 ideas nurtured by February 2013. Partners include NACOSTI, Youth Enterprise Development Fund and Orange); and **International University of Professional Studies IUPS** (formerly Inoorero University) - **Regional Centre for Enterprise Development** provides business-mentoring courses to SMEs. IUPS and International Labour Organisation (ILO) offered a four-month part-time Practical Enterprise Training Course to Kenyan entrepreneurs from February 2013.

Jomo Kenyatta University of Agriculture and Technology supports industrial take-up of research results by implementing the Nairobi Industrial and Technology Park with the Ministry of Industrialization.

iHub launched in March 2010 as a Tech pre-Incubation and Collaborative Working Space. Regular community events are hosted to encourage sharing of experiences. Over 50 companies have been established since its launch. iHub activities include iHub Research (March 2011), m:lab (June 2011), Pivot25/Pivot East (mobile app competition), UX Lab and Supercomputing Cluster (2012).

m:lab East Africa was launched in June 2011 as a mobile technology incubation centre with \$725,000 funding from InfoDev (www.infodev.org). Services include incubation, training, research and application testing. Up to June 2014 [18] m:lab supported over 60 startups through its four-month Mobile Application Development and Entrepreneurship Programme and office space for up to 24 months to five past and five current incubatees and Savannah Fund. m:lab supporters include Nokia, Samsung, Microsoft and SEACOM. m:lab is an implementing partner in InfoDev two year East Africa Virtual Incubation pilot (\$180,000 funding from UKAid) running in Kenya, Rwanda, Tanzania and Uganda.

NaiLab is a Business Incubator targeting mobile/web innovations. Launched in August 2011 with support from Accenture and 1% Club, it provides collaborative working space and mentoring. Nine start-ups have been incubated to date, with five more being incubated. NaiLab was awarded the \$1.6 million Kenya ICT Incubation Program contract in January 2013 [8] to incubate 30 startups by 2016, and is a partner in InfoDev East Africa Virtual Incubation pilot [11].

GrowthHub is an incubator and accelerator targeting Clean and Green-Tech, Mobile and IT, Agro-processing, Professional services and Essential Services (health, education, water and sanitation). Launched by GrowthAfrica, a Danish consulting company in May 2012, it offers shared desk and meeting space, advisory services, training, access to seed funding and monthly pitch meetings. GrowthHub partnered with Village Capital [17] to provide a three month Accelerator Programme for start-ups with prototypes (18 in 2012, 14 in 2013). 25 start-ups are currently supported in two Agribusiness programmes, with 24 supported since 2012.

88 mph was launched by Danish investors in August 2011 (rebranded as **Nairobi Startup Garage** in June 2014), offering seed capital (\$1.7 million in 19 startups) and accelerator programmes for mobile and web start-ups. 88mph / IPO48 has invested in 10 start-ups and started 5 companies.

A small but notable actor is **Pawa254**, a collaborative space focused on dynamic creative industry fields and artists.

The Public Sector has a key role to play in the Innovation Ecosystem. The **Directorate of eGovernment**, Office of the President, established in 2004 and now part of **Kenya ICT Authority**, is responsible for public sector online services.

Institutions responsible for innovation include **Ministry of Education Science and Technology**, **Ministry of Information and Communications** and associated parastatals, **National Commission for Science, Technology and Innovation (NACOSTI)** and **Kenya ICT Authority**. The proposed **Kenya National Innovation Agency** may play a key coordination role, with offices in all 47 Counties, and a mandate to institutionalise linkages.

In summary, Nairobi is a vibrant Innovation Ecosystem, with strong private sector Innovation engagement through local Research Centres (e.g. NOKIA, IBM), and support for Entrepreneurship (e.g. Safaricom, Samsung, Google, Orange).

B. Policy and Regulatory Environment

The Kenyan Policy and Regulatory environment is pro-Innovation. ICT, Job Creation and developing a Knowledge Economy are key pillars of Vision 2030. Under the Science, Technology and Innovation Bill 2012 passed by Parliament in January 2013, three bodies were enabled under a Department for Science, Technology and Innovation – **NACOSTI** (established), **National Innovation Agency** and **National Research Foundation** (neither established). Connected Kenya Master Plan priorities are Digital Inclusion, ICT Innovation and Access beyond Broadband. While communication sector liberalisation facilitated infrastructure and service deployment, rural areas are underserved. This will be addressed by the Universal Service Fund - Universal Service Advisory Council was established on 24 July 2014.

