

BACKGROUND PAPER

Digital Dividends

How Tech Hubs are helping to Drive Economic Growth in Africa

Tim Kelly
World Bank Group

Rachel Firestone
World Bank Group



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How Tech Hubs are helping to Drive Economic Growth in Africa

Background Paper for the World Development Report 2016: Digital Dividends

Dr. Tim Kelly (Lead ICT Policy Specialist),
tkelly@worldbank.org

Rachel Firestone (ICT Programs Officer)¹
rfirestone@worldbank.org

Abstract:

Digital technologies have spread rapidly. Digital dividends—the broader development benefits from using these technologies—have not. Digital technologies to benefit everyone everywhere requires improving the “analog” complements to digital investments—by strengthening regulations that ensure competition among businesses, by adapting workers’ skills to the demands of the new economy, and by ensuring that institutions are accountable. Inclusion, efficiency, innovation are the main mechanisms for the internet to promote development. How can these mechanisms be leveraged to promote Africa’s development? The paper tracks some 117 Tech Hubs across Africa, many of which have been created in the last few years. The paper looks at the patterns of origin by which Tech Hubs are created, why they have a high failure rate, and what makes for success.

Keywords:

ICT for Development, Tech Hubs, Industry/Academic collaboration, Africa, World Development Report, Economic growth.

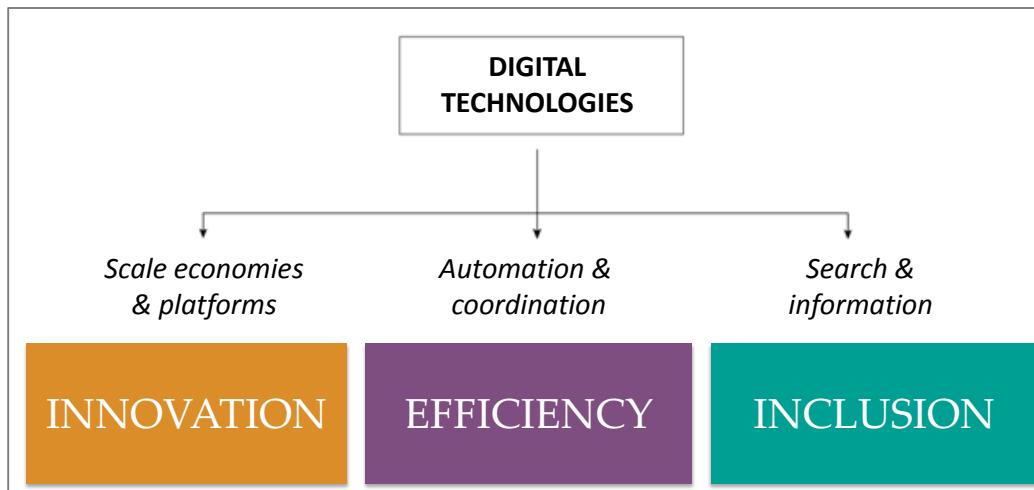
¹ The views expressed in this paper are those of the authors and do not necessarily engage the World Bank or its membership.

Introduction

Digital technologies have spread rapidly. Digital dividends—the broader development benefits from using these technologies—have generally not done so. In many instances digital technologies have boosted growth, expanded opportunities, and improved service delivery. Inclusion, efficiency, innovation are the main mechanisms by which digital technologies promote development (Figure 1). Yet their aggregate impact has fallen short and is unevenly distributed. To maximize the digital dividends, and mitigate risks, requires a better understanding of how technology interacts with other, non-technical factors that are important for development—which may be considered as the “analog” complements to digital investments. These include strengthening regulations that ensure competition among businesses, adapting workers’ skills to the demands of the new economy, and ensuring that institutions are accountable.

This paper looks at one very specific interaction between digital investments and analog complements—namely the development of Tech Hubs across Africa. Research carried out for the WDR16 tracks some 117 separate Tech Hubs, many of which have been created in the last few years (see Figure 2). The Tech hubs and co-working spaces cropping up across the Africa continent have consistently made headlines in their effort to bring tech business to the grassroots. Overall, they have brought many new ideas and have provided a rich source of employment and new firm formation². However, they also demonstrate a high failure rate and varying degrees of success. This research examines the patterns of origin of the Tech Hubs, the non-digital complements that they provide to the digital technologies, what makes for success, and the impact of government and academic sector support on the role of Tech Hubs in the emerging digital ecosystem in some of Africa’s largest cities.

