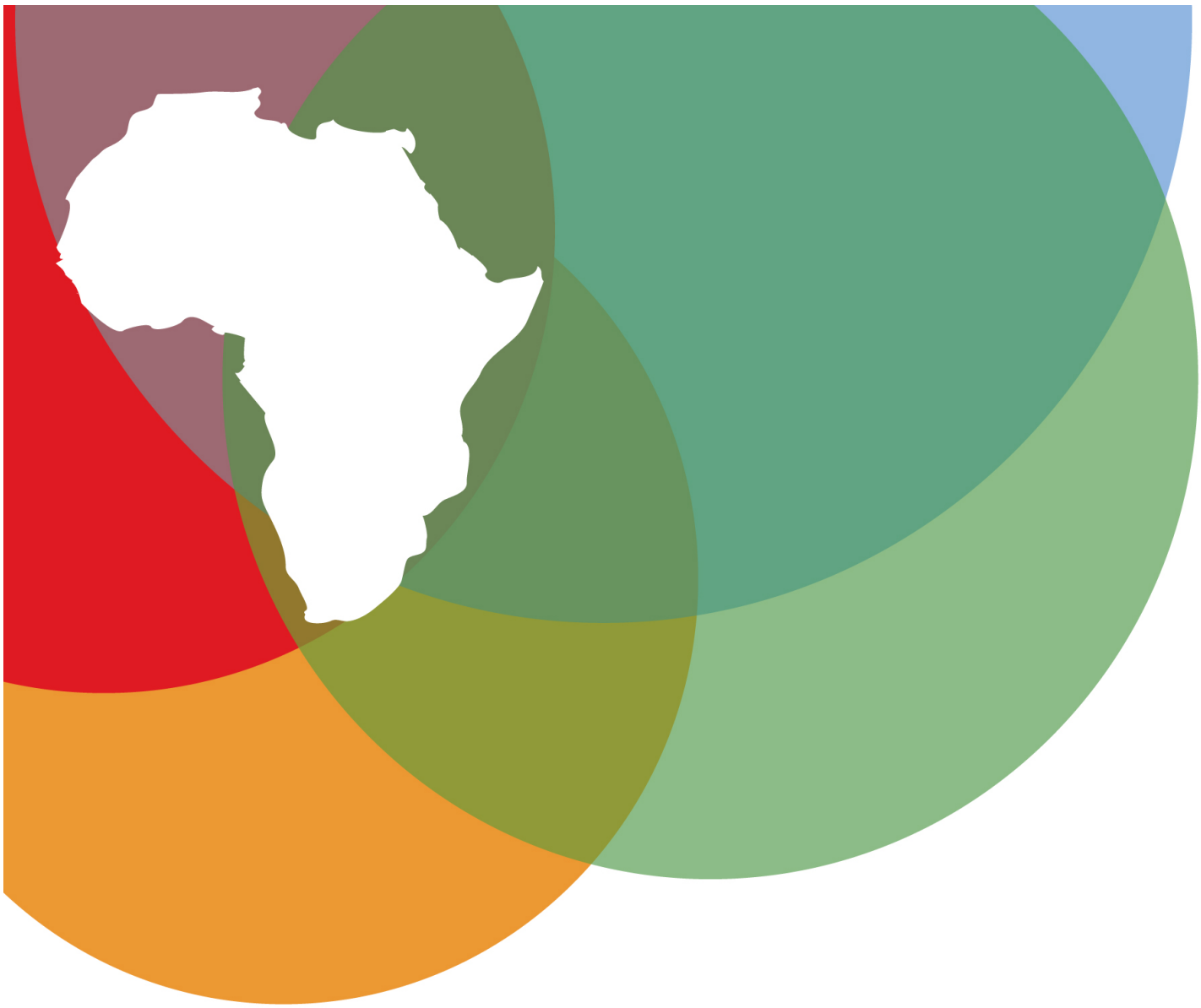

A Framework for Assessing Technology Hubs in Africa

Jeremy de Beer, Paula Millar, Jacquelene Mwangi, Victor Nzomo, and Isaac Rutenberg

Working Paper 2
Published: 12 January 2017

openAIR
AFRICAN INNOVATION RESEARCH

Authors

Jeremy de Beer
Full Professor, Faculty of Law, University of Ottawa
Senior Research Associate, Intellectual Property Unit, University of Cape Town
Co-Founder and Director, Open African Innovation Research (Open AIR)

Paula Millar
Lawyer, Blackhawk Network
New and Emerging Research Fellow, Open African Innovation Research (Open AIR)

Jacquelene Mwangi
Research Assistant, Centre for Intellectual Property and Information Technology Law (CIPIT), Strathmore Law School
New and Emerging Research Fellow, Open African Innovation Research (Open AIR)

Victor Nzomo
Research Fellow, Centre for Intellectual Property and Information Technology Law (CIPIT), Strathmore Law School
New and Emerging Research Fellow, Open African Innovation Research (Open AIR)

Isaac Rutenberg
Senior Lecturer, Strathmore Law School
Director, Centre for Intellectual Property and Information Technology Law (CIPIT)
Co-Investigator, Open African Innovation Research (Open AIR)

Abstract

This article fills a gap in the research on technology hubs in Africa. It explains the importance of hubs as drivers of technological innovation, social change, and economic opportunity within and beyond the African continent. The article is the first to thoroughly review and synthesize findings from multi-disciplinary grey literature, and integrate insights from qualitative data gathered via interviews and fieldwork. It identifies three archetypes of hubs—clusters, companies, and countries—and discusses examples of each archetype using Kenya as a case study. The article discusses potential collaboration, conflicts, and competition among these archetypes of hubs, and concludes with recommendations for future researchers.

Keywords

technology, hubs, clusters, incubators, makerspaces, science parks, Africa, Kenya

Introduction

Africa's startup revolution has spurred a proliferation of hubs, accelerators, incubators, and co-creation spaces across the continent. When AfriLabs, the leading network of African technology hubs, was founded in 2011, its membership included five incubators in four countries.[1] By 2016, the number of active hubs on the continent had grown to 314.[2] While half of these hubs are located in five countries (South Africa, Kenya, Nigeria, Egypt and Morocco), nearly every other African country is home to at least one or two hubs.[3]

The impressive growth and perceived potential of Africa's technology hubs has garnered global interest from news outlets like The Economist[4] and international agencies like the World Bank.[5] The global Managing Director of McKinsey recently explained to the World Economic Forum the significance of "rapidly accelerating technological change that can unlock growth and leapfrog the limitations and costs of physical infrastructure in important areas of economic life."[6] Demographic facts alone suggest that in 20 years Africa will add more to the world's workforce than the rest of the world combined,[7] and by 2050 a quarter of earth's population will be African.[8] Attention paid to Africa's technology hubs has also increased as a result of events like Facebook founder and CEO Mark Zuckerberg's first-time visit to hubs in Nigeria and Kenya, when he remarked: "The future will be built in Africa."[9]

The emergence of Africa's technology hubs is of crucial importance for those living within the continent, as the trend represents an opportunity for home-grown entrepreneurship

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[1] Erik Hersman, *Afrilabs Provide a Model for African Innovation, Collaboration*, Memeburn (Feb. 8, 2011), http://memeburn.com/2011/02/afrilabs-provide-a-model-for-african-innovation-collaboration/.
[2] Victor Du Boucher, *A Few Things We Learned About Tech Hubs in Africa and Asia,* GSMA (Aug. 5, 2016), http://www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/things-learned-tech-hubs-africa-asia/.
[3] Ibid.
[4] The Economist*, Homes for Africa's Tech Entrepreneurs: Tech Hubs are Expanding Fast Across Africa*, The Economist (Mar. 12, 2015), http://www.economist.com/news/middle-east-and-africa/21646216-tech-hubs-are-expanding-fast-across-africa-homes-africas-tech-entrepreneurs/.
[5] Tim Kelly, *Tech Hubs Across Africa: Which Will be the Legacy-Makers?*, The World Bank Group(Apr. 30, 2014), https://blogs.worldbank.org/ic4d/tech-hubs-across-africa-which-will-be-legacy-makers/.
[6] Dominic Barton and AchaLeke, "3 Reasons things are looking up for African economies," *World Economic Forum*, (May 5, 2016), https://www.weforum.org/agenda/2016/05/what-s-the-future-of-economic-growth-in-africa.
[7] Rene Vollgraaf, "Africa to Add More to Workforce in 2035 Than World Combined," *Bloomberg*, (April 28, 2015), https://www.bloomberg.com/news/articles/2015-04-28/africa-s-labor-force-newcomers-to-exceed-world-by-2035-imf-says.
[8] United Nations, "World Population Prospects" (New York, 2015), https://esa.un.org/unpd/wpp/Publications/Files/Key_Findings_WPP_2015.pdf.
[9] Toby Shapshak, "Africa Will Build the Future Says Zuckerberg, Visits Kenya on First African Trip," *Forbes* (September 1, 2016), http://www.forbes.com/sites/tobyshapshak/2016/09/01/africa-will-build-the-future-says-zuckerberg-visits-kenya-on-first-african-trip/#67a838595214.

devising local solutions to socio-economic problems and propelling Africa's innovation revolution. Africa's technology hubs are also important for the world outside of the continent, as they are a locus for partnership opportunities. On the margins of the most recent United States – Africa Business Forum, President Obama's former Senior Director for Africa at the White House suggested that one of the keys to understanding the continent's "profound impact on world markets" in coming decades is better education about what's going on in Africa.[10] Looking toward the future, technology hubs may indeed be among the most significant drivers of global engagement with Africa's entrepreneurs.[11]

There is, however, very little research on this important new phenomenon. "Grey" literature, like blog postings, white papers, and consultancy reports, remains the predominant source of detailed information. Much of the terminology associated with Africa's high tech hubs is adapted from Silicon Valley, including the moniker "Silicon Savannah". This language has been popularized in media on technology (e.g. TechCrunch[12] and Wired[13]) and finance (e.g. Bloomberg,[14] Financial Times[15] and Harvard Business Review[16]), and by influential writers like Melinda Gates in the New York Times.[17] As explained in this article, however, our new research shows that African technology hubs are more complex than such catchphrases would suggest.

African scholars in economics and innovation studies have started to identify and analyze technology hubs, laying the groundwork for nuanced analysis of legal and policy implications.[18] But besides that work, most research about Africa's technology hubs has focused on highlighting success stories rather than critical analysis. Only recently some

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[10]Grant T. Harris, "U.S. Investors Are Missing Out On Africa's Economic Growth," *FORBES* (September 20, 2016), http://www.forbes.com/sites/realspin/2016/09/20/bedwetting-u-s-capital-missing-out-on-african-growth/2/#6d6795343b8f.

[11]ShirinElahi et al., *Knowledge and Innovation in Africa: Scenarios for the Future* 63 (Cape Town, Open AIR Network 2013).

[12]Jake Bright and Aubrey Hruby, "The Rise of Silicon Savannah and Africa's Tech Movement," *TechCrunch* (July 23, 2015), https://techcrunch.com/2015/07/23/the-rise-of-silicon-savannah-and-africas-tech-movement/. These authors have also published a book on the topic.

[13]Ian Steadman, "Kenya breaks ground on its 'Silicon Savannah' city project," *WIRED*, (January 25, 2013), http://www.wired.co.uk/article/kenya-silicon-savvanah.

[14]"Silicon Savannah: Kenya's Billion-Dollar Tech Bet," *Bloomberg,* (April 18, 2016), https://www.bloomberg.com/news/videos/b/fa73fc02-c511-4824-806d-5656acdfae7c.