Rebranded in June 2014, the **Communications Authority of Kenya (CA)** digitized secondary school curriculum, with **Kenya Institute of Education** and established ICT centers in 8 schools and 4 community centers with disability institutions.

Although Kenya Open Data Initiative launched on 8 July 2011 “to make core government development, demographic, statistical and expenditure data available in a useful digital format for researchers, policymakers, ICT developers and the general public”, Wide-spread take-up is 2 – 3 years away.

An important initiative for promoting innovation is **Konza City Technology Park**, where ground was broken in January 2013. However, with increasing power transferring to county government, some counties plan to compete with Konza City.

In summary, the policy and regulatory environment is conducive to innovation and entrepreneurship and the public sector understands the employment and economic potential.

C. Digital Infrastructure

In addition to the innovation initiatives described above, the ICT sector in Kenya has changed dramatically over the past decade. A national fibre optic infrastructure is in place and four submarine cables are online. According to CA [1], as of March 2014, mobile penetration grew to 78.2% or 31.8 million subscriptions (98% of which are pre-paid), fixed lines decreased to 204,354, Internet penetration grew to 13.3 million subscriptions and Broadband subscriptions (primarily mobile and WIMAX) increased to 1.44 million subscriptions.

According to the Regulator, the Government hopes to roll out 4G and broadband in underserved areas through Public Private Partnerships. Digital TV migration is subject to legal cases.

The **KENET NREN** is a key actor managing the largest IP network in Kenya. With six points of presence, as of July 2014, it provides bandwidth to over 150 campuses. Housed in University of Nairobi Library, the data centre is mirrored at United States International University. **KENET** provides

cost-effective Internet connectivity to member institutions using lease lines and dark fibre. Each University has an equipment node and **KENET** provides hands on training to help them maintain their own LAN. **KENET** manages international links (Amsterdam, London), the national circuit and data centres. **KENET** has a small infrastructure grant from Google and works with the Google Cash community aggregating traffic. **KENET** launched the first African Internet Measurements Lab [5] in February 2013 with the Measurements Lab Project and Google to support regulation.

In summary, while Kenya has excellent digital infrastructure and a strong NREN, delays in digital TV migration constrain spectrum reallocation for new services.

D. Innovation Funding Mechanisms

Despite these initiatives, the generally low level of national funding for ICT-related research and Innovation is a significant challenge. Access to private sector capital and micro financing is difficult, as banks require collateral, which makes accessing funding for ICT innovation difficult.

Public Sector Innovation Funding Mechanisms include the Youth Enterprise Development Fund (launched February 2007, seed loans to existing businesses through micro-finance institutions), the concluded Tandia Digital Content Grants and proposed National Research Foundation.

Private Sector Innovation Funding Mechanisms include Orange African Social Venture Prize (launched in 2011 with prizes of €25k, €15k, €10k and six months coaching for winners) and AppCampus, a joint Alto University/Microsoft €21 million project (launched in 2012, coaching and funding up to €70,000) for Windows Phone Developers.

Kenya has sectorial bilateral cooperation agreements for Science Technology and Innovation/ICT [4] with France, UK, Spain, Netherlands, Germany, Norway, Finland and Sweden, many supporting education and research programmes. Other international programmes on Environment, climate change, agriculture and Forestry are funded by **UNESCO**, **UNEP**, **UNDP** and **FAO** regional offices in Nairobi.

ICT related bilateral support is primarily from Sweden (SPIDER Programme) and Germany (ict@innovation Open Source Regional Project). IICD funded some eEducation projects and ACP-ICT funded capacity building projects.

Kenya secured participation in 68 FP7 projects providing €12.3 million in research funding [4] and 417 EU and Associated Country organisation partners.

Funding Mechanisms include **SAVANNAH Fund** (launched June 2012, 3 - 6 month accelerator programme based on prototype, for-profit business model and revenue, €25k for 15% equity), 15 investments to date (5 in Kenya).

In summary, the delay in launching the **National Research Foundation** (and Ministry of Finance pressure to reduce funding from 2% to 1% GDP) is unfortunate.