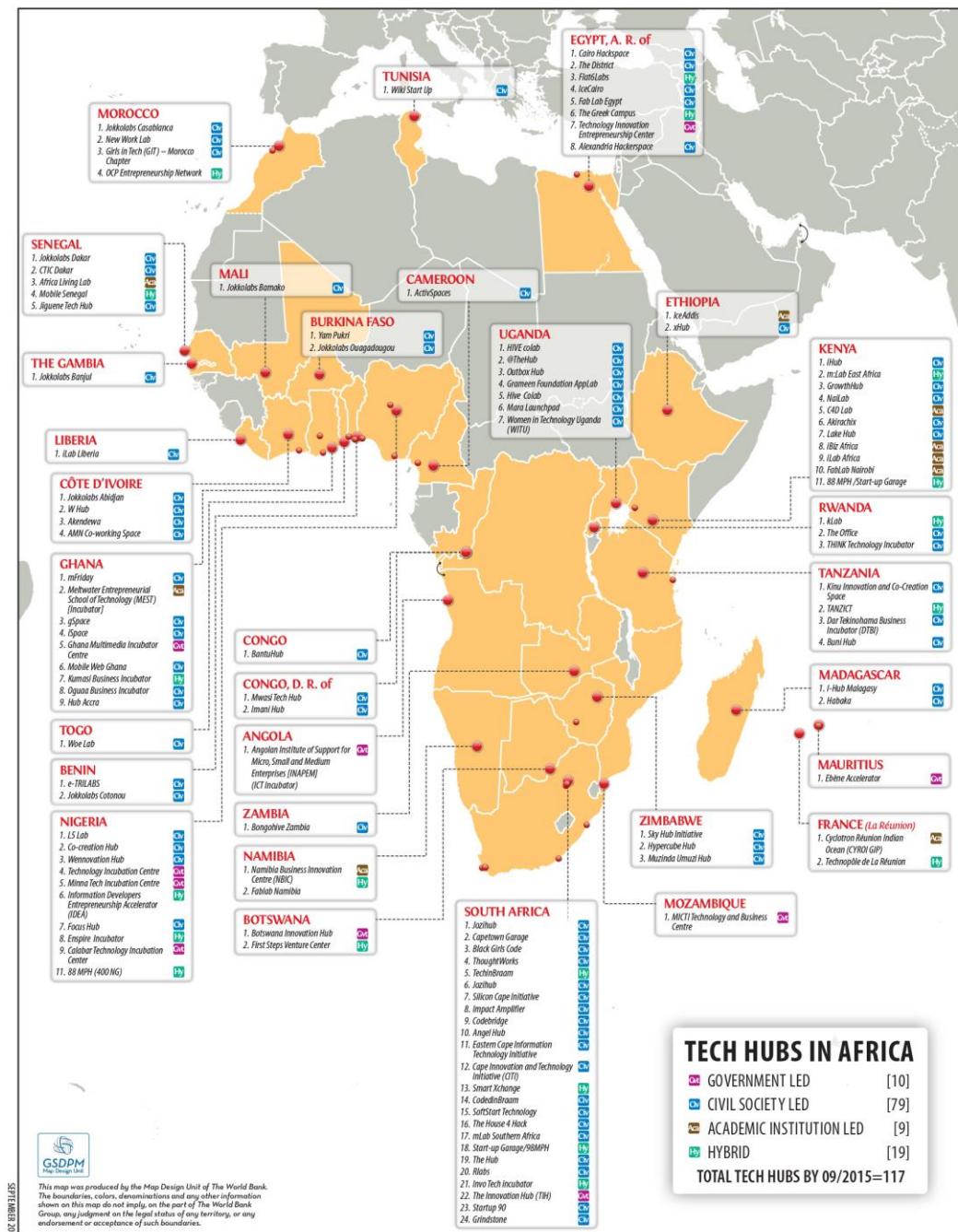
Figure 1: How digital technologies impact development



Source: World Bank, WDR 2016 team.

² See, for instance, GSMA (2014) Digital Entrepreneurship in Kenya, available at: <http://www.gsmaentrepreneurshipkenya.com/>.

Figure 2: Tech Hubs across Africa



Source: WDR 2016 team. An interactive version of the map is available at: <https://firestonerachel.cartodb.com/viz/a6f8f7a6-7cfe-11e5-9d7e-0ef7f98ade21/m>.

Looking at the Data

The Tech Hubs examined over the course of this research can be roughly divided into four main operating types—Academic institution-led, civil society-led, government-led, and hybrid-led. The civil society-led model is by far the most common, constituting 79 out of the 117 currently documented hubs, and it refers to Tech Hubs run by foundations, NGOs, activist/tech developer consortiums, or private sector firms unaffiliated with either government or academic institutions. The Hybrid-led model refers to hubs and incubators, such as Nairobi’s m:Lab East Africa³, established with World Bank support through *infoDev*, who self-govern through an administrative board or consortium comprised of multiple stakeholders, in this case a private sector firm (eMobilis⁴), an academic organization (University of Nairobi⁵), an NGO (World Wide Web Foundation⁶) and a pre-existing Tech Hub (iHub⁷). Academic Institution-led and Government-led models refer to hubs that garner the largest chunk of their funding from support from such institutions, and whose organizational structure falls under the supervision of a university or government administrative or oversight body. While these organizations typically avail of university or government real-estate, this is not a definitive criterion as hybrid and civil society led models often do the same, particularly when they have access to subsidized space in government-funded tech parks.