[15] Sally Davies, "Silicon Savannah springs to life," *Financial Times*, (November 4, 2014), https://www.ft.com/content/83b0b4f4-5fa5-11e4-986c-00144feabdc0; David Pilling, "Kenyans start to roam Silicon Savannah," *Financial Times* (April 27, 2016), https://www.ft.com/content/1cda231c-0bdb-11e6-9456-444ab5211a2f.

[16]Jonathan Berman, "Meet the Tech Companies Creating Opportunity in Africa," *Harvard Business Review* (April 12, 2016), https://hbr.org/2016/04/meet-the-tech-companies-creating-opportunity-in-africa.

[17]Melinda Gates, "Technology can make a better world, if we want it to," *New York Times*, (December 22, 2015), http://www.nytimes.com/roomfordebate/2015/07/22/is-silicon-valley-saving-the-world-or-just-making-money/technology-can-make-a-better-world-if-we-want-it-to.

[18] Neville Raymond Comins& Erika Kraemer-Mbula, *Innovation Hubs in Southern Africa* in *Innovation Africa: Emerging Hubs of Excellence* (OlugbengaAdesida, GeciKaruri-Sebina& Joao Resende-Santos eds., Emerald 2015).

critics have begun to question technology hubs and their purposes, outputs, and sustainability.[19] However, both qualitative or quantitative data respecting the operations and impact of the continent's hubs are limited. Even if such data existed, until now there has been no consistent terminology and research framework with which to analyze the incredible and rapid growth of Africa's technology hubs.

This article is the first to offer a framework for systematically describing and critically assessing the emergence of high technology hubs throughout Africa. It is also the first article to explain the legal and policy implications of Africa's innovation revolution for those both within and outside of the continent. This article will, therefore, open up new opportunities for researchers of African innovation to conduct further empirical studies in years to come.

To address the current global knowledge gap on Africa's technology hubs, we undertook a thorough review of all relevant literature.Our literature review used a two-step method. First, we reviewed formal academic scholarship, considering a range of academic publications, including journals, conference papers, dissertations, and theses. Second, we examined grey literature, including articles, blog posts, and reports. Both steps employed similar search techniques and search terms.[20]

From our review, we identified three archetypes of "hubs" described in the literature. Based on several variables—including the hubs' size and scope, administrative structure, business practices, funding, participant demography, and sustainability—we created an original taxonomy that can be used to guide future research and data collection in this area.

We then supplemented our literature review and framework development with qualitative data gathered via semi-structured interviews in one particular country: Kenya. The purpose of the interviews was to gather primary data on the nature of Kenya's high technology hubs, thereby establishing the country as a case study from which to test and refine our taxonomy. Contributing authors conducted interviews at various hubs, accelerators and incubators in Nairobi between November 2015 and August 2016.

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[19] TayoAkinyemi, *All Hands on Deck: Why Hub Sustainability is a Complex Challenge that Requires a Systemic Solution,* Medium (Nov. 10, 2014), https://medium.com/@Temitayo/all-hands-on-deck-why-hub-sustainability-is-a-complex-challenge-that-requires-a-systemic-solution-237012240686#.wb1nov4b2.

[20] We were guided by leading sources on literature review methods: see, for example, Arlene Fink, *Conducting Research Literature Reviews: From the Internet to Paper* (4th ed. 2014). We used Boolean logic techniques to search leading international databases and internet research repositories with the terms AND/OR/NOT to combine or limit results. Search terms included variations of the term "hub", including "incubator", "accelerator" and "co-creation space". We also used bibliographic analysis and citation tracing to work backwards from known sources, thus thoroughly identifying relevant earlier research. After our initial research revealed that the most relevant grey literature was very recent, our methods were innovatively adapted to concentrate on material generated through Google Alerts and Twitter lists.

We present our research findings as follows: Part I of the article synthesizes the current state of knowledge about high technology hubs by presenting the results of our literature review. Part II of the article describes a new analytical framework distilled from our research. Part III contains discussion and analysis, informed by our qualitative data. Finally, Part IV offers conclusions and recommendations for future research.

Synthesis of Existing Research

Existing literature implicitly suggests that hubs can take many forms, yet most operate as some combination of a workspace, Internet café, coffee shop, training centre, incubator, accelerator, event venue, and/or maker space.[21] While there is great diversity hub-to-hub with respect to structure, amenities, membership, and other factors, the general consensus among academics and hub members is that hubs serve as a meeting place for a community.[22] For instance, hubs seek to support knowledge sharing and inspire creativity by connecting like-minded people with skilled outsiders through mentorship and networking opportunities.[23] Overall, hubs exist primarily to enable and support entrepreneurship and innovation, more than to create or implement them.[24]

For example, in 2010, the iHub emerged as a "space for the tech community in Nairobi to gather, to call home and build connections to each other and work on ideas from."[25]iHub co-founder Erik Hersman explained that, at least as of 2012, the right environment for a hub could only be found in five or six African cities: Nairobi, Lagos, Accra, Cape Town, Cairo, and possibly Dakar.[26] The success of these ventures depends upon the proper combination of "location, talent, policies, entrepreneurial culture, infrastructure, and money."[27]

For Hersman, the biggest challenge facing Africa's technology scene is the absence of angel investors and seed capital. The dearth of investment, according to Hersman, has three causes: local investors who prefer traditional and straightforward investments in real estate, local investors who cannot comprehend the software space, and international investors who fail to understand the local situation.[28] Despite this, Hersman attests that the strength of African technology initiatives stems from the fact that such ideas could not come from the West.[29] The ideas are Africa-specific solutions to Africa-specific problems, attuned to local constraints, and derived from cultural idiosyncrasies. A recent case study of the iHub found that hubs also serve as links and catalyzers affording entrepreneurs

[21]TayoAkinyemi, *Decoding #hubsustainability: Confronting the Critically Important yet Painfully Obvious*, Afrilabs (Mar. 30, 2015), http://www.afrilabs.com/2015/03/30/decoding-hubsustainability-confronting-the-critically-important-yet-painfully-obvious/.
[22] Nicolas Friederici, *What is a tech innovation hub anyway?* Oxford Internet Institute (Sept. 16, 2014), http://cii.oii.ox.ac.uk/2014/09/16/what-is-a-tech-innovation-hub-anyway/.
[23]Ibid.
[24]Ibid.
[25] Erik Hersman, *iHub: The Next Chapter,* iHub (Mar. 11, 2016), http://ihub.co.ke/blogs/26994/.
[26] Erik Hersman, *Mobilizing Tech Entrepreneurs in Africa: Innovations Case Narrative: iHub,* 7Innovations: Technology, Governance, Globalization, 59, 60 (2012).
[27] Ibid.
[28]Ibid.
[29] Ibid.

access to opportunities beyond their immediate locales and enabling integration into global production networks.[30]

Indeed, the prevailing sentiment is that hubs and startups play an important role in generating employment, creating wealth, and improving Africans' quality of life. Further, a 2015 report by VC4Africa revealed that startups that participate in an incubator or accelerator program, or are selected for a "pitch event" obtain on average USD 126,090 in external investment– a figure 23% higher than their counterparts who do not engage in such activities.[31]

For years, grey literature on African hubs adopted an optimistic tone, epitomized in such popular catchphrases as "Africa Rising", "Lions go digital", and "Africa's Silicon Savannah". The optimism was not entirely unfounded. In 2000, the entire African continent had less connectivity than Luxembourg.[32] Today, new undersea fibre optic cables and improved inland connectivity have dramatically increased Internet penetration rates and the widespread accessibility of inexpensive smartphones has allowed Africans to connect online like never before.[33] This unprecedented ease of access has spurred a wave of innovation from the likes of entrepreneurs and corporations, resulting in the rise of thousands of technology-based ventures.

Critical voices, however, began emerging after concerns were spread over the sustainability of Silicon Cape's startup bubble.[34] Other developments fueling this new sentiment included the transition of C4DLab (a startup incubation hub at the University of Nairobi) to a lean model, until it reaches a break-even point,[35] and the fact that another accelerator, known as "88mph", pulled out of Kenya and had limited success in South Africa.[36] One recent series of blog posts also indicated the fading dominance of the iHub in Kenya's maturing technology scene.[37]

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[30] Mie Hvas, *Tech Hubs in Africa and Their Ability to Act as Catalysers for Integration into Global Production Networks: A Case Study of the iHub in Nairobi, Kenya*, Copenhagen Business School Student Theses, 1, 71 (2015).

[31] Venture Capital for Africa, *2015 Venture Finance in Africa: The progress of early-stage high-potential growth companies*, VC4Africa (Jan. 2, 2015), https://vc4africa.biz/assets/pdf/Summary-VC4Africa-2015-Report.pdf/.

[32] Eleanor Whitehead, *WEF Africa 2012: How Technology Changes Africa's Development Prospects,* This is Africa (May 1, 2012), http://www.thisisafricaonline.com/Reports/WEF-Africa-2012-How-technology-changes-Africa-s-development-prospects/.

[33] ShirinElahiet. al., *Knowledge and Innovation in Africa: Scenarios for the Future* 63 (Cape Town, Open AIR Network 2013).

[34] Mark Ashton, *Silicon Cape Start-up Bubble will Burst,* mybroadband (Oct. 26, 2014), http://mybroadband.co.za/news/business/112729-silicon-cape-start-up-bubble-will-burst.html/.

[35] Tom Jackson, *Nairobi's C4DLab to Adopt Lean Model,* Disrupt Africa (Mar. 11, 2015), http://disrupt-africa.com/2015/03/nairobis-c4dlab-adopt-lean-model/.

[36] DrazenJorgic, *Kenya's Technology Push Leaves Investors Cold*, Reuters (Dec 31, 2014), http://www.reuters.com/article/kenya-tech-idUSL6N0UE15920141231/.

[37] Wilfred MutuaMworia, *The Decentralization of Nairobi's Tech Startup and Innovation Ecosystem,*Afrinnovator (Jul. 20, 2016), https://blog.afrinnovator.com/2016/07/the-decentralization-of-nairobis-tech.html/.

Criticism appears to be directed at three main issues: the challenge of measuring the success of African hubs and similar entities, the sustainability of the continent's hubs and its startup revolution, as well as concerns regarding the reigning incubation model.[38]

There is limited academic scholarship on hubs and their processes. While comparative studies form the bulk of research on this topic, regional or country-specific data and inconsistent nomenclature study-to-study complicate understanding these works as part of a larger narrative.[39]

New academic research suggests that hubs are necessary components of the knowledge-based economic and social development emerging across Southern Africa.[40] Such hubs should serve as intermediaries connecting players across the public and private sectors, fostering meaningful relationships, and inspiring collaboration.[41] Rather than importing a universal design, each hub should reflect the local ecosystem and cater to its particular needs.[42]

In sum, hubs have been a topic of extensive discussion in recent years. Academics and reporters, both on and off the African continent, have written with optimism about the power of the hub to solve the myriad development challenges. On the other hand, some have suggested that hubs are overhyped and under-delivering, and are unlikely to have a substantial long-term impact on economic growth.

The shortage of research-based evidence, to resolve these debates, stems partly from the topic's newness and fluidity, and from the fact that it may take several years before a startup or hub succeeds or fails. Africa's first hub, Ghana's Meltwater Entrepreneurial School of Technology, emerged in 2008 and startup accelerators only emerged on the continent following the 2011 launch of 88mph in Kenya.[43] While some research suggests it may take anywhere between three to 40 months to reach a break-even point, one article

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[38] Malik Fal, *Accelerating Entrepreneurship in Africa Innovations*, 8Innovations: Technology, Governance, Globalization, 149, 160-163 (2013); *see also* Randall Kempner, *Incubators Are Popping Up Like Wildflowers…But Do They Actually Work?,* 8Innovations: Technology, Governance, Globalization, 3, 4 (2013); Mark Essien, *Startup Incubators in Africa and Why They Don't Work,* (Feb. 28, 2015),http://markessien.com/startup-incubators-in-africa-and-why-they-dont-work/; Morgan McClain-McKinney, *Who Needs Incubators? A Lesson from Young Entrepreneurs in Sub-Saharan Africa*, Ventures Africa (Feb. 14, 2015), http://venturesafrica.com/who-needs-incubators-a-lesson-from-young-entrepreneurs-in-sub-saharan-africa/.