V. DAR ES SALAAM INNOVATION ECOSYSTEM

A. Innovation Stakeholders

Fig. 2 contextualizes key Innovation stakeholders supporting Innovation and Entrepreneurship in Dar es Salaam.

Education and Research institutions supporting ICT entrepreneurship and innovation include **University of Dar es Salaam (UDSM)**, **Dar es Salaam Institute of Technology (DIT)** and **Vocational Education and Training Institutions**.

UDSM and DIT are the primary education and research institutions focused on ICT/Technical skills in Dar es Salaam. UDSM, DIT and VET Institutions have a critical role to play in preparing students for employment and self-employment.

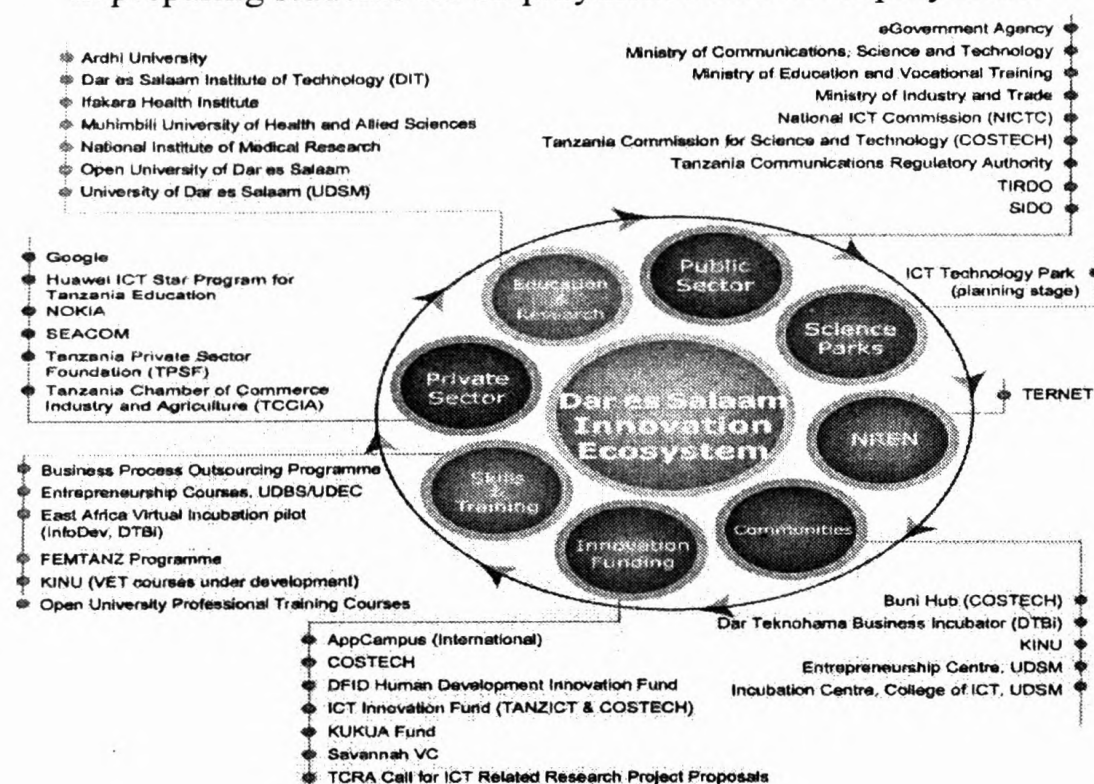


Fig. 2 Dar es Salaam Innovation Ecosystem

UDSM Entrepreneurship Centre offers entrepreneurship diploma and degree courses, and College of ICT is establishing an Incubator on campus. The DIT India-Tanzania Centre of Excellence in ICT has a High Performance Computing Centre. DIT is exploring launching rural Innovation Centres and engages with industry through joint projects and training courses.

Tanzania Commission for Science and Technology (COSTECH) has an influence that reinforces its national mandate, as it provides research funding and Internet access to the education and research sector; and hosts the **Tanzania Education Research Network (TERNET) NREN**.