Of the 102 hubs initially documented in the World Bank’s 2013 stocktaking of African tech hubs,⁸ 27 have closed. Compared to the U.S. Census Bureau’s *Business Dynamics Statistics*’ 5-year failure rates for firms, plotted by industry, the failure rate exhibited by African tech hubs tracked between 2013 and 2015 is actually ahead of the curve. The tech hubs’ 26% is far more benign than its 60.6% equivalent amongst American communications/utilities firms from 2005–10.⁹

The high start-up rates for new Hubs, and a deeper dive into the dynamics surrounding surviving tech hubs, provides some insight into determinants of sustainability. In order to examine why some African tech hubs fail while others flourish, and to explore ways to distribute digital dividends equitably rather than entrenching them amongst an elite few, it may be useful to consider the following three issues:

- a) The link between the goals of innovation entities and their organizational and governance structure, which often betrays a disconnect.
- b) The degree of public sector involvement, which may be an asset for sustainability, but not necessarily for organic growth.
- c) The value-added provided by different stakeholders.

³ See: <http://www.mlab.co.ke>.

⁴ See: <http://www.emobilis.ac.ke>.

⁵ See: <http://www.uonbi.ac.ke>.

⁶ See: <http://webfoundation.org>.

⁷ See: <https://www.ihub.co.ke>.

⁸ See <http://blogs.worldbank.org/ic4d/tech-hubs-across-africa-which-will-be-legacy-makers>.

⁹ See: Brownlee, Gary. “Small Business Failure Rates and Causes,” ISBDC, 2014.

<http://www.isbdc.org/small-business-failure-rates-causes/>; It should also be noted that calculations using the BDS database covered years during the worst economic turndown in the United States since the Great Depression, a fact which might skew mortality rates for all industries in this context towards the high side.

Matching Goals and Business Plans and the Hub vs. Incubator Debate

As part of the research for this paper, interviews were carried out with hub founders and managers, as well as a desk review of organization documentation and survey and case study research conducted by sector stakeholders and observers such as *InfoDev*, GSMA, IST@frica, and some of the major hubs themselves, such as Nairobi-based iHub and national members of the Fab Labs consortium. The research suggests that tech hub failure often comes out of a disconnect between either the organization's goals and its business structure, or between its goals and the needs of its operating environment. Some organizations pursue a classic Silicon Valley type incubator model, offering seed funding in return for an equity stake alongside a multiple month full-time accelerator program. The investors behind these incubators look for "big ideas," and with these, aim to secure a significant share of the new tech market.¹⁰ The incubator model focuses on helping the start-ups with product focus, go-to-market, and finding business models, with much of the program working with the startup to establish a good foundation, budgetary plan, and understanding around growth and next stage investors. Other, more open-ended models who self-define as innovation spaces, tech hubs entrepreneurship centers, or eco-system builders prioritize skills over companies. These tech innovation practitioners focus instead on skills training and job creation over seed funding, while others prefer simply to act as an open co-working space providing facilities, promoting collaboration, and creating an entrepreneurial "headquarters."¹¹

The challenge to sustainability comes in when a disconnect arises between innovation practitioners' goals and the business plans they structure to achieve those goals. In particular, the more open-ended "ecosystem booster" models suffer from a lack of clarity on whether they operate as non-profits or profit-generating enterprises, or whether they aim to make money of their investments or rely on funding from external grants.¹² The now closed *Plug and Play Egypt* over-extended itself in an attempt to accelerate and mentor start-ups, provide training to young entrepreneurs, and offer financial support to incubatees, without having a sufficient funding pool to support such a wide apparatus.¹³ The operating environment in Egypt over the last few years, following the political upheaval of the Arab Spring, has also been quite hostile to new ventures.

Challenges also arise when the aims of even a carefully modeled organization fail to fit the needs of its contextual environment. A debate ensues on whether an incubator or a hub approach is most appropriate for the African tech entrepreneurship scene more generally. Many ecosystem booster models revolve around incubators prioritizing investments in mature companies for quick wins over making skill development opportunities more available to the larger public, and growing the country's pool of "ideators." At the same

¹⁰ See: Friederici, Nicolas. "What is a Tech Innovation Hub Anyway?" Oxford Internet Institute, University of Oxford, 2014. <<http://cii.ox.ac.uk/2014/09/16/what-is-a-tech-innovation-hub-anyway/>>

¹¹ See: <http://venturesafrica.com/features/how-business-incubators-in-africa-are-starting-a-change/>

¹² iHub, one of the best known tech hubs in Kenya went through such organizational growing pains over 2012-13, interviews with iHub staff, May 2014.