[39] LindileNdabeni, *The Contribution of Business Incubators and Technology Stations to Small Enterprise Development in South Africa*, 25 Development Southern Africa, 259 (2008); *see also* Robert Yawson, *The Place Technology Based Incubators in Ghana's Economic Development,* SSRN (Jun. 11, 2009) https://ssrn.com/abstract=1418103/.

[40] OlugbengaAdesida et al, *Innovation Africa: Emerging Hubs of Excellence* 96 (Emerald 2016).

[41] Ibid.

[42] Ibid.

[43] Tom Jackson, *Africa Tech Trends: The Age of Start-up Accelerators*, How We Made It in Africa (Feb. 16, 2015), http://www.howwemadeitinafrica.com/africa-tech-trends-the-age-of-start-up-accelerators/.

notes it may take up to five years to build a business.[44] AfriLabs Director TayoAkinyemi advises new technology hubs to assume that it will take "at least three years, probably more" for a hub to become sustainable.[45] Unsurprisingly, reliable observations and analysis of such phenomena lag several years behind.

At this time, the development of a robust framework characterizing the continent's hubs and their operations is prudent. Indeed, empirical research on Africa's high technology hubs will likely be stalled until an adequate research framework exists. The next section of this article introduces such a framework.

[44] Charles Rambo, *Time Required to Break-Even for Small and Medium Enterprises: Evidence from Kenya,* 6 International Journal of Management and Marketing Research, 81, (2013); *see also* Kelly Berold, *Accelerating Forward with KrestenBuch,* Finweek (Oct. 9, 2014), http://connection.ebscohost.com/c/articles/95842436/accelerating-forward-kresten-buch/.
[45] TayoAkinyemi, *Decoding #hubsustainability: Confronting the Critically Important yet Painfully Obvious*, Afrilabs (Mar. 30, 2015),http://www.afrilabs.com/2015/03/30/decoding-hubsustainability-confronting-the-critically-important-yet-painfully-obvious/.

Archetypes of African Technology Hubs

Most writings about Africa's technology hubs lack a consistent nomenclature. That is not unexpected, however, since there are dramatic hub-to-hub differences in terms of facilities, services, clientele, and organizational structure, among other factors. The physical and cultural environment of each hub is unique. In effect, generalizations of hubs are difficult to substantiate and are qualified with many exceptions. It helps, therefore, to create an adaptable framework for characterizing the hubs and their various aspects of operation.

A starting point for our framework can be found in research on cluster theory, adapted from the fields of economic geography and strategic management. Derived from the ideas of Alfred Marshall,[46] cluster theory posits that advantages exist in the geographic concentration of enterprises that compete and cooperate in a specific sector.[47] Cluster participation affords certain benefits to members of a regional network, including opportunities for coordination, mutual improvement, and productivity growth.[48]

This theory has been used to explain the relative successes and failures of high technology clusters in California's Silicon Valley and the Greater-Boston corridor known as Route 128, both regionally network-based industrial systems.[49] The concepts of clusters and urban agglomeration are potentially applicable in the context of African high technology hubs too.[50]

Advantages can be based on geography, human capital, natural resources, or a range of other economic and environmental factors. Knowing why clusters emerged or why they were successful, however, does not explain why they developed into certain kinds of high technology clusters seen or described in the literature in Africa.

A study on cluster-based growth in Africa divided cluster development on the continent into two broad categories: (i) the spontaneous congregation of enterprises and supporting entities in a geographic area, or (ii) intentionally induced by policymaking or 'constructed' (e.g. "technopoles" and industrial parks).[51] This study focused mainly on the first category

[46] Alfred Marshall, *Principles of Economics*, (Macmillan & Company 1890).
[47] Michael Porter, *The Competitive Advantage of Nations* (Free Press 1990).
[48] Michael Porter, *Location, Competition and Economic Development: Local Clusters in a Global Economy*, Economic Development Quarterly, (February 2000), http://home.furb.br/wilhelm/COMPETIV/Porter_Cluster3.doc/.
[49] AnnaleeSaxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route* 128 (Harvard University Press 1996).
[50] BanjiOyelaran-Oyeyinka& Dorothy McCormick eds., *Industrial Clusters and Innovation Systems in Africa* (United Nations University Press 2007).
[51] Douglas Zhihua Zeng ed., *Knowledge, Technology, and Cluster-based Growth in Africa* (World Bank 2008).

of clusters, with case studies drawn from clusters in the agricultural, metalworking to manufacturing sectors.[52]

Categorizing Africa's technology hubs has been attempted with minimal success. According to the 2016 World Bank Development Report ("the World Bank Report"), hubs in Africa can be divided into four main categories: government-led hubs, civil society led hubs, academic institution led hubs, and hybrid hubs.[53] According to the same study, Kenya is reportedly home to 11 hubs: five civil society led hubs (e.g., the iHub), four academic institution led hubs (e.g., University of Nairobi and Strathmore University account for two hubs each) and two hybrid hubs (e.g., m:Lab East Africa and GrowthHub).[54] No hubs in Kenya are government-led, according to that study.

Several commentators and researchers have confirmed, however, that the World Bank Report's statistics on hubs are already outdated, and that there are 27 active hubs in Kenya.[55] Based on our research, the number of Kenyan hubs has at least doubled since the World Bank's recent assessment. Additional organizations that could be classified as hubs include: KICTANET, Sinapis, Nest, Savannah Fund, Swahili Box, Lake Hub, Sote Hub, mtHub, Chandaria Business Innovation and Incubation Centre, ARO Fab Lab, Kenya Climate Innovation Centre and Gearbox. Further, this existing categorization framework misses many of the nuances that distinguish the various hubs, their operations, and their impact.

Another study identified three types of hubs in Southern Africa: traditional science parks, activity-based innovation centers, and co-creation hubs.[56] While path breaking, that study proposed a typology specific to Southern Africa which may apply differently to Eastern Africa or other regions of the continent. One reason is the different approaches to establishing innovation hubs. For instance, unlike those in Southern Africa, countries in Eastern Africa like Kenya, Ethiopia, Uganda, Tanzania and Rwanda have no government-led hubs that could be categorized as traditional science parks.[57] In addition, the existing models for categorizing hubs do not account for tech-focused business initiatives such as South Africa's 'Silicon Cape.'[58] As such, this paper proposes a somewhat broader framework for assessing hubs that could be applied across the continent.

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[52] Ibid.
[53] World Bank Group *World Development Report 2016: Digital Dividends*, World Bank (May 17, 2016), http://www.worldbank.org/en/publication/wdr2016/.
[54] Ibid.
[55] Victor Du Boucher, *A Few Things We Learned About Tech Hubs in Africa and Asia,* GSMA (Aug. 5, 2016), http://www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/things-learned-tech-hubs-africa-asia/; *see also* Gabriella Mulligan, *Niche Tech Hubs to Boom Across Africa in 2016*, Disrupt Africa (Mar. 7, 2016), http://disrupt-africa.com/2016/03/niche-tech-hubs-to-boom-across-africa-in-2016/.
[56] OlugbengaAdesida et al, *Innovation Africa: Emerging Hubs of Excellence* 40 (Emerald 2016).
[57] World Bank Group, *World Development Report 2016: Digital Dividends*, World Bank (May 17, 2016).
[58] Justin Spratt, *Can Cape Town become SA's Silicon Valley?,* TechCentral (Oct. 5, 2009), https://www.techcentral.co.za/can-cape-town-become-sas-silicon-valley/10348/; Simon Mundy, *South Africa: Silicon Cape?*, The Financial Times (FT.com) (Jan. 12, 2011), http://blogs.ft.com/beyond-brics/2011/01/12/south-africa-silicon-cape/; Martin Carstens, *6 Reasons Why SA's Western Cape Deserves tobe Called Silicon Cape,* Ventureburn (Apr. 30, 2013), http://ventureburn.com/2013/04/6-reasons-why-sas-

We have identified and defined three archetypes of "hubs": cluster hubs, company hubs, and country hubs.

First, a "cluster hub" refers to a cluster of distinct entities that are located physically close to one another, and therefore tend to promote regular and intimate interactions. Here, established cluster/agglomeration theory is most applicable. Second, a "company hub" describes a hub as a specific entity, attracting and defining its own community, and interacting with the outside world in a manner similar to a company. This is how "hubs" are most commonly referenced and understood in the grey literature we reviewed. Third, a "country hub" tier reflects a more macro view of a hub, where an entire country or region advertises itself as a progressive hub, and government policies guide the actions of the country or region. This terminology is most closely aligned with national and regional policy instruments.

Even within this taxonomy, of course, there can be substantial variations in hub structure, operation and overlap of the entities existing within the tiers. Notwithstanding such complications, the activities of individual actors are given helpful context when hubs are identified and analyzed within this three-tiered framework.

1. Cluster Hubs

The quintessential Cluster Hub in Kenya is found along Ngong (pronounced 'gong') Road, a major roadway connecting Nairobi's Central Business District to Ngong Town in the western outskirts of Nairobi.[59] Since 2011, a specific four-kilometer stretch of Ngong Road has become the nerve center of Kenya's tech boom.[60] Currently, six of the 11 Kenyan hubs listed in the 2016 World Bank Development Report are located on or around this particular section of Ngong Road.[61] The cluster of hubs, startups, and venture capital firms found within this four kilometer-stretch has been referred to as[62] "silicon savannah,"[63] "silicon

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western-cape-deserves-to-be-called-silicon-cape/;*See also,* Jessica Morris, *Silicon Savannah: Is Africa Tipped for a Tech Take-off?,* CNBC (Jan. 7, 2014), http://www.cnbc.com/2014/01/07/silicon-savannah-is-africa-tipped-for-a-tech-take-off.html/; Berenice Magistretti, Is Cape Town The New Silicon Valley?, Seedstars World (Jul. 13, 2015), http://www.seedstarsworld.com/blog/2015/07/is-cape-town-the-new-silicon-valley/.

[59] Dan Evans, *Welcome to the Silicon Savannah - Researching Africa's Startup Ecosystems,* Venture Capital for Africa (vc4a) (Apr. 18, 2014), https://vc4a.com/blog/2014/04/18/welcome-to-the-silicon-savannah-researching-africas-startup-ecosystems/.

[60] Upwardly Mobile: The Economist*, Kenya's Technology Start-up Scene is About to Take Off*, The Economist (Aug. 25, 2012), http://www.economist.com/node/21560912/; *see alsoKenneth Griffith, The Silicon Savannah - An Insider's View, Linkedin article (Jul. 18, 2014),* https://www.linkedin.com/pulse/20140708181255-31799348-the-silicon-savannah-an-insider-s-view/.

[61] World Bank Group *World Development Report 2016: Digital Dividends*, World Bank (May 17, 2016), http://www.worldbank.org/en/publication/wdr2016/.

[62] Stephanie Findlay, *Welcome to the 'Silicon Savannah*, Canadian Business (Jun. 10, 2013), http://www.canadianbusiness.com/global-report/global-report-welcome-to-the-silicon-savannah/.