Innovation Spaces are focused on Pre-Incubation (**Buni Hub, KINU**), and Incubation (**DTBi - Dar Teknohama Business Incubator**). An Incubator opened by **Mara Launchpad** in Q1 2013 was closed by 2014. **TANZICT** is a bilateral project (2011 – 2014) between the Ministry of Communications, Science and Technology (MCST), Tanzania and Ministry of Foreign Affairs of Finland [13], which supports the **Buni Hub** (COSTECH Pre-Incubation Space established October 2011), training for women entrepreneurs (FEMTANZ Program), community events and hands-on support to emerging Living Labs in Iringa, Kigamboni, Mwanza, Mbeya, Zanzibar and Arusha.

Buni Hub is hosting 15 pre-incubation teams (three months to develop a prototype, six months start-up support).

Launched in July 2012, **KINU** provides dedicated and co-working space, application testing facilities, workshops and training with a focus on technology start-ups and women. **KINU** cooperate in ICT entrepreneurship activities (e.g. hackathons) with **TANZICT** and **DTBi** and are now diversifying their revenue streams to achieve sustainability. **KINU** recently finalized an agreement with **Vocational Education and Training Authority** to certify entrepreneurship training programmes in several entrepreneurship related areas. Community members are mainly students and startups during the day and professionals during evenings and weekends.

DTBi was established in June 2011 as a Public Private Partnership, hosted by **COSTECH** with initial funding from **InfoDev**. **DTBi** currently supports 4 pre-incubatees (1 resident, 3 virtual), 8 startups (4 resident, 4 virtual) and 8 companies (2 resident, 6 virtual), and collaborates with **Buni Hub**. **e** provides loan guarantees for incubated companies with signed contracts who need working capital. **DTBi** is implementing partner for the **InfoDev East Africa Virtual Incubation Pilot** launched January 2013 [14].

Private sector support beyond hackathon prizes or donating connectivity is primarily from MNCs. **Google** provided a grant to **KINU**. **NOKIA** cooperated with **DTBi** in 2012 to provide mobile application training. In November 2012 **Huawei** launched an education program supporting schools (equipment, eLearning) and Universities. Students can apply for scholarships to be trained at Huawei Africa Training Centres. The **Nelson Mandela African Institute of Science and Technology (NM-AIST)** secured €90,000 from Huawei over three years to improve ICT infrastructure.

In summary, while Dar es Salaam is a fast maturing Innovation Ecosystem, it is still strongly reliant on public sector support due to limited private sector engagement.

B. Policy and Regulatory Environment

The Policy and Regulatory environment in Tanzania is pro-Innovation. The **Tanzania Development Vision 2025** highlights the importance of leveraging ICT alongside necessary skills and capabilities to realise a well-educated society; and strong, competitive economy capable of growth.

Two of the three main policies supporting Innovation and Entrepreneurship have been under review since 2012: **Science, Technology and Innovation Policy** and **ICT Policy** (2003). The updated STI Policy will incorporate Entrepreneurship and the first draft of the revised ICT Policy (process supported by **TANZICT**) is still being reviewed.

The **Tanzania National Innovation System Background Report** (September 2012) compiled by the **MCST** under the guidance of the National Steering Committee for the National Innovation System Reform Program, highlighted weaknesses in the National Innovation Ecosystem including: Weak coordination and networking among key actors; inadequate human resource development and training; mismatches between HEI/VET education and market requirements; limited private sector support for STI and weak mechanisms for innovation transfer and commercialization. STI Policy review recommendations include that STI coordination should be re-located to the President's Office with a STI Parliamentary Standing Committee, better alignment between R&D objectives and national priorities, incentives including technology incubators, training curricula aligned with current and emerging market needs, incentives for private sector R&D and mandatory ICT training at all levels of education.

MCST established **National ICT Commission** in July 2013 to strengthen co-ordination and harmonisation.

The national regulatory environment has enormous influence on innovation. Under **Tanzania Communications Regulatory Authority (TCRA)**, the Licensing Framework consists of Network Facilities and Services, Application Services and Content Service Providers.

Tanzania joined the Open Government Partnership Initiative (www.opengovpartnership.org) in September 2011. There was limited progress until 2013 [18]. The Second Action Plan (2014/15 – 2015/16) focuses on Education,

Health and Water service delivery, and adds Freedom of Information Act, Open Budgets, Open Data, Land Transparency and Extractive Industries Transparency [15].