¹³ Interview with Fab Lab Egypt, May 2015; See also for background information: <<http://thenextweb.com/me/2011/01/22/from-silicon-valley-to-cairo-plug-and-play-egypt-becomes-a-reality/>>

time, tech hubs generally provide no financial guarantee for their mentees, which ultimately may deter potential entrepreneurs from taking their ideas to market. The critique of the latter often looks back to the business model where the incubator's own sources of funding are closely tied to the success of their investments, which it self-defines as sustainable since the mother organization is particularly invested in its startups' success. Nevertheless, with such models, the commercialization of skills within the organization and within the start-ups they prop up must be quick, and must be able to go to scale quickly. In contexts where the entrepreneurship ecosystem is still in early development, pickings for such talent sharks and idea-spotters can be slim, and resources might be better used to first boost the skilled labor force and cultivate an idea generation culture.

Models like the partnership between the Nigerian incubator program, 400.NG¹⁴, and venture capital firm, L5Lab¹⁵ in Lagos, Nigeria, try to fill this gap between talent picking and skill development. In this case, 400.NG liaises with more ecosystem-focused hubs like Focus Hub¹⁶ and Enspire Incubator¹⁷, to provide accelerator opportunities to high-performing potential entrepreneurs, while L5Lab picks up graduate incubatees to invest in. In Nairobi, the incubation-focused model of m:Lab East Africa, which is physically located in close physical proximity to the prototype ecosystem-builder, the iHub, with many co-run programs developed between them, aims at a similar symbiosis. The Dakar, Senegal-based Africa-Living Lab, Jokkolabs Dakar¹⁸, and Jiguene Tech Hub¹⁹, seek to funnel high performers towards incubators such as CTIC Dakar.²⁰ In this way, the various actors along the tech hub innovation driver spectrum can offer a diverse menu of services and mutually gain from the roles and responsibilities of the other.

Public Sector Involvement—can Elephants dance?

In his New Trade Theory and critiques on specialized industrial policy, the economist and Nobel Memorial Prize laureate, Paul Krugman, deems it unnecessary for governments to “pick winners” unless an industry is faced with some particular market failure.²¹ Similarly, discourse on the African tech innovation space debates whether government support for technology innovation—particularly in the form of planned tech parks—spreads or stifles innovation and its social gains. Comparing the ‘Silicon Savanna’ and ‘Silicon Wadi’ ecosystems of Nairobi, Kenya and Amman, Jordan respectively helps exemplify the nuances of these arguments and the merits and demerits of government involvement. Labor, capital, and investment naturally move towards high growth industries in order to maximize their profits and wages. While not necessarily harmful to the chosen industry, government incentivizing firms and labor to do what market forces already encourage can

¹⁴ See: <http://www.l5lab.com>. A joint venture program between L5Lab and 88mph Nigeria.

¹⁵ Ibid.

¹⁶ See: <http://focushub.net>.

¹⁷ See: <http://enspire.org.ng/wp/about-us/>

¹⁸ See: <http://dakar.jokkolabs.net/>

¹⁹ See: <http://jjiguenetech.com/>

²⁰ See: <http://www.cticdakar.com/>

²¹ Krugman, Paul R. and Maurice Obstfeld. International Economics: Theory and Policy, Eighth Edition, Pearson Education, Inc., Boston: MA, 2008, p. 293. Print.

cause resource surplus in certain areas and scarcity in others.²² At the same time, government support can play a powerful role in enabling new entrants to overcome barriers to entry and enter the competitive space, something difficult for small enterprises to achieve in industries associated with high fixed costs and heavy R&D investments.

Nairobi's tech space prides itself in taking off in-spite, rather than because of the Kenyan government picking winners and hosting entrepreneurship centers. The development of Nairobi's tech cluster dates to the founding of iHub in March 2010. Growth has spread, first to the rest of the Bishop Magua Centre where it is located (including NailLab²³, m:Lab East Africa²⁴ and the longer-established Ushahidi²⁵), and then and then to nearby Strathmore University (where iBiz²⁶ and iLab²⁷ are located) and along Ngong Road to the GreenHouse and [88 MPH/Startup Garage](#).²⁸ iHub refers to this as a “community-centred” development model (see Figure 3). In contrast, proponents of Amman's more centrally planned ecosystem argue the Kenyan space grew thanks to the size of the economy overall, and that the lack of centralized guidance would have stunted growth in smaller, more resource poor and politically risky economies, such as Jordan and its conflict ridden neighbors, and Rwanda and its risk of violent spillover from the Congo.