[63] Guy Alexander, *Kenya's Tech Visionaries Lead the Way*, The Guardian (Sept. 15, 2013), https://www.theguardian.com/world/2013/sep/15/kenya-technology-visionaries/; *see also* Mathew Hussey,

avenue,"[64] "Nairobi's now African IT–synonymous Ngong Road,"[65] "tech row," "entrepreneurship corridor," and "entrepreneurship row."[66] Due to the numerous and substantial differences from Silicon Valley, we advocate for alternatives to the term "Silicon Savannah" when describing any part of the Nairobi tech scene. Our particular recommendation is the "Digital Savannah."

The pioneering and now anchoring entity along Ngong Road is one particular "company hub" called iHub (also known as Nairobi's Innovation Hub), founded in March 2010 by technopreneurs previously associated with the not-for-profit startup Ushahidi.[67] Following Kenya's disputed 2007 presidential election, Ushahidi developed a crowd sourced-mapping tool that garnered international attention.[68] The founding of the iHub along Ngong Road, as a space for the emerging technology community, followed from Ushahidi's success and popularity.[69]

The iHub occupies the top floor of a four-story building on Ngong Road, called the Bishop Magua Centre.[70] International donors and Ushahidi provided initial funding for the iHub space. The launch of iHub is considered by many as a key factor that positioned and transformed Kenya's capital, Nairobi, into a center for startups, technology and innovation.[71] According to a GSM (GroupeSpeciale Media) Association (GSMA) study, Kenyan entrepreneurs outside Nairobi (e.g., those located in Mombasa or Kisumu) tend to relocate closer to the Bishop Magua Centre and Ngong Road once their startups gain traction.[72]

Silicon Savannah - How Start-ups in Africa are Taking on Some of Humanity's Biggest Challenges, Huffington Post (Jan. 6, 2015), http://www.huffingtonpost.co.uk/matthew-hussey/african-startups-take-on-challenges_b_6416676.html.

[64] Lillian Nduati, *The Value of a Strong Tech Eco-system*, Startup Academy (Dec. 2, 2013), http://www.startupacademy.co.ke/blog/the-value-of-a-strong-tech-eco-system/.

[65] Jack Bright & Aubrey Hubry, *The Rise of Silicon Savannah and Africa's Tech Movement,* Tech Crunch (Jul. 23, 2015), http://www.techcrunch.com/2015/07/23/the-rise-of-silicon-savannah-and-africas-tech-movement/.

[66] Jason Loughnane, *GF Fellow Jason Loughnane: Nairobi's Tech Row*, Bankers Without Borders (Jul. 2, 2014), http://www.bankerswithoutborders.com/blog/gf-fellow-jason-loughnane-nairobis-tech-row/.

[67] World Bank Group, *World Development Report 2016: Digital Dividends*, World Bank (May 17, 2016), http://www.worldbank.org/en/publication/wdr2016/.

[68] M. Drouillard et al., *Digital Entrepreneurship in Kenya2014*, The GSMA Mobile for Development, GSMA Intelligence, 24 (Feb. 4, 2014), www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/digital-entrepreneurship-in-kenya-2014-2/.

[69] Ibid.

[70] *See*, Erik Hersman, *iHub: Nairobi's Tech Innovation Hub is Here,* White African,(Jan. 25, 2010), http://whiteafrican.com/2010/01/25/ihub-nairobis-tech-innovation-hub-is-here/; *see also*, Geoffrey York, *The Entrepreneurs of Africa's Silicon Savannah,* The Globe and Mail (Sept. 2, 2013) http://www.theglobeandmail.com/report-on-business/international-business/african-and-mideast-business/the-entrepreneurs-of-silicon-savannah/article14073645/.

[71] DipoleloMoime, *Kenya, Africa's Silicon Valley, Epicentre of Innovation,*Venture Capital for Africa (Apr. 25, 2016), https://vc4a.com/blog/2016/04/25/kenya-africas-silicon-valley-epicentre-of-innovation/.

[72] M. Drouillard et al., *Digital Entrepreneurship in Kenya2014*, The GSMA Mobile for Development, GSMA Intelligence, 24 (Feb. 4, 2014), www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/digital-entrepreneurship-in-kenya-2014-2/.

A 2014 report by the Vodafone Institute for Society and Communications[73] cites the iHub's success when recommending the establishment of additional co-working spaces, incubators and accelerators by companies, government and development organizations in Africa. The report argues that a comparative look at Silicon Valley is worthwhile since there, too, the proximity of institutions with similar interests, the concentration of expertise, and the pronounced culture of recommendations and networking are important factors for success in consolidating innovations.

Over the three years following iHub's launch, it incubated over 100 startups and was seeking further expansion at the Bishop Magua Centre, by then dubbed the "mecca for African ICT (information and communication technology) entrepreneurs."[74] Erik Hersman initially thought the space on the fourth floor of Bishop Magua was too big, but it was soon outgrown with a community of over 10,000 online and physical members.[75] According to iHub's own observations in 2013, their space at Bishop Magua had propelled them from being the space "where things happen, to the centre of where things happen, the centre of ideas on the future of this region and across Africa".[76]

Since the iHub moved into the Bishop Magua Centre in 2010, other hubs and a host of startups have clustered in that complex and the surrounding area. In addition to the iHub, three of the 11 tech hubs in Kenya listed in the 2016 World Bank Development Report are located at the Bishop Magua Centre: m:Lab East Africa, Nailab, and Akirachix.[77] Each of these entities serves a distinct subset of the overall entrepreneurship community: m:Lab is primarily an incubator focusing on very early stage startups, Nailab is an accelerator focusing on early to medium-stage startups, and Akirachix focuses on increasing the number and role of women in the technology scene.

The iHub community is also responsible for the 2014 creation of a new makerspace at the Bishop Magua Centre called Gearbox, a Kenyan makerspace for design and rapid prototyping.[78] Savannah Fund is another entity located at the Bishop Magua Centre. It is an accelerator fund set up by several partners, including an iHub founder, focusing on finding

[73] Julia Manske, *Innovations Out of Africa. The Emergence, Challenges and Potential of the Kenyan Tech Ecosystem*, Vodafone Institute for Society and Communications, 29 (2014), http://whiteafrican.com/wpcontent/uploads/2014/05/1404_VFI_Report_Innovations_out_of_Africa.pdf.
[74] Gemma Soles, *iHub a Mecca for African ICT Entrepreneurs,* UrbanAfrica.Net (Nov. 26, 2013), http://www.urbanafrica.net/urban-voices/ihub-mecca-african-ict-entrepreneurs/.
[75] Jimmy Gitonga, **iHub: A Growing Community,*iHub (Mar. 2, 2013), http://ihub.co.ke/blogs/12778.
[76] Ibid.
[77] World Bank Group, *World Development Report 2016: Digital Dividends*, World Bank (May 17, 2016), http://www.worldbank.org/en/publication/wdr2016/.
[78] Jessica Colaco, *Gearbox - A Space for Tinkering and Making Things*, iHub (Sept. 09, 2013), http://ihub.co.ke/blogs/15711/ *; See also,* Erik "Hash" Hersman, *Launching Gearbox, A Kenyan Makerspace*, White African (Sept. 09, 2013), http://whiteafrican.com/2013/09/09/launching-gearbox-a-kenyan-makerspace/.

and investing in East Africa's highest potential, pre-revenue startups.[79] As described in the section below, the Savannah Fund itself exhibits many characteristics of a company hub.

The Bishop Magua Centre is just one pole of the Ngong Road hub. Approximately four kilometres west of the Bishop Magua Centre is Piedmont Plaza – the base for Nairobi Garage, Nest and Sinapis. Outside Piedmont Plaza and the Bishop Magua Centre, the Ngong Road cluster is home to other key entities, including Growth Africa (formerly Growth Hub).

Characteristics of a Cluster Hub

A cluster hub is a relatively small geographical region containing a high density of hubs, as well as the infrastructure and organizations that support such hubs. The hubs within a cluster hub are generally independent entities that interact with one another. Such interactions include the sharing of physical spaces, Internet access, human resources/capital, and other resources. Within the cluster hub, members and users of one hub may use another hub's facilities or even join an alternative hub. Individuals seen as "experts" (e.g., engineering or IT experts, entrepreneurship coaches, intellectual property experts, etc.) frequently split their time within one or among the various hubs.

Supporting entities, such as food and beverage vendors (particularly coffee shops), serve all of the hubs within a cluster and often function as ad hoc meeting spaces where members from the various hubs gather and interact.

The services offered and the scope of activities in a cluster hub can vary widely. A cluster hub is likely to have at least one incubator, accelerator, shared-working space and investment entity. As the cluster hub develops, training and mentorship opportunities multiply. Specific experts, such as engineers and lawyers, may also be brought in when the cluster hub reaches a critical mass and the community requires such support on a regular basis.

The growth of a cluster hub can take several paths. In some cases, the founding member(s) of one hub may identify an unmet need and create a new hub to fill that void. Efficiency and proximity naturally lead the new hub to share facilities and resources with the original hub. The new entity may be an entirely separate entity (e.g., the iHub's emergence from Ushahidi), or may remain owned and operated by the original hub (e.g., iHub Research, an entity owned and operated by the iHub). Further, one hub's success appears to attract others to create similar but separate (and sometimes complementary) spaces (e.g., Nailab's existence next to iHub). The founder of the new hub may be a former user of the original hub, a friend of the original hub's founder(s), or an unrelated person drawn by the hub's success. Through a combination of the varying types of growth, multiple hubs now occupy

[79] Erik Hersman, *Launching the Savannah Fund in East Africa*, White African (June. 6, 2012), http://www.whiteafrican.com-launching-the-savannah-fund-in-east-africa/.

a substantial portion of the Bishop Magua Centre, a key point along the Ngong Road cluster.

2. CompanyHubs

The concept of a hub as a company recognizes that most hubs, when viewed independently from their regional ecosystems, are similar to for-profit or non-profit entities in structure and operation. Interestingly in the literature, critical language and analysis not present elsewhere tends to be used in commentary on individual company hubs. When hubs are viewed as independent operating entities as opposed to regional agglomerations, new issues emerge, including long-term sustainability, scalability, and, in some cases, even profit.

This lens typically reflects a micro-economic analysis, where individual hubs are structured, managed, and assessed like any other business. Financial monitoring and evaluation methods are essential in this context to quantify and value a hub's impact. In our view, this change in tone is a natural and expected progression, as these firms *per se* become increasingly important actors in Africa's economy.

While our classification of "cluster hubs" most easily aligns with established theories in strategic management and economic geography, most of the grey literature we reviewed defines hubs (implicitly) as particular companies. Based on the concept of a hub as a company, the literature then focuses on the scalability and sustainability of these ventures. This is particularly the case for hubs that offer support services to startups, such as co-working spaces, incubators, accelerators and maker-spaces. Writings about such topics are varied both in terms of geographic focus and sectoral focus. Such facts further support the categorization of certain individual organizations as hubs and vice versa.

The application of conventional business principles and success metrics to company hubs has gained support among the organizations themselves. For example, in 2013, iHub Research (i.e., the research arm of the iHub) released a comparative study of seven technology hubs in Africa: the iHub, Hive Colab (Uganda), Activspaces (Cameroon), kLab (Rwanda), MEST (Ghana), Bongo Hive (Zambia), and Kinu (Tanzania).[80] The report aimed to document the various ICT hub models emerging across the continent in order to determine how they differ, and to identify the challenges they face. The study yielded lessons learned, recommendations, and strategies for success.