In summary, STI and ICT Policy finalization and implementation will strengthen the Innovation Ecosystem.

C. Digital Infrastructure

The digital infrastructure in Tanzania has improved significantly with the fibre-optic network, investment in local Internet Exchange Points, migration to IPv6 and construction of the National ICT Backbone (NICTBB), which now has over 30 national PoPs, with links to Kenya, Uganda, Rwanda, Burundi, Malawi and Zambia. NICTBB connected to SEACOM in July 2009 and EASSY in April 2010. The Universal Communication Fund was introduced to facilitate wider telecoms access across all rural areas.

Mobile penetration is growing. As at March 2014, TCRA [17] reported 27.9 million mobile subscriptions, 154,143 fixed lines (tele density penetration of 63%) and 9.3 million Internet users (penetration rate of 21%). Mobile money applications are very popular for paying bills and sending or receiving funds, with offerings from M-Pesa, Zap and Z-Pesa.

Digital TV migration has been slow to date.

An **ICT Park** in Bagamoyo was announced in October 2013 as a joint venture between COSTECH and the Export Processing Zone Authority (EPZA). This 400 acre site will include a 2 Tier data centre, R&D university and Incubator providing co-working space, seed funding, training and mentorship for ICT entrepreneurs. The ICT Park will be classified as a Special Export Zone, thus attracting low tax and tariffs, with SEACOM providing bandwidth.

TERNET was established in 2008, with 128 education and research institutions identified for connection. By December 2012, 14 Institutions were connected to the Network Operations Centre at COSTECH, which has a STM-1 line provided via SEACOM. As part of the **Science Technology and Higher Education Program (STHEP)** World Bank project, eLearning was piloted in 6 institutions, and Education Management Information System & E-libraries piloted in 16 institutions during 2013.

In summary, while significant progress is being made, TERNET needs additional support to achieve its objectives.

D. Innovation Funding Mechanisms

The main STI funding mechanisms are COSTECH grants, participation in Horizon 2020. COSTECH is in discussions with Ireland and Canada to provide innovation and entrepreneurship funding. Tanzania Investment Bank is considering supporting innovation. TCRA provides ICT Scholarships and launched a Call for ICT Research proposals.

Private Sector Innovation Funding Mechanisms include the AppCampus programme described in section IV D.

International Development Sector Innovation Funding Mechanisms include the TANZICT Innovation Fund (grants of \$10k - \$20k, c. €300,000 still available) and the five year, 30 million **DFID Human Development Innovation Fund** supporting Pilots and larger scale projects in the education, health and water, sanitation and hygiene (WASH) sectors (2014 Grants < £400k, < £3 million in 2015).

Tanzania has bilateral cooperation agreements [3] with Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Sweden, UK, India, Japan and South Korea. World Bank and EU are multilateral donors. Bilateral

Support for ICT is provided by Finland, Sweden and Norway. Germany supported regional **ict@innovation Open Source Project** and Ireland supported **Young Scientist Competition**.

Up to July 2014 Tanzania secured participation in 39 FP7 projects [4] providing €12 million in research funding and 170 European and Associated Country partner organisations.

STHEP is a seven year World Bank funded project implemented through the **Ministry of Education and Vocational Training** program with support from **MCST**. STHEP aims to strengthen STI human capacity and create a knowledge-based economy within the next ten years.

Funding Sector Innovation Funding Mechanisms include: the **Tanzania Innovation Fund** (open calls in 2013 and 2014 funded by TANZICT and COSTECH); **SAVANNAH Fund** (section IV D); and **KUKUA Fund** launched in November 2012 by **RLabs** with **Bertha Foundation** to support early stage Internet and mobile start-ups focused on social impact in South Africa, Tanzania, Zimbabwe and Namibia

In summary, innovation and entrepreneurship is still heavily reliant on direct and indirect public sector support.

VI. KAMPALA INNOVATION ECOSYSTEM

A. Innovation Stakeholders

Fig. 3 below contextualizes key Innovation stakeholders supporting Innovation and Entrepreneurship in Kampala.

While Government understands the need to support Entrepreneurship, the Innovation ecosystem is fragmented, with limited strategic partnerships to leverage capacity.