In an attempt to overcome the constraints of a national monopoly of the fixed, mobile, and Internet communications market, and to expand the telecommunications sector and tech business scene,²⁹ Ethiopia is developing a different type of growth model, based in inward investment. With a top-down policy-level push to link the education and health sectors to government funded tech initiatives, and with a US\$250 million investment in building the Ethio ICT Village (see Figure 4), the numbers of national firms in the sector have grown.³⁰ The technology park has also drawn increasing numbers of foreign firms to establish a local presence, some of whom, like China's ZTE and Techno Mobile, have committed to establishing their own incubation centers.³¹

²² Ibid.

²³ See: <http://www.nailab.co.ke>.

²⁴ See: <http://mlab.co.ke/about/>

²⁵ See: <https://www.ushahidi.com>.

²⁶ See: <http://www.ibizafrika.co.ke/>

²⁷ See: <http://www.ilabafrika.ac.ke/>

²⁸ See WDR16, chapter 4.

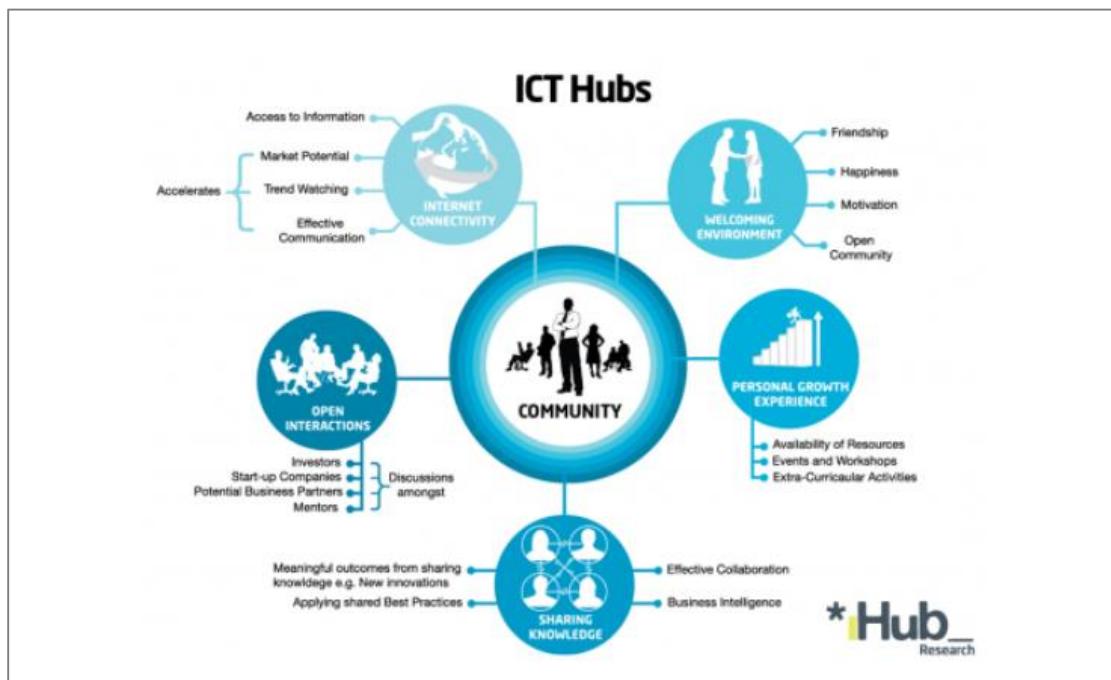
²⁹ See: http://www.researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_3_-Understanding_what_is_happening_in_ICT_in_Ethiopia.pdf.

³⁰ See: <http://www.bbc.com/news/business-23086014>.

³¹ See: <http://ela-newsportal.com/Ethiopia-iceaddis-tech/>;