While recognizing that the appropriate hub model will differ based on the country context, the report outlined "critical common success factors for a strong ICT hub:" government support (e.g., funding, market, infrastructure), science, technology and innovation, strategic partners (e.g., business partners, funders, mentors); community of members (e.g., entrepreneurs), human capital (i.e., skills, education, experience), research and

[80] Erik Hersman, *Afrilabs Provide a Model for African Innovation, Collaboration*, Memeburn (Feb. 8, 2011) http://memeburn.com/2011/02/afrilabs-provide-a-model-for-african-innovation/.

development, as well as monitoring and evaluation mechanisms.[81] Based on the high number of hub graduates and the emergence of numerous successful startups, the arguably optimistic report concluded, "the hype surrounding technological hubs can be justified."[82] Despite this, the report notes that most African hubs are in their infancy and thus their long-term self-sustainability is not yet certain.[83] Furthermore, the report finds that the success of individual hub models also depends on external factors that impact a country's potential for ICT growth: ICT GDP, government support for ICT, corruption levels, existing infrastructure, ICT budget allocation, investment in telecommunications, and prioritization of ICT initiatives.[84] Overall, the report suggests that hubs strive to achieve long-term sustainability by filling local gaps and resolving contextual needs rather than trying to replicate successful models achieved elsewhere.[85]

There are additional examples that show members within the hub community characterizing hubs as companies. Since November 2014, AfriLabs Director TayoAkinyemi has penned two pieces on hub sustainability. In Akinyemi's first post, she argued that Africa's hubs were fragile and had no clear path towards long-term sustainability. In March 2015, Akinyemi's second post proposed 11 lessons learned regarding hub sustainability on the African continent. The advice was the product of a series of Google Hangouts on hub sustainability held in November and December 2014.[86]Akinyemi explained that there was no single substitute for a typical technology hub, as "[a] hub is a workspace, Internet café, coffee shop, training centre, incubator, accelerator, event venue, maker space; [and] it's usually many of these at the same time."[87] While this presents opportunities, Akinyemi pointed out that it also posed challenges.[88] Hubs fill the gaps in the enabling environments of Africa's technology sectors by providing and serving as the necessary infrastructure to support local entrepreneurs.[89] However, problems arise when hubs overextend themselves and engage in too many activities that do not generate revenue.[90]

While noting that "the exact formula for a truly sustainable business model remains to be seen," Akinyemi offered the continent's technology hubs practical advice to achieve sustainability.[91]Akinyemi suggested that hubs plan for sustainability from the outset, regardless of whether they receive donor funding. While hubs should not depend on

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[81]Duncan Gathege& Hilda Moraa, *Draft Report on Comparative Study on Innovation Hubs Across Africa*, iHub Research 31-33, (May 2013)*http://research.ihub.co.ke/uploads/2013/may/1367840837__923.pdf.*
[82]Ibid.
[83]Ibid.
[84]Ibid.
[85]Ibid.
[86] Tom Jackson, *Afrilabs, AfriHive partner for hub sustainability series*, Disrupt Africa, (Nov. 13, 2014), http://disrupt-africa.com/2014/11/afrilabs-afrihive-partner-for-hub-sustainability-series/.
[87]TayoAkinyemi, *Decoding #hubsustainability: Confronting the Critically Important yet Painfully Obvious,* Medium, para 2 (Mar. 29, 2015), http://www.medium.com/@Temitayo/decoding-hubsustainability-confronting-the-critically-important-yet-painfully-obvious-5136a0d8cec1.88cny3c2/.
[88]Ibid.
[89]Ibid.
[90]Ibid.
[91]Ibid.

government support, Akinyemi recommended hubs align their priorities with government to ensure a cooperative relationship while still maintaining their independence.[92] To attract partnerships and investment, Akinyemi advised hubs to publicly communicate their impact to key stakeholders using accessible metrics.[93] Finally, as there is no "one size fits all" model for sustainability, Akinyemi noted that the road to sustainability would differ from hub to hub.[94]

Writings such as these firmly place the discourse about hubs into the business world. So it not surprising that, in March 2016, the iHub announced that it had received new investors "in order to help it grow, to tighten up its service offerings and make them more profitable, and to help it figure out how not to just find startups but to grow the ones that are getting traction."[95]

A potential conflict exists, however, because at the same time some hubs are expected to exist solidly in the nonprofit space. In 2012, the Aspen Network of Development Entrepreneurs (ANDE) and Village Capital undertook a study on the role of social-impact focused accelerators and released a report in 2013.[96] The study examined the global accelerator landscape, but the majority of the 52 accelerator operations surveyed were based in Africa.[97] The study provided a number of key findings with respect to the variables linked to the success and failure of accelerators as well as the sustainability of these ventures. First, the study found that a lower acceptance rate and rigorous selection process, as well as partnerships with in-country commercial investors are factors in favor of an accelerator's success.[98] The study also found that while 75 percent of accelerators depended on philanthropy to survive and grants funded 54 percent of all accelerator budgets, such funding was not statistically related to the success of incubated startups.[99] Based on these findings, the study concluded that the business models of social-impact accelerators had not been proven to generate sustainable revenue streams.[100]

The study further warned that accelerators may confront a "free rider" problem going forward: investors look to accelerators as "sourcing mechanisms," but do not view it as their role to support accelerators – in fact, only 20 percent of investors help to fund the

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[92] Ibid.
[93] Ibid.
[94] Ibid.
[95] Erik Hersman, *iHub: The Next Chapter*iHub (Mar. 11, 2016), http://ihub.co.ke/blogs/26994.
[96] Ross Baird, Lily Bowes &SaurabhLall, *Bridging the "Pioneer Gap": The Role of Accelerators in Launching High-Impact Enterprises* Aspen Institute Network of Development Entrepreneurs (June 2013), http://www.aspeninstitute.org/bridging-the-pioneer-gap-the-role-of-accelerators-in-launching-high-impact-entreprises/.
[97] Ibid.
[98] Ibid.
[99] Erik Hersman, *Mobilizing Tech Entrepreneurs in Africa: Innovations Case Narrative: iHub* 7:4 Innovations: Technology, Governance, Globalization 59 (2012), http://www.mitpressjournals.org/doi/pdf/10.1162/INOV_a_00152.
[100] Ibid.

operations of accelerators.[101] This imbalance adds to the complexity of assessing and sustaining individual hubs: Are they ordinary businesses themselves, or platforms for business that warrant different kinds of support?

Further external critiques of hubs are not difficult to locate. GSMA's Digital Entrepreneurship in Kenya 2014 survey of more than 230 startups across Kenya reveals that at least 70 percent of the country's startups are "not earning enough to maintain business and living expenses for a small team."[102]Overall, these developments appear to have enlightened the African technology community and, in turn, spurred a flood of critical pieces on Africa's hub and startup ecosystem. In its summary, the GSMA Report notes that while hands-on support for entrepreneurs is available through hubs and accelerators, there is insufficient support to meet demand. As a result, entrepreneurs appear to be very aware of the fact that they must increase their skills and balance out their teams but struggle to do so. Therefore, the report suggests that one-to-one mentorship across a broad variety of topics is desperately needed for start-ups, especially in marketing, technology access and skills, growth strategy, and business management.

The discourse of hubs as companies can creep into the goals, operations, and management of hubs, causing them to alter behaviors to better resemble those of traditional companies. In 2015, C4DLab, which was mentioned earlier in the article, announced that it would run on a "lean model" until it reaches a break-even point.[103] The reworking of C4DLab's business model reinforced the seriousness posed by the failure to confront the issue of hub sustainability. Startup accelerator 88mph's recent departure from Kenya for Nigeria also raised concern. Nikolai Barwell, former Nairobi-based director of 88mph, explained the accelerator was exiting Kenya in favor of Nigeria, where "the tech ecosystem is more profit-focused and there is less fluff."[104]

The now-common practice of applying the language of private companies to hubs is not without critics. Mostly such criticism is due to imposing corporate or non-profit oriented goals on entities that were originally intended merely to provide a community space where previously there was none. For example, prominent African technology entrepreneurs, including Mark Essien, have expressed concerns regarding the current trajectory.[105]

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[101]Ross Baird, Lily Bowes &SaurabhLall, *Bridging the "Pioneer Gap": The Role of Accelerators in Launching High-Impact Enterprises* Aspen Institute Network of Development Entrepreneurs, 23 (June 2013), http://www.aspeninstitute.org/bridging-the-pioneer-gap-the-role-of-accelerators-in-launching-high-impact-entreprises/.

[102]M. Drouillard et al., *Digital Entrepreneurship in Kenya2014*, The GSMA Mobile for Development, GSMA Intelligence, 24 (Feb. 4, 2014), www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/digital-entrepreneurship-in-kenya-2014-2/.

[103] Tom Jackson, *Nairobi's C4DLab to adopt lean model*, Disrupt Africa (Mar. 11, 2015), http://disrupt-africa.com/2015/03/nairobis-c4dlab-adopt-lean-model/.

[104]DrazenJorgic, *Kenya's technology push leaves investors cold,* Reuters, para 5 (Dec. 31, 2014), http://www.reuters.com/article/kenya-tech-idUSL6N0UE15920141231.

[105] Mark Essien, *Startup Incubators in Africa and why they don't work*, Venture Capital for Africa, (Apr. 21, 2015), https://vc4a.com/blog/2015/04/21/startup-incubators-in-africa-and-why-they-dont-work/.

Essien, founder of successful Nigerian startup Hotels.ng, took aim at the current approach taken by the majority of startup incubators in Africa. Essien's critique centers on the fact that the reigning incubation model has yet to yield any "big successes", as well as his belief that the fundamentals of entrepreneurship cannot be taught. Furthermore, the ANDE and Village Capital study mentioned above has found that the difficulty in assessing accelerator performance arose partly from the fact that many accelerators are not collecting data, or tracking graduates of their programs.[106] Such difficulty is echoed by a 2013 report by Dalberg,[107] which notes that while the concept of incubators and accelerators is not new, additional research is needed to determine what truly drives growth and impact on entrepreneurs in Africa.[108]

Such criticisms point to a half-way approach at corporatizing hubs: hubs are expected to grow, become sustainable, and do many other things that businesses do, but rarely make the effort to monitor, evaluate, and communicate their activities. The identity crisis that company hubs face is unsustainable.

Applying the unforgiving language of the business world to hubs means that entities must prove their value or are assumed obsolete and are subsequently abandoned, sold, or subject to takeover. In February 2015, USAID's Morgan McClain-McKinney questioned the role and usefulness of incubators in the context of sub-Saharan Africa's emerging markets.[109] McClain-McKinney sought to evaluate the success and utility of these ventures, but encountered numerous challenges in doing so. For McClain-McKinney, the challenge stemmed from the fact that the success of an incubator is generally measured on the basis of the number of program graduates or the number of startups that voluntarily exit the incubator, after receiving investments or other support.[110] The problem with this metric is that a likelihood of failure persists following a startup's exit from an incubator. While McClain-McKinney noted that a better measure of success would be to track the number of graduates continuing to operate their startups three to five years post-graduation, she also recognized that these figures were not available, as the vast majority of incubators in Africa have yet to be in existence for five years.[111]

Characteristics of a Company Hub

A company hub is characterized by its individuality. Unlike a cluster hub, a company hub is typically a separate legal entity. It may be for-profit or non-profit, and is able to enter into bilateral agreements with other entities. The company hub is also answerable to an

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[106] Ibid.
[107] Dalberg, *Digital Jobs in Africa: Catalyzing Inclusive Opportunities for Youth,* The Rockefeller Foundation, 13 (2013) http://www.dalberg.com/documents/Digital_Jobs_in_Africa.pdf.
[108] Ibid.
[109] Morgan McClain McKinney, *Who Needs Incubators? A Lesson from Young Entrepreneurs in sub-Saharan Africa* Ventures Africa (Feb. 14, 2015), http://venturesafrica.com/who-needs-incubators-a-lesson-from-young-entrepreneurs-in-sub-saharan-africa/.
[110] Ibid.
[111] Ibid.

identifiable entity, e.g., a group of shareholders, investors, or board members. Such stakeholders may or may not have in mind the best interests of the hub users. Company hubs may be structured with a variety of internal checks and balances, and may produce corporate-style documents such as strategic plans and earnings reports.