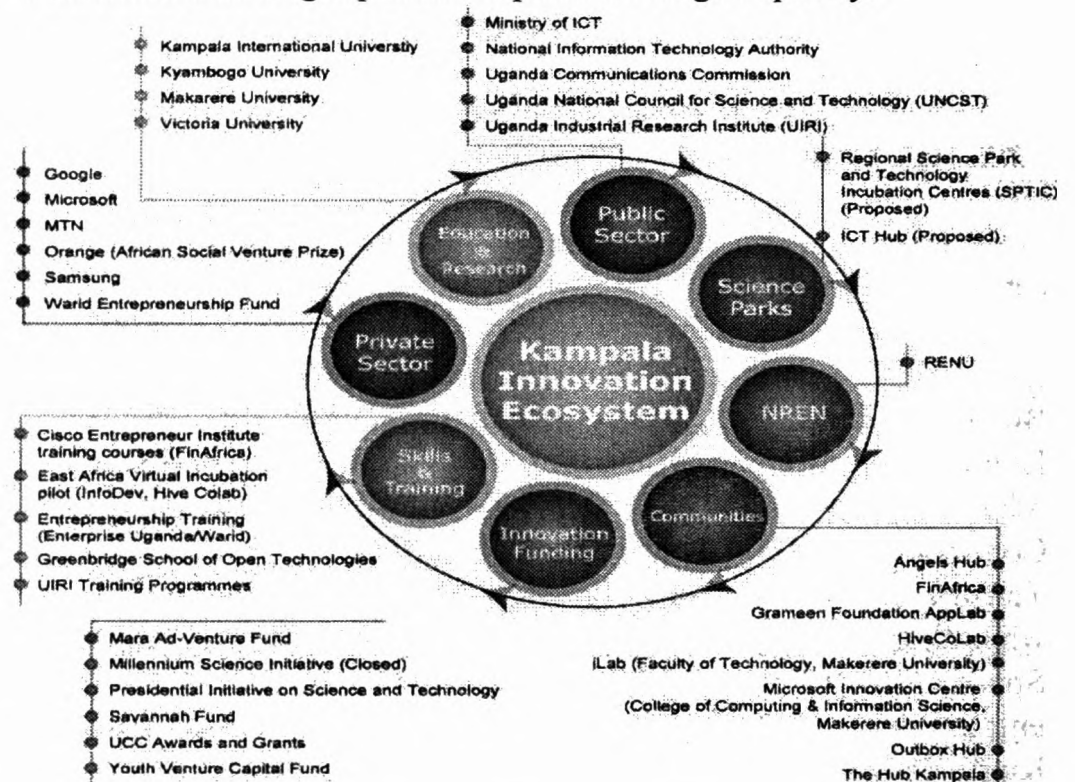


Fig. 3 Kampala Innovation Ecosystem

Uganda National Council for Science and Technology (UNCST) and **Uganda Communications Commission (UCC)** provide support (research grants, events and awards).

Makerere University supports Tech Entrepreneurship through **Microsoft Innovation Centre**, **College of Computing and Information Science** from November 2011. The **College of Engineering, Design, Art and Technology** established **iLab@MAK** in 2005.

There are many Innovation Spaces offering Pre-Incubation (**Hive Colab**), Incubation (**Outbox**, **Angels Hub**, **tookMara**, **LaunchPad** in September 2013), Co-working spaces for SMEs (**The Hub**), Entrepreneurial Training (**FinAfrica**) and commercialisation of apps (**Grameen Foundation AppLab**).

Launched in July 2010 and supported by **Indigo Trust** and **Hivos**, iHive Colab targets graduate startups and web and mobile technology entrepreneurs. A founding member of **AfriLabs**, Hive Colab undertakes research, collaborates with local universities and is an implementation partner for **InfoDev East Africa Virtual Incubation pilot** [14].

Outbox was launched in July 2012 as a technology incubator and collaborative working space for mobile and web entrepreneurs, with support from Google and Deloitte.

Established in April 2011, **The Hub Kampala** rents collaborative and dedicated working space for freelancers, consultants and entrepreneurs, and collaborates with **FinAfrica** for training and **Mara Foundation** for mentoring.

FinAfrica was founded in 2009 as a not-for-profit training, enterprise incubation and advisory centre. A **Cisco Entrepreneur Institute**, it can also host up to 20 incubatees.