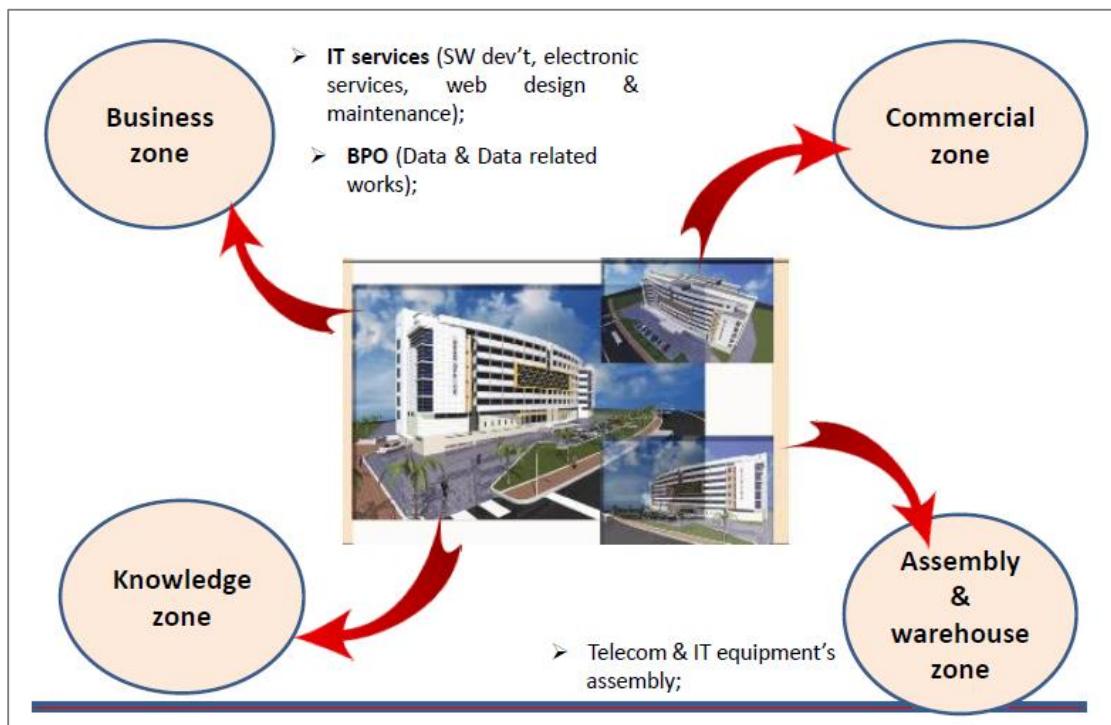
http://www.researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_3_-Understanding_what_is_happening_in_ICT_in_Ethiopia.pdf

Figure 3: Community-centred Tech Hub development (à la iHub, Kenya)



Source: iHub.co.ke.

Figure 4: Real-estate centered ICT Park development (à la ICT village, Ethiopia)



Source: Abdissa Yima Tika (2015) "Status of ICT development in Ethiopia: Challenges and future direction"

Nairobi's tech start-up scene illustrates the difficulty that governments have in creating technology clusters. A government plan to establish an out of town growth pole (Konza City³²) as a smart city, has been under discussion since 2008, but has yet to take real shape and has been associated with corruption over politicians acquiring land close to the planned site, with a view to making windfall profits. Instead, the local tech scene has tended to grow organically as firms draw upon, and thus, continually invest in and re-skill the same talent pool. Startups have spun off from established enterprises and even have created new additional enterprises based on common values and mutually reinforcing skillsets. Between the top-down vision and the bottom-up reality, there should be some kind of middle ground that pairs market driven decision-making with public sector guided regulation. While governments can unwittingly undermine a local ICT sector with lax rules on intellectual property protection or burdensome taxes on the import of ICT goods and components, public sector support in the form of positive regulation can be invaluable. The influx of local-content based value-added services in Tanzania's mobile money market, which has developed since the national payment systems regulations nominally came into effect, demonstrates that regulation is an important source of protection for a business ecosystem³³. Rather than providing direct funding, governments can use regulatory framework to increase revenue to the ICT sector by removing certain costs of doing business. Such actions include instituting favorable tax regimes or liberal policies on forming legal entities, enabling easier access to finance, or awarding employment permits to skilled workers.

Academic stakeholder value-add—does involvement stimulate or stifle?

In contexts where incubators and angel investors are still nascent and where government and the private sector view one another as antagonists rather than partners, academic institutions can play a unique role as conduit between the two. Typically, research institutes and higher education institutions have links with both the public and private sectors, and while often leaning closer to one side or the other, they do not fall into either camp. In this unique position, academic institutions can facilitate links between innovation practitioners and other networks within the wider ecosystem, including students and academics, as well as providing a unique source of funding to the hub organization or its incubatees. The bridging role these institutions can play will continue to grow in importance as innovation increasingly relies on new developments in the scientific and technological space, which often require costly initial investments in R&D.³⁴

As a case in point, Johannesburg's Braamfontein area is developing into a self-identified tech hub cluster through a mix of spontaneous, organic private sector generation, and calculated development on the part of academic institutions and government. After the initial success of the some of Braamfontein's first movers such as CodedinBraam³⁵,

³² See: <http://www.konzacity.go.ke/>.

³³ See: "Mobile financial services in Tanzania: The current and future status of the legal and regulatory framework." Banking Briefing, Clyde &Co., 2014.

³⁴ See: http://www.ist-africa.org/home/files/IST-Africa LL InnovSpaces v1_281114.pdf.

³⁵ See: <http://www.meetup.com/CodedInBraam/>.

IMPACT Hub³⁶, Black Girls Code³⁷, and ThoughtWorks³⁸, new practitioners such as TechinBraam³⁹, the Branson Centre of Entrepreneurship⁴⁰, Code&Coffee⁴¹, and the coding and gaming community group “Make Games Johannesburg” have entered the space.⁴² A longtime, if increasingly derelict industrial center, Braamfontein’s businesses and suppliers still contribute a lion’s share of Johannesburg’s 40% to the country’s total GDP⁴³ and have been identified as both a source of demand for locally sourced ICT products and services and an opportunity for externships and mentoring opportunities for potential entrepreneurs.⁴⁴

Figure 5: The likelihood of “collisionable moments” in high-tech clusters



Source: World Bank (forthcoming, 2015) Growth and sustainability of tech innovation ecosystems in city environments.