In light of their independence, the services provided by a company hub are likely to be less extensive than those available at cluster hubs consisting of multiple loosely organized or unconnected companies. Company hubs can, however, overcome this shortcoming by partnering with other company hubs. Individual company hubs may vary widely in their offerings to users and in other aspects, as shown in Tables 1 and 2.[112]

Table1: Company Hubs in Kenya located within Ngong Road Cluster.

Name of Hub	Type of Hub	Main Offering of Hub
iHub	Civil Society led	Co-working space/ pre-incubation
Nailab	Civil Society led	Incubation/Accelerator
m:lab East Africa	Hybrid	Incubation
Nairobi Garage	Hybrid	Co-working space
Sinapis	Hybrid	Accelerator
Savannah Fund	Hybrid	Accelerator
Gearbox	Civil Society led	Makerspace
Akirachix	Civil Society led	Co-learning space
88mph (inactive)	Hybrid	Accelerator

Table 2: Company Hubs in located outsideNgong Road Cluster Hub.

Name of Hub	Location of Hub	Type of Hub	Main Offering of Hub
Fab Lab Nairobi	University of Nairobi	Academic Institution led	Makerspace
iLabAfrica/iBizAfrica	Strathmore University	Academic Institution led	Incubation
Chandaria BIIC	Kenyatta University	Academic Institution led	Incubation
Kenya CIC	Strathmore University	Academic Institution led	Co-working space/Accelerator
C4D Lab	University of Nairobi	Academic Institution led	Incubation
GrowthHub/ Growth Africa	Kilimani, Nairobi	Civil Society led	Accelerator
Lake Hub	Kisumu	Civil Society led	Incubation
Sote Hub	Voi	Civil Society led	Co-working/Incubation/ Accelerator
SwahiliBox	Mombasa	Civil Society led	Incubation
ARO Fab Lab	Kisumu	Civil Society led	Makerspace
KICTANET	Virtual (online only)	Hybrid	ICT reform catalyst (online platform)

[112] The categorizations used in the column "type of hub" are borrowed from the World Bank Report.

3. Country Hubs

The category of country hub recognizes that, in addition to small geographic areas emerging as cluster hubs, very large geographic areas can become known as centers of entrepreneurship activities. This is an especially important archetype in terms of government policy initiatives. While innovation policy is often made at local level, it is also very often the focus of national-level attention. Therefore, discussions about countries as technology hubs are most closely aligned with theoretical concepts and literature on national systems of innovation.[113]

In Africa this is particularly, but not exclusively, evident in tech entrepreneurship. As discussed below, the country hub may evolve intentionally due to government policies (government-led country hubs) or unintentionally due to an organic clustering of like-minded entrepreneurs in a city, country, or region (sector-led or "government-follows" country hubs, or a combination thereof). Although the term "country hub" implies a political boundary, these hubs are not explicitly limited to entire countries – regions smaller and larger than a country may also qualify.

Kenya exemplifies the sector-led or "government follows" country hub. Since the launch of M-Pesa in 2007 and other technological milestones such as Ushahidi and the iHub, Kenya has been recognized as Africa's leading technology hub.[114] The country has been hailed as the origin of technological ventures on the continent, leading to the Silicon Savannah moniker,[115] or our preferred term "Digital Savannah." Going forward, Kenya is anticipated to maintain this lead ahead of other African countries.[116] Below, a variety of government actions are described that illustrate Kenya's intentional and continued development as a country hub.

Vision2030, a new Constitution, and the ICT Masterplan

The Kenyan government has set out a detailed action plan designed to further Kenya's reputation as a country hub. These actions include the enactment of ICT friendly laws and policies, investment in critical ICT infrastructure, and the establishment of e-services.

Launched in 2008, Vision 2030 (the country's development blueprint) is a foundation to Kenya's development as a country hub. The blueprint recognizes the ICT sector's potential

[113] Lundvall, B, ed. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning* (1992).
[114] Sophie Mongalvy, *Inside the African Tech Hub Rising in Nairobi*, Bloomberg News (July 30, 2015) https://www.bloomberg.com/news/articles/2015-07-29/inside-the-african-tech-hub-rising-in-nairobi/.
[115] DipoleloMoime, *Kenya, Africa's Silicon Valley, Epicentre of Innovation,* Venture Capital for Africa (Apr. 25, 2016), https://vc4a.com/blog/2016/04/25/kenya-africas-silicon-valley-epicentre-of-innovation/.
[116] Lily Kuo, *African startups are defying the global tech slowdown*, Quartz Africa (Jan. 12, 2016), http://qz.com/592119/african-startups-are-defying-the-global-tech-slowdown/.

to foster economic development and to improve quality of life. Vision 2030's overall aim is to transform Kenya into an industrialized, middle-income country by 2030. Progress is to be achieved by way of five-year, medium term plans. Currently, the blueprint is in its second medium term plan.

Under the first medium term plan, Kenya transitioned to a new Constitutional dispensation that introduced a partially devolved government. Milestones of the first medium term plan in the ICT sector included the laying of three undersea submarine fiber-optic cables, linking Kenya to the global broadband highway, and the completion of a 5,500km terrestrial fiber-optic network. These milestones were achieved in 2010, the same year that the iHub was launched. High-speed Internet access enabled the development of Kenya's ICT industry. From 2009 to 2012, Internet subscriptions increased over 500 percent – from 1,579,387 to 8,506,748.[117] During this time, Kenya also established an open-data portal that provides public access to government data, and multinationals such as Google and IBM opened offices in Nairobi.[118]

The second medium term plan (2013-2017), entitled "Transforming Kenya: Pathway to devolution, socio-economic development, equity and national unity", identifies ICT as one of the foundations for national transformation.

> "Kenya's vision of knowledge based economy aims at shifting the current industrial development path towards innovation where creation, adoption, adaptation and use of knowledge remain the key source of economic growth. ICT is a critical tool for expanding human skills and rests largely on a system of producing, distributing and utilizing information and knowledge that in turn plays a great role in driving productivity and economic prosperity."
> Government of Kenya, Vision 2030 2nd Medium Term Plan, 21 (2013-2017)

The National ICT Masterplan guides the country's ICT transformation. Launched in 2014, the plan provides for four flagship projects: the upgrading of national ICT infrastructure, improvement of public service delivery through the use of ICT, development of the ICT industry, and the upgrading of ICT capacity. The Masterplan's aim is "to make Kenya an ICT hub and a globally competitive digital economy."[119]

The Masterplan notes certain ongoing activities that put Kenya on the map as an African ICT hub, including e-government, infrastructure projects, public-private partnerships (PPP's) and support of private initiatives.

The National Optic Fibre Backbone Infrastructure (NOFBI) project aims to increase connectivity and enable communication across Kenya's 47 counties. In phase 1 of the project, completed in 2009, NOFBI access points were established in major towns in Kenya,

[117] Government of Kenya, Vision 2030 2nd Medium Term Plan (2013-2017).
[118] *Kenya Open Data Portal*, https://www.opendata.go.ke.
[119] Kenya ICT Authority, National Masterplan, 39 (2014).

covering a total distance of 4,300km.[120] In phase 2 of the project, launched in 2014, the government aims to extend connectivity to all 47 counties covering a total of 2,100km.[121] According to the 2015 Report of the Kenya National Bureau of Statistics, the implementation of the NOFBI project led to an exponential increase in the number of Internet users by 23 percent, from 21.3 million in 2013 to 26.3 million in 2015.[122] The County Connectivity Project (CCP) utilizes the NOFBI to connect the national government to county governments and to interconnect county governments. It is aimed at enhancing the quality of e-government services; thereby improving service delivery to citizens.

The Masterplan also recognizes the importance of incubators and co-working spaces, referred to as "local ICT development groups."[123] In turn, the government established incubation hubs at Kenyatta University (Chandaria Business Innovation and Incubation Centre) in 2011 and at the University of Nairobi (Computing for Development Lab) in 2013. These innovation centers were situated in public universities to afford citizens opportunities to innovate, thereby furthering national development.

From 2012 to 2015, the government partnered with Nailab to launch a KES 144 million (which is equivalent to USD 1.4 million) incubation project.[124] The creation of the incubator was carried out as a Business Process Outsourcing project, which allowed the government's commitment to supporting startups to be outsourced to a specialist hub. Over the three-year contract period, the program aimed to incubate 30 startups countrywide. Digital Villages, also known as 'Pasha Centres' ("pasha" is a Swahili word for "inform"), are another example of a PPP. Launched in 2009, Pasha Centres are essentially ICT hubs created to bring online services to marginalized communities.[125]Private entrepreneurs who secure loans from the ICT Authority operate these centers.[126] The benefits of this initiative are two-fold: it not only provides jobs to youth but also ensures digital inclusion across Kenya. The ICT Authority reported that there were approximately 61 operational Pasha Centres in April 2016, but statistics available via the Kenya Open Data portal suggest that figure is likely inflated.[127]

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[120] Kenya ICT Authority, *National Optic Fibre Backbone Infrastructure,* ICT Authority, http://www.icta.go.ke/national-optic-fibre-backbone-nofbi/#.
[121] Ibid.
[122] Kenya National Bureau of Statistics, *Economic Survey 2015* 19 (2015), http://www.knbs.or.ke/index.php?option=com_phocadownload&view=category&id=107:economic-survey-publications&Itemid=1181.
[123] Kenya ICT Authority, National ICT Masterplan, 35 (2014).
[124] Kenya ICT Authority, *Nailab Incubation Project* ICT Authority, http://www.icta.go.ke/incubation-nailab-incubation-project/.
[125] Peter Drury, *Kenya's Pasha Centres: Development Ground for Digital Villages*, Cisco (Jan 2011) http://www.cisco.com/c/dam/en_us/about/ac79/docs/case/Kenya-Pasha-Centres_Engagement_Overview_IBSG.pdf.
[126] Kenya ICT Authority, *Digital Villages: Pasha Centres*, ICT Authority http://www.icta.go.ke/digital-villages-pasha-centres/.
[127] Kenya ICT Authority, *Digital Villages: Pasha Centres*, ICT Authority http://www.icta.go.ke/digital-villages-pasha-centres/; *see also*Kenya Open Data, *Distribution of Pasha Centres in Kenya (2016 Update,* Kenya Open

Despite this, the development of Konza Technology City remains the kingpin of government efforts to advance Kenya to a "country hub". Konza is a massive Vision 2030 flagship project with a vision "to be a sustainable, world class technology hub and a major economic driver for the nation, with a vibrant mix of businesses, workers, residents and urban amenities."[128] The project was initiated in 2009 with the procurement of a 5,000-acre parcel of land located 60km southeast of Nairobi. In phase 1 of the project, the authority made a call for investors to take up 24 parcels of land for development. It is estimated that the first phase of the project will be complete and ready for occupation in 2017. Konza is expected to host business processing, outsourcing, residential areas, a university focused on research and technology, hotels, shopping malls, schools and hospitals.[129] The project, which will take 20 years to complete, is set to host the largest technology hub in East and Central Africa.

Characteristics of a Country Hub

A country hub, then, is a relatively large geographic area with several sub-regions that are similarly governed (typically this is a single country although, as we discuss below, characteristics of a country hub are discernable in multilateral regional political bodies). There are a number of critical factors for countries aiming to establish themselves as a hub: presence of an ICT regulatory framework, the existence and implementation of government policies, a highly educated and skilled workforce, a business friendly environment, incentives for private sector development, and a viable IT infrastructure, among others. Intentional efforts toward formation of a country hub typically involve local and/or national governments addressing these factors through policies, procurement and public relations.