Grameen Foundation AppLab Uganda develops applications and information services targeting the poor, and collaborates with **Makerere** and **Victoria Universities**. Launched in 2009, the **Community Knowledge Worker Initiative** has over 1,000 ICT-enabled agriculture extension workers trained as data enumerators providing rural community data to organisations providing services to farmers. **AppLab Money Accelerator** is supported by **Gates Foundation** to expand the mobile money ecosystem and deliver appropriate products and services to the poor.

Kampala Innovation Spaces collaborate through **Business Innovation Consortium Kampala** (founded by **Grameen**). While **Mara Launchpad** expanded too quickly, **Mara Foundation** provides mentoring and **Ad-venture Fund**.

There is good private sector engagement – **MTN** cooperate with **Grameen Foundation AppLab**, **Warid Entrepreneurship Fund**, **Orange African Social Venture Prize**, **Google** (**Outbox** and **HiveCoLab**) and **Samsung** (**Outbox**).

In summary, **Kampala** is a quickly maturing **Innovation Ecosystem**, with strong public support for innovation and entrepreneurship and ambitious **BPO** and **Science Park** goals.

B. Policy and Regulatory Environment

The Policy and Regulatory framework in Uganda is pro-Innovation. The Government has prioritised **ICT** and implementing a **National Innovation System** as part of **Vision 2040**. **UCC** oversees the **Rural Communications Development Fund** as the **Universal Service Fund**.

Policies supporting **Entrepreneurship** and **Innovation** include the **Science, Technology and Innovation Policy** (August 2009), implemented through the **National Science, Technology and Innovation Plan 2012/2013 – 2017/2018**. The revised draft **ICT Policy** (September 2012) [8] is still under review. **Ministry of ICT** has proposed establishing an **ICT Hub** at **Entebbe** and **UNCST** is drafting architectural drawings for a **Science and Technology Park** in **Kampala**. The **Parliamentary Science and Technology Committee** have proposed establishment of a **Ministry of Science and Technology** with the current **Ministry of ICT** as a **Directorate**.

In summary, the policy and regulatory environment is conducive to innovation and there is strong parliamentary committee support for investment in **Science and Technology**.

C. Digital Infrastructure

The telecommunications sector has been liberalised and infrastructure capacity is rapidly improving. **Ugandan National Information Technology Authority (NITA)** is

responsible for coordinating, promoting and monitoring **IT** developments, including **National Data Transmission Backbone Infrastructure** linking major economic centres and **eGovernment Infrastructure**. According to 2012-2013 [19] figures, as of June 2013 Uganda has 207k fixed landlines, 6.8 million Internet users, 3.5 million Internet Subscriptions (including 98k fixed internet), 25.6 Gbps international bandwidth and 25% **Mobile Money** penetration.

RENU NREN was established in 2006. Owned by universities through the **Vice Chancellors Forum**, **UCC** granted **RENU** a special license to operate a private network providing an international gateway and transmit members' traffic from other African **NRENS**. Hosted in **Makerere University**, it has over 10 active members who contribute towards group purchasing of bandwidth. The **Ugandan Government** will provide the national network with **Members** addressing the last mile. In January 2014, **UbuntuNet** established a **Point of Presence (PoP)** in **Kampala**, linking **RENU** to other African **NRENS** and **PoPs** in **Amsterdam** and **London**. Testing started in February 2014, with 70% of campus connections expected by year end.

In summary, while significant progress is being made, **RENU** needs continued support to fulfil its mission.

D. Innovation Funding Mechanisms

While funding mechanisms are improving, there is a need for micro-financing of **Innovation** and **Entrepreneurship**. **Public Sector Innovation Funding Mechanisms** include: **UCC Research Grants and Awards** launched in 2012 (**Application Services**, **Energy Efficiency**) and **Annual Communication Innovation Awards**; **Youth Venture Capital Fund** launched February 2012, providing four year micro-finance loans through **DTCU**, **Stanbic** and **Centenary Banks**; **Millennium Science Grants** financed 40 research projects 2007 – 2012; **Presidential Science and Technology Innovations Initiative** through **Uganda Industrial Research Institute (UIRI)**, **UNCST** or **Makerere University**.