³⁶ See: <http://johannesburg.impacthub.net>.

³⁷ See: <http://www.meetup.com/blackgirlscodejhb/>.

³⁸ See: <http://info.thoughtworks.com/Johannesburg-office.html>.

³⁹ See: <http://techinbraam.co.za>.

⁴⁰ See: <http://www.bransoncentre.org>.

⁴¹ See: <http://www.meetup.com/Code-Coffee-JHB/>.

⁴² See: <http://mg.co.za/article/2013-05-30-00-jozis-tech-revolution-goes-to-town>;

<http://seedacademy.co.za/techno-accelerator/>

⁴³ See: <http://www.techcentral.co.za/braamfontein-tech-hub-ready-for-liftoff/41272/>

⁴⁴ See: http://www.itweb.co.za/index.php?option=com_content&view=article&id=64815

The emergence of Braamfontein is a good illustration of the tendency of high tech industry to cluster together. On the supply side, this reflects the way in which new firms spin off from established firms, and both compete for a highly specialized pool of labor. On the demand side, it is driven by “social networking”, or the likelihood that like-minded people will come into contact with each other. This is sometimes referred to a “collisionable moments” (see Figure 5), which are more likely to happen where there is an existing high density of tech graduates. In other words, clusters promote further clustering.

Tension over intellectual property regulation and taxation policies have traditionally has existed between Johannesburg’s burgeoning tech start-ups and longtime industrial firms and the government. Yet bordered by two of Johannesburg’s most prestigious universities, Braamfontein’s startups and “ideators” were well positioned to avail of academic skill development opportunities and financial support, which often also included parallel financing from the government.⁴⁵ In addition, it was arguably the additional financial resources awarded to TechinBraam by the University of Witwatersrand’s Joburg Centre for Software Engineering (JCSE)⁴⁶, as well as the university name’s halo effect bringing in a multi-million dollar IBM investment, which also brought the government in as a direct stake-holder in some of TechinBraam programming. JCSE’s acting as a facilitator bringing in an influx of financial and technical support from both government and international private sector firms is arguably what has enabled Braamfontein to sustainably continue its trajectory as the vibrant tech hub cluster we see today.

kLab⁴⁷ (knowledge Lab), a Kigali-based co-working space for IT entrepreneurs housed within the government sponsored “ICT Park” and run through a hybrid, consortium model exemplifies how academic institutions can link facilitators of tech innovation to potential practitioners. The Rwandan government heavily supported kLab’s ecosystem boosting activities as part of its operationalizing the “participatory” phase of its National ICT Plan (NICI-3),⁴⁸ which aims to link fibre-optic connectivity to systemic economic growth and equitable distribution of development benefits. When implementing its outreach activities, the tech hub found that since most of the population was still being exposed to the concept of tech entrepreneurship, its link with Kigali Institute of Technology (KIST), National University of Rwanda, and other institutions became one of its main access points to potential clientele.

Yet precisely because academic institutions provide utility to the tech innovation organizations as bridging points between disparate stakeholders and as sources of funding and in-kind resources, their involvement can also inadvertently distort the market and make survival without that support difficult. In a short market survey of other co-working spaces in the region, The Office, a Rwandan ICT-focused co-working space, suggests that when selected spaces are provided with recurrent cost subsidies it becomes much more difficult for other spaces to operate on a purely commercial and sustainable basis.⁴⁹

⁴⁵ See: <http://ventureburn.com/2014/10/government-supporting-sas-startup-ecosystem/>

⁴⁶ See: <http://www.jcse.org.za>.

⁴⁷ See: <http://klab.rw>.

⁴⁸ See: “<http://www.howwemadeitinafrica.com/klab-a-space-for-innovation-in-rwanda/18942/>”

⁴⁹ Ibid.

Research and Education Networks—more stimulating, less stifling

Enabling tech hub partners to avail of National Research and Education Networks (NRENs)⁵⁰ is one way higher education institutions in Africa can provide support for tech innovation, maximizing mutual gains without distorting hub-to-hub competition. Tech innovation practitioners associated with universities can use the NREN networks to strengthen connections to other tech hubs and incubators and support the overall tech entrepreneurship ecosystem rather than propping up the assets of certain particular hubs and incubators over others. In addition to the high speed, reliable, and affordable internet it affords, an NREN's unique and secure network between member institutions provides both a new communication avenue and a pooled technology platform in a hands-on link between cutting edge scientific research, new technologies, and entrepreneurship ideas and business plan development. Furthermore, its organizational body functions as yet another connector institution aiming to facilitate information and learning exchange between disparate entities.