A country can become a technology hub either led or followed by conscious government policy choices and decisions to encourage, facilitate and foster innovation while enhancing the uptake of ICT by locals. Kenya undertakes this process by building ICT capacity in its human resources, creating a foundation for Internet infrastructure and creating an enabling environment for technology startups.[130] The implementation and impact of projects under the named policies are addressing these areas in a bid to strengthen Kenya's position as Africa's leading technology hub.

Above, Kenya is discussed as one example of a country hub. Rwanda, Tanzania and Uganda are also taking steps to assert themselves as country hubs, particularly in the area of technopreneurship.[131] Country hubs may further evolve intentionally into multi-national

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Data (Mar. 21, 2016), https://www.opendata.go.ke/ICT/Distribution-of-Pasha-Centers-in-Kenya-2016-Update/nvcf-4k6c/data.

[128] Konza Technology City, *The Vision*, www.konzacity.go.ke/the-vision/.

[129] Ibid.

[130] In 2015, a new Companies Act was enacted enabling individuals to form single member companies.

[131] Tanzania Invest, *Tanzania to Become ICT Hub in East and Central Africa* (Aug. 5, 2015), http://www.tanzaniainvest.com/telecoms/Tanzania-to-become-ict-hub-in-east-and-central-africa/; *see also*

regional hubs through joint collaboration and implementation of regional policies. There is evidence that the East African Community (EAC) is cooperating with a common goal of regional integration in the area of ICT – perhaps, with the ultimate goal of becoming the equivalent of a regional country hub.[132] This cooperation, evidenced by a Protocol for Cooperation on ICT Networks and a Model ICT policy framework, is aimed at harmonizing ICT policies across all member states in order to increase penetration of ICT and to encourage innovation in ICT.[133]

Challenges to such regional integration remain, including a lack of convergence of the ICT regulatory frameworks[134] and different timelines for infrastructure development in the six EAC member states.[135] Despite high levels of political unity and shared development goals, diverse needs country-to-country will complicate establishment and maintenance of regional-level country hubs.

Republic of Rwanda Ministry of Youth and ICT, *Co-creating a Smart Rwanda, Smart Africa and Smart World*, http://www.myict.gov.rw/ict/smart-rwanda/smartrwanda-concept/;
Joseph Mayton, *Uganda: Government Plans to Set Up ICT Hub*, IT News Africa (June 1, 2015), http://www.itnewsafrica.com/2015/06/uganda-govt-plans-to-set-up-ict-hub/.

[132] Maurice Okore, *East Africa to expand One Network Area to Data,* New Vision (Apr. 3, 2015), http://www.newvision.co.ug/new_vision/news/1323586/east-africa-expand-network/; *see also* Frank Kanyesigye, *EAC eyes Stronger ICT Agenda*, The New Times, Rwanda (Sept. 4, 2013), http://www.newtimes.co.rw/section/article/2013-09-04/68906/.

[133] The New Times Rwanda, *EAC Ministers Approve Bill on One Stop Border Posts*, The New Times Rwanda (Feb. 26, 2012), http://www.newtimes.co.rw/section/article/2012-02-26/88973/; see also East African Legislative Assembly, Report of the Committee on Communications, Trade and Investments on the On-Stop Assessment of Regional Cooperation in ICT, EALA (Nov. 2013); http://www.eala.org/uploads/Report%20-%20Onsport%20Assment%20on%20EAC%20ICT%20-%20Nov%2011-15%202013%20Partner%20States-tabled%20on%2025%20Nov%202013-NBO.pdf/;
East African Communications Organization, *EAC Model ICT Framework* (Mar. 20, 2015), EACO, http://www.eaco.int/docs/WGsReports/Draft_Model_ICT_Policy_KGJ_March_2015.pdf.

[134] Joseph Kariuki, *Regulatory Convergence of ICT sectors in the East African Community (EAC): Challenges for the current legislative and regulatory frameworks and lessons from the European Union Experience*, IEEE Xplore, (2013), http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6701794.

[135] Frank Kanyesigye, *EAC eyes Stronger ICT Agenda*, The New Times, Rwanda (Sept. 4, 2013), http://www.newtimes.co.rw/section/article/2013-09-04/68906/.

Discussion/ Analysis

The cluster hub and company hubs of Nairobi's vibrant technology scene developed organically and the Kenyan government has positioned itself to capitalize on that success by way of new complementary initiatives, aiming at developing Kenya into a country hub. While there are instances of collaborative interaction between the three tiers, there is also the potential for conflict between the country hub, Nairobi's company hubs and the cluster hub of Ngong Road. Beyond collaboration and conflict, however, evidence suggests that the tiers also compete.

Table 3 contains a summary of the archetypes of hubs we have identified.

Table 3: Archetypes of African Technology Hubs.

	Cluster Hub	**Company Hub**	**Country Hub**
Characteristics	Small geographical region (e.g. a neighborhood, municipality, urban corridor) containing a high density of hubs, and supporting entities.	Separate legal entity (for-profit or non-profit) able to enter agreements, accountable to investors/funders and stakeholders.	Large geographic area with distinct political identity and/or several similarly governed sub-regions (e.g., a country, countries or region).
Development	One company hub's success attracts others; member(s) of existing company hub create(s) a new hub in close proximity to original company hub; association/partnership (formal or informal) between separate company hubs.	Unmet need identified and new entity created to satisfy void. Driven by entrepreneurial individuals and/or investors.	Government policymaking as leader (to strategically develop strengths in a particular field, e.g. ICTs) or follower (to identify and capitalize on emerging strengths).
Governance	Informal, community-led.	Funders/investors, board, executives.	Government officials.
Factors for success	Hub-to-hub interaction and sharing of resources (e.g., physical spaces, Internet access, human resources, venture capital).	Sustainability, scalability, profitability.	Regulatory framework; government policies; educated/skilled workforce; business environment; incentives for private sector development; IT.
Kenyan examples	Ngong Road	iHub	Kenya

1. Hubs as Complementary and Collaborative

There are complementary relationships both between the cluster hubs and the company hubs and between the company hubs/cluster hubs and the country hubs.

Company Hubs and Cluster Hubs

The settlement of many company hubs in one location forms a cluster hub. This co-location results in the geographical concentration of open-working spaces, incubators, accelerators, startups, and venture capitalists, which together derive the benefits of collective efficiency common in clusters. Having various actors in the cluster offering diverse services creates an opportunity for mutual benefits from the roles and responsibilities of the others.

For instance, the different hubs at the Bishop Magua Centre (i.e., the iHub, Nailab, m:Lab and AkiraChix) are made up of distinctively different models, offering different services to their startups but with the common goal of cultivating early stage startups. There consists an open working space where entrepreneurs meet (iHub), an incubator that provides training and mentorship to early stage mobile startups (m:Lab), and an accelerator that provides rapid fix-term mentorship, funding, and education to early-stage growth driven startups (Nailab). It is common to find startups that have been part of these different hubs at different stages of their growth.

The concentration of different services in one area results in the concentration of technology entrepreneurs in that area, which in turn facilitates the accumulation of knowledge and skills, thus generating more innovation.

Besides benefitting startups, company hubs attain sustainability by relying on the structure of a cluster hub i.e., a geographical concentration of distinct hub models offering different services. Thus, company hubs do not stretch their budgets in order to meet all the needs of a given startup, one of the factors known to hamper the sustainability of hubs.

Company / Cluster Hubs and Country Hubs

The successes of company hubs and cluster hubs have the ability to elevate the status of a country hub on the international stage. Kenya's company and cluster hubs continue to position the country as the regional leader in technology. The activities of the iHub, for instance, have highlighted Kenya's potential to be a center of innovation on the African continent.

The company and cluster hubs are also considered to be necessary factors in sustaining the entrepreneurship goals of a country hub. In this light, company and cluster hubs fulfill government mandates of training and creating a startup culture, factors that are key to the creation of a technology revolution in Kenya and other African countries. Through

public/private partnerships, the government's commitment to supporting start-ups is outsourced to specialist company hubs. A key example is the ICT Authority's partnership with the accelerator Nailab. In the absence of these partnerships, company hubs fill the gap and rely on their own resources to train entrepreneurs.

Similarly, supports and policies to build country hubs assist in the sustainability, scalability, value, and impact of the cluster and company hubs. These policies relate to Internet infrastructure and the creation of an enabling environment necessary to attract foreign investment, to reduce the costs of doing business for company hubs and startups, and to eliminate barriers to entry for new entrants.

The promotion of country hubs continues to be an important part of innovation systems in a country and consequently in the companies and clusters that exist there. For example, the availability of cheap, reliable Internet in Kenya is attributed to the laying of three undersea fiber optic cables in 2010 and the ongoing National Optic Fibre Backbone Infrastructure Project.

The government has also changed many of its policies with a view to create an enabling environment for startups and company hubs and to attract foreign investment. For example, a new Companies Act was enacted in 2015 enabling the formation of single member companies and making it possible for foreign companies to be registered by the use of electronic documents. It also did away with the mandatory requirement of a company seal and company secretary for private companies with a share capital of less than KES 5 million (which is equivalent to USD 50,000). The Companies (General) regulations also provide Model Articles of Association thus making it easier and faster for entrepreneurs to register their companies. Through these efforts, Kenya's Ease of Doing Business rank has improved from 129 in 2014 to 108 in 2015. The government has also put in place Huduma (Swahili for 'service') centers, which aim to transform public service delivery by providing a one-stop shop for government services including registration of business names, national identity cards, drivers' licenses, and filing of tax returns, among others. Through these and ongoing efforts, Kenya has become a leading destination for direct foreign investment in Africa.

2. Hubs in Conflict

The primary conflict among the three archetypes of hubs we have identified stems from a number of ICT-related laws and policies (including drafts and proposals) by the country hub, which appear to have a negative impact on the scalability and/or sustainability of both company hubs and cluster hubs. Three recent examples illustrate this conflict: the proposed law to regulate ICT practitioners, the country hub's stance on Bitcoin and other crypto-currencies in Kenya, and the draft regulations on electronic transactions and cyber security. Each example will be discussed in turn.

In June 2016, the Information Communication Technology (ICT) Practitioners Bill, 2016 was published in the Kenya Gazette[136] and is set to be tabled in Parliament as a Private Member's Bill.[137] The Preamble of this "Anti-Innovation" Bill[138] states that it is an Act of Parliament to provide for the training, registration, licensing, practice, and standards of ICT practitioners.