Private Sector support includes **Orange African Social Venture Prize** and **AppCampus (IV D)**, and **Warid Entrepreneurship Fund** (October 2012) offering youth enterprises grants and business mentorship for 12 months.

Funding Sector Innovation Funding Mechanisms are limited to the **Savannah Fund** (one investment in Uganda), **Mango Fund** (\$15,000 - \$50,000 convertible loans and advisory services) and **Mara Ad-Venture Fund**, offering \$2k - \$4k, mentoring and support, all for minority stakes.

Bilateral Support for **ICT-related** activities and supporting **Infrastructure** and **Capacity building** in **Higher Education Institutions** is primarily provided by **Germany**, **Ireland**, **Netherlands**, **United Kingdom**, **Norway**, **Sweden** & **IICD** [3].

Uganda had participated in 41 **FP7** projects [3] with €7.7 million in research funding and partnerships with 195 **European** and **Associated Country** organizations.

The last decade has witnessed enormous support by the **Carnegie Corporation of New York** to **Makerere University** with over \$16 million for **Food**, **Nutrition** and **Value Addition**.

In summary, there is strong public sector and increasing private sector support for innovation and entrepreneurship.

VII. SUMMARY AND RECOMMENDATIONS

Kenya, **Tanzania** and **Uganda** are now experiencing considerable **ICT-related** entrepreneurial growth in an environment that has improved considerably after

deregulation and improved infrastructure. Nevertheless, it is clear that the innovation ecosystems in these countries are still fragmented, Innovation Spaces are insufficiently differentiated and measures must be taken:

- Many university graduates lack necessary skills required by employers, let alone entrepreneurs, which is a serious structural problem in need of urgent reform
- Many users of Innovation Spaces are undergraduates or unemployed graduates, with limited targeting of experienced professionals exploring self-employment and supporting mechanisms must be introduced
- Stimulate clear differentiation between Innovation Spaces and strengthen management capacity and service delivery
- Higher priority must be given to support Independent Innovation Spaces to improve service delivery
- The quality and appropriateness of training and mentoring provided by Innovation Spaces must be improved, through necessary public, private and funding sector support
- Affordable mechanisms for high quality mentoring, training and finance for entrepreneurs must be introduced
- Bank debt is inaccessible without guarantees, government enterprise loans are too expensive and seed capital sources focused on African innovation must be increased
- Need to transform the culture and business models of education and research institutions and achieve greater research & innovation alignment with policy priorities
- Recent progress with national Internet Exchange Points and cross-border links co-funded by AfricaConnect to keep African traffic in Africa must be accelerated
- The public and education sectors should sensitize students to entrepreneurship opportunities, while Innovation Spaces should focus on providing quality services to committed graduate teams and experienced professionals.

Consequently, while there are many challenges of various complexities to face, there are also counter-measures that are comparatively straightforward to undertake.

VIII. CONCLUSIONS

The universe of contributing Innovation Stakeholders in Nairobi, Dar es Salaam and Kampala has expanded as a result of globalisation and technological and social change. This affects the operation and development of these innovation ecosystems. Understanding the characteristics of innovation ecosystems in developing countries is essential for developing a sufficiently flexible model. This study has found that, while the fundamental building blocks for effective Innovation Ecosystems already exist in Nairobi, Dar es Salaam and Kampala (particularly in terms of innovation friendly enabling environments and public, private and education and research stakeholder engagement), each city faces serious common challenges resulting in fragmented Innovation Ecosystems. While there is no lack of enthusiasm and commitment by most teams operating Innovation Spaces in Nairobi, Dar es Salaam and Kampala, some may not have the full range of skills required to effectively support entrepreneurs. Management would benefit from training and mentoring to strengthen operational and strategic capacity.

In a series of subsequent papers, we will assess the current level of Innovation related Collaboration and Absorption Capacity in Nairobi, Dar es Salaam and Kampala, the potential to improve coordination and collaboration between Innovation and Entrepreneurship Stakeholders; and suggest a

scalable model to strengthen these Innovation Ecosystems, that takes sufficient account of local adaptation requirements.

ACKNOWLEDGMENT

This research was co-funded by the European Commission under IST-Africa, (FP7 Contract 288691). The authors wish to acknowledge invaluable contributions and insight from IST-Africa Partners, workshop participants and senior representatives of key institutions interviewed in East Africa.

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