

THE INSTITUTE FOR
BUSINESS IN THE
GLOBAL CONTEXT



On Hubs, BRCKs, and Boxes

The Emergence of Kenya's Innovation and Technology Ecosystem

Owen Sanderson

Master of Arts in Diplomacy, 2015



THE FLETCHER SCHOOL

TUFTS UNIVERSITY

On Hubs, BRCKs, and Boxes: *The Emergence of Kenya's Innovation and Technology Ecosystem*

Author: Owen M. Sanderson
Advisor: Professor Kim Wilson

Updated: January 11, 2015

INTRODUCTION

Erik Hersman ordered a large chai ya maziwa (Kenyan “milk tea”) from Dominic, one of Pete’s legendary baristas, and made his way up to the outdoor patio. Hersman came to Pete’s Coffee at least once a day. The combination coffee shop and burrito stand had established quite a cult following over the last several years. Located in the Kilimani neighborhood of Nairobi, Pete’s catered to Kenya’s growing cohort of tech entrepreneurs. Hersman appreciated Pete’s California-quality burritos and its location directly underneath the iHub—the open workspace and tech incubator he helped establish in 2010. The iHub was Hersman’s second big win in Kenya following the success of his crowd-sourced software company called Ushahidi. Many viewed the iHub as the “unofficial headquarters of Kenya’s tech movement” and a model for other African tech incubators.¹

Hersman was proud of the impact he’d created in less than a decade, but he sought more. A serial entrepreneur, Hersman aimed to take the iHub even further. Preparing to meet with his board of advisors, several questions swirled through his mind as he took a sip of his chai. How could he support Kenya’s promising tech ecosystem and attract new interest and investment to the so-called Silicon Savannah? Where could he leverage his talents and existing network to spark real transformational change? And more fundamentally, was the iHub (and its affiliated organizations) contributing to economic development in one of the world’s poorest countries?

BACKGROUND ON KENYA

While Kenya has made a big splash in the tech space over the last five years, it faces tremendous hurdles to development. With a GDP per capita at less than \$1,000 per year, Kenya remains one of the world’s poorest countries.² At last count, between 34 and 42 percent of Kenyans live below the poverty line.³ Low primary education rates and limited professional opportunities threaten to stall Kenya’s economic engine.

¹ Erik Hersman, Interview by Owen Sanderson, Tape recording, Nairobi, Kenya, January 6, 2015.

² World Development Indicators Online (WDI), Washington, DC: World Bank, 2013.

³ “Time for Kenya to Shift Gears to Accelerate Growth and Reduce Poverty,” *World Bank*, June 17, 2013, Accessed November 14, 2014, <http://www.worldbank.org/en/news/press-release/2013/06/17/time-for-kenya-to-shift-gears-to-accelerate-growth-and-reduce-poverty>.

Despite the growth of Kenya's service sector (which accounts for approximately 60 percent of the economy), unemployment remains stubbornly high at almost 40 percent, particularly among youth.⁴ **Exhibit 1 illustrates key development indicators in Kenya over time.**

In addition to these troubling economic indicators, health inequalities also hold Kenya back. Tropical diseases like malaria and yellow fever are widespread and the country's HIV/AIDS rate is alarmingly high. While 3,000 miles away, the recent Ebola outbreak in West Africa highlights the devastating economic effects of endemic disease on the continent. Kenya is not immune to these shocks. In a 2014 report, the World Bank underscored the country's continuing health challenges, noting, "Kenya's health outcomes are not commensurate