According to iHub Executive Director Josiah Mugambi, the Bill is "hugely detrimental to the ICT industry"[139] and has caused "much concern and angst among people in the ICT industry in Kenya."[140] As a result, the iHub hosted a workshop session to familiarize its members with the contents of the Bill, particularly those relating to registration and licensing of ICT practitioners which have a direct impact on the iHub members who work as freelance software consultants.[141] In July 2016, the iHub together with a number of ICT industry stakeholders drafted and presented a memorandum to Parliament[142] in which they described the Bill as "ill-advised and completely out of touch with the realities in the ICT industry today."[143] Among the issues raised by the iHub and others in the memorandum are the lack of stakeholder participation in the drafting of the Bill, the lack of congruence between the Bill and various government policies on ICT, labour, youth, and employment. The memorandum by the iHub and others concludes that innovation and learning/knowledge, technology transfer, and fostering technology entrepreneurship will suffer if the Bill is passed by Parliament in its current form.[144]

The regulation of crypto-currencies such as Bitcoin and blockchain technology in Kenya is another example of conflict between the country hub and various company hubs. In December 2015, the Central Bank of Kenya issued a public notice cautioning the public on "virtual currencies such as Bitcoin." Further, the Central Bank declared that such currencies

[136] Kenya ICT Practitioners Bill (2016), http://kenyalaw.org/kl/fileadmin/pdfdownloads/bills/2016/InformationCommunicationTechnologyPractitioners_Bill_2016.pdf.
[137] Sandra Chao-Blasto, *ICT secretary disowns Bill seeking to have practitioners licensed* Business Daily Africa (July 7, 2016), http://www.businessdailyafrica.com/Corporate-News/ICT-secretary-disowns-Bill-/-/539550/3284184/-/fmb8g1/-/index.html.
[138] MainaWaruru, *Opposition To Kenyan "Anti-Innovation" ICT Bill Grows* Intellectual Property Watch (July 13, 2016), http://www.ip-watch.org/2016/07/13/opposition-to-kenyan-anti-innovation-ict-bill-grows/.
[139] Josiah Mugambi, *An update on the proposed ICT Practitioners' Bill,* iHub (Aug. 19, 2016), http://ihub.co.ke/blogs/28245/.
[140] Ibid.
[141] Ibid.
[142] Ibid.
[143] A copy of the Stakeholders' Feedback on the ICT Practitioners Bill is available online: https://drive.google.com/file/d/0Bw6KfbaBAWJ_TU5jOWRBSnhOLUE/view/.
[144] MbuguaNjihia, *3 Concerning Issues Regarding Kenya's Information Communication Technology Practitioners Bill*iAfrikan (July 8, 2016), http://www.iafrikan.com/2016/07/08/3-concerning-issues-regarding-kenyas-information-communication-technology-practitioners-bill-that-need-to-be-addressed/; *See also*: John Ngirachu, *Bloggers raise storm over draft ICT Bill* Daily Nation (July 8, 2016), http://www.nation.co.ke/news/Bloggers-raise-storm-over-draft-ICT-Bill/1056-3284286-rpw0tx/index.html.

were not legal tender in Kenya and the public should "desist from transacting in Bitcoin and similar products."[145]

This move appears to be in direct conflict with the existence of company hubs such as BitHub.Africa, a commercial Kenyan-based blockchain accelerator driving the adoption of blockchain technology and solutions across Africa.[146] According to the founder of BitHub.Africa, the Central Bank should take time to assess the potential of blockchain technology to reduce costs and enhance transparency across multiple sectors of the economy.[147]

The final example of conflict between the country hubs and the company hubs is the proposed draft Kenya Information and Communications Regulations on Electronic Transactions[148] and Cyber security,[149] prepared by the Communications Authority of Kenya. According to iHub Executive Director Josiah Mugambi, there are two main problems with the draft regulations: the requirement that owners of public Wi-Fi networks are required to register their users and the requirement that all Kenyan companies ought to host their websites locally.[150] The Wi-Fi registration requirement has elicited considerable criticism both locally[151] and abroad.[152]On the requirement to host websites by Kenyan companies

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[145]Public Notice: Caution to the Public on Virtual Currencies such as Bitcoin, Central Bank of Kenya (Dec. 2015), https://www.centralbank.go.ke/images/docs/media/Public_Notice_on_virtual_currencies_such_as_Bitcoin.pdf/.

[146] Diana Ngo, *BitHub Africa's Founder: 'Achieving the Dream of Global Inclusiveness' with Bitcoin*BTCManager (Jan. 23, 2016), https://btcmanager.com/news/business/bithub-africas-founder-satoshis-innovation-brings-us-closer-to-achieving-the-dream-of-global-inclusiveness/.

[147]Ibid.

[148] Victor Nzomo, *You Will Need a License to Sell Stuff on Whatsapp: Thoughts on the Electronic Transactions Regulations 2016 by Communications Authority,* Centre for Intellectual Property and Information Technology Law (CIPIT) Blog (Jan. 19, 2016), http://blog.cipit.org/2016/01/19/you-will-need-a-government-license-to-sell-stuff-on-whatsapp-thoughts-on-the-electronic-transactions-regulations-2016-by-communications-authority/.

[149] Josiah Mugambi, *Of cyber security and public wifi,*iHub (July 2, 2015), http://ihub.co.ke/blogs/24750.

[150]Ibid.

[151] Josiah Mugambi, *Of cyber security and public wifi,*iHub (July 2, 2015), http://ihub.co.ke/blogs/24750*; see also*: Moses Kemibaro, *Kenya's Communication Authority Goes All 'Big Brother' on Public WIFI Networks to Curb Cybercrime,* Moses Kemibaro (July 1, 2015), http://www.moseskemibaro.com/2015/07/01/kenyas-communications-authority-goes-all-big-brother-on-public-wifi-networks-to-curb-cybercrime/;
Victor Nzomo, *State Surveillance, Mixed Signals and Seven Years in Jail: Thoughts on Cybersecurity Regulations 2016 by Communications Authority* Centre for Intellectual Property and Information Technology Law (CIPIT) Blog (Jan. 18, 2016), http://blog.cipit.org/2016/01/18/state-surveillance-mixed-signals-and-seven-years-in-jail-thoughts-on-cybersecurity-regulations-2016-by-communications-authority/;
Sidney Ochieng, *Deciphering the Kenya Information and Communications Act Amendment Drafts,*iAfrikan (Feb. 20, 2016), http://www.iafrikan.com/2016/02/20/decipehering-the-kenya-information-and-communications-act-amendment/.

[152] Jillian York, *Kenya to Require Public Wi-Fi Users to Register with Phone Number* Electronic Freedom Frontier (July 14, 2015), https://www.eff.org/deeplinks/2015/07/kenya-require-wireless-users-register-phone-number; *see also* Karl Bode, *Kenya's Ingenious Solution to Cybercrime: Register Every Wi-Fi User and Device with The Government*Techdirt (July 6, 2015),

locally, the view of the iHub's Executive Director is that it ought to be a business decision for companies to make based on a determination of various factors, including cost, uptime, reliability, and security.[153]

3. Hubs in Competition

Competition can be defined as interaction between the tiers, in which the growth, success and/or failure of a particular tier depends on gaining a share of the limited market. One example of this potential for competition is the government's flagship project of Konza Technology City (i.e., the development of Kenya into a country hub).

Ultimately, Konza can take one (or some combination) of two paths – either collaborative or competitive.[154] Under a collaborative or complementary approach, Konza could serve to accelerate synergy between Konza and the so-called "iHub community" (i.e., the Ngong Road Cluster Hub and Nairobi's Company Hubs).[155] In this form, the country hub's policies would not serve to displace the existing company hubs or cluster hubs of multiple companies. Rather, the country hub serves as a platform enabling members of the other tiers to operate more productively.[156]

Alternatively, Konza also has the potential to undercut the organic 'iHub community' in at least three ways.[157] First, there remains a limited supply of local talent in Kenya. As such, a competition for top talent is conceivable. In this scenario, Konza could compete with the other tiers by attracting talent to the country hub and away from existing hubs.

Second, the government's focus on Konza could result in the prioritization of the country hub over the acceleration of the Ngong Road cluster hub and associated company hubs. Practically, this could take the form of government funds dedicated to improving infrastructure (e.g., roads, electricity, water and sanitation) in Konza rather than within Nairobi.

Third, Konza's development could disrupt the existing innovation ecosystem and encourage competition by (1) dividing the 'iHub community' between the Cluster Hub of Ngong Road and country hub of Konza and/or (2) isolating Konza-based developers and entrepreneurs from end-users in Nairobi and elsewhere in Kenya. The success of M-Pesa, among others, is commonly attributed to the ability of its innovators to liaise with end-users, become attuned to local needs, and update the product accordingly.[158]

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https://www.techdirt.com/articles/20150701/13054431518/kenyas-ingenious-solution-to-cybercrime-register-every-wi-fi-user-device-with-government.shtml.

[153] Josiah Mugambi, *Of cyber security and public wifi,*iHub (July 2, 2015), http://ihub.co.ke/blogs/24750.

[154] Michael Blowfield& Leo Johnson, *Turnaround Challenge: Business and the City of the Future*, 214 (2013).

[155]Ibid, 216.

[156]Ibid.

[157]Ibid, 215-216.

[158] Michael Blowfield& Leo Johnson, *Turnaround Challenge: Business and the City of the Future*, 215 (2013).

While the Konza development is still in progress, there is already evidence of tier-to-tier competition. The lack of local interest and investment in Konza is one example of this competitive sentiment.[159] Entrepreneurs and investors from the Ngong Road cluster hub and Nairobi's individual company hubs have expressed misgivings regarding Konza's likely impact, including the iHub's Erik Hersman who noted that Konza's success was "a bit of a long shot."[160]

[159] Tom Jackson, *Kenya's Konza Tech City: A step too far?* Ventures Africa paras 15-17 (July 23, 2012), http://venturesafrica.com/kenyas-konza-tech-city-a-step-too-far/.
[160] Jake Bright, *Billion dollar tech cities Hope and Konza: Boon or bane to Africa's tech movement?* This is Africa, para 24 (July 3, 2014), http://www.thisisafricaonline.com/News/Billion-dollar-tech-cities-Hope-and-Konza-Boon-or-bane-to-Africa-s-tech-movement?ct=true.

Conclusion and Recommendations

This paper defines the current state of knowledge on African hubs, using the example of Kenyan-based entities, and proposes a framework for characterizing the continent's hubs and their practices. Reviews of the relevant literature and theory reveals gaps in academic scholarship and grey literature on this topic, which this paper addresses through the development of a categorization framework. Further, the growth and diversity of hubs across Africa makes the development of an analytical framework to facilitate future research especially prudent. Based on our hypothesis that Kenya is a microcosm of the continent, the framework advanced herein suggests a three-tiered system for categorizing African hubs as: a cluster, a company, or an entire country.

Our original framework is derived from and applied to Kenya's hubs, and leaves at least three clear areas for follow-up research, which we recommend.

This Kenya-specific approach leaves, first, the opportunity for future works to consider the application of the framework to hubs across the continent. Indeed, some research is already underway, supported by the Open African Innovation Research network (www.OpenAIR.org.za). This framework will facilitate better and more informed research in countries like South Africa, Nigeria, Ghana, and Egypt.

Second, the government-led versus government-follow approach to technological innovation presents another avenue for further study. There is a gap in academic scholarship on the potential impact of government support and ICT friendly policy making on hubs and their future development. As such, a comparative study of the workings, successes and failures of organic technology communities (cluster hubs) and government-backed ventures (country hubs) could be undertaken. For example, we see much potential in a comparative analysis of the successes and failures of policies from countries within a particular region, such as Kenya, Rwanda, Uganda, and Tanzania, for example. There is also significant potential in comparative analyses across geographic regions. Comparative analysis could be done in developing regions, such as between Africa and Latin America, South Asia, or South East Asia. Alternatively, it could be done between a developing region and a developed region, for example Africa and Europe or North America.

Third, our framework will facilitate more nuanced empirical research focusing on individual company hubs. It will help researchers understand and distinguish existing literature that may use "hub" terminology, but is discussing a different one of the three distinct archetypes of hubs that we have identified.

By reviewing the relevant literature and synthesizing the state of current knowledge about high technology hubs, developing an original taxonomy to describe and assess technology

hubs, and discussing implications of our research, we have laid the ground for other researchers to pursue further study in this area.

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For more Information about Open AIR, please visit our website: www.openair.org.za
or contact one of our Program Managers:
ottawa@openair.org,za
capetown@openair.org.za

This work was carried out by Open AIR with the aid of a grant from
the International Development Research Centre, Ottawa, Canada
the Social Sciences and Humanities Research Council of Canada, and
in cooperation with the International Centre for Trade and Sustainable Development and
the Department for International Development.