CB-Tech, an incubator hosted within Cyclotron Réunion Indian Ocean (CYROI GIP)⁵¹, a research and tech focused public interest group created by the University and University Hospital of Réunion, provides young biotech companies access to a high level technical platform and hints at the gains an NREN could provide in the tech innovation space. In addition to availing of co-working spaces, business plan support, and access to angel investors, CB-Tech incubatees have access to technologies and innovation currently being developed or used within the university or hospital.⁵² CB-Tech affiliates also have access to research groups within the university's partner institutions in France and neighboring Mauritius, as well as national research groups housed within the university such as APLAMEDOM (Aromatic and Medicinal Plants Association of Reunion), and CRVOI, an infectious disease and pharmaceuticals research group.⁵³ However, CB-Tech still lacks access to the technology platforms and learning exchanges it could avail of should it have access to an aggregated network of research institutes, science practitioners, and other affiliated hubs throughout the region.

In contrast, back in Kenya, iLab⁵⁴ and iBiz,⁵⁵ the ICT innovation center and tech business incubator housed within Nairobi's Strathmore University demonstrate how association with a National Research and Education Network (NREN) can further boost innovation activities. Given that Strathmore University is a member of KENET⁵⁶, Kenya's NREN, iLab and iBiz have access to databases, information systems, archives, online computation and collaboration, and interactive learning available to and shared by all other NREN member institutions and affiliated centers and institutes. As a network linking govern-run research institutes as well as universities, the NREN also strengthens iLab and iBiz's relationship with government entities. Finally, an independently run organization committed to equitably spreading the applied use of communications infrastructure as well

⁵⁰ See: <https://www.terena.org/publications/files/20090127-case-for-nren.pdf>.

⁵¹ See: <http://www.cyroi.fr/category/pepiniere-entreprise/>.

⁵² See: <http://www.cyroi.fr/category/pepiniere-entreprise/>.

⁵³ Ibid.

⁵⁴ See: <http://www.ilabafrica.ac.ke/>.

⁵⁵ See: <http://www.ibizafrica.co.ke/>.

⁵⁶ See: <https://www.kenet.or.ke>.

as promoting its physical build-out, KENET has extended funding opportunities for targeted research and supported several iLab research projects on e-learning implementation in rural areas and deployment of mobile learning tools.⁵⁷

KENET's reach to the Southern and Eastern African regional network, UbuntuNet⁵⁸, and the global network GEANT⁵⁹, has opened iLab and iBiz to a larger network beyond traditional university partners. Should other tech hubs and incubators establish similar partnerships with NREN member institutions, the network infrastructure could also function as a network linking the entire innovation ecosystem. On the other hand, should use of a Research and Education Network (REN) become relatively ubiquitous with certain players excluded for some reason, the opportunities would clearly still be exclusionary. However, so long as participation criteria are clear and equitable, opening REN access can support the overall ecosystem and build networks, internship placement opportunities, and collaborative research prospects for the university REN host.

Conclusion

Inclusion, efficiency, innovation are the main instruments spreading development gains from digital technologies, and the African tech hubs and incubator entities, across a wide range, aim to maximize all three in different ways. While digital technologies can make routine, transaction-intensive tasks dramatically cheaper, faster, and more convenient, most tasks also have a non-automatable part, whose execution requires human judgment, intuition, and discretion. In the case of Tech Hubs, the non-automatable part involves issues like choosing the right location, developing an appropriate governance structure, and being lucky enough to have inspirational leadership.

The fact that, of the 117 ICT hubs and incubators documented in this research, only 9 are academic institution-led and another 10 led by governments, suggests that entrepreneurship and innovation are mainly demand and market driven, and do not necessarily revolve around public or academic sector management. Yet analyzing the positive and negative interactions that African Tech Hubs have with government and academic institutions also suggests that a balanced partnership with stakeholders of each sector boosts sustainability for both hub and incubator models. Research into the experience of surviving and newly entering African tech innovation entities over 2013–15 suggests that both models have important roles to play, so long as their business plans match the needs of their operating environment. Finally, while the majority of African tech hubs do not currently see university partnerships as crucial to growing market-driven tech innovation, this research suggests that innovation entities could be taking more advantage of academic sector resources to embed more deeply in the local ecosystem and better match their operating models to the needs at hand. The academic and nonacademic networks provided by academic institutions in general, and Research and Education Networks more specifically, augment tech hub and incubators' ability to spread digital gains by increasing their access to their client innovators as well as the technology platforms instigating ongoing innovation.

⁵⁷ iLab-iBiz-Strathmore University Interview, October, 2015.

⁵⁸ See: <http://www.ubuntunet.net>.

⁵⁹ See: <http://www.geant.net/Pages/default.aspx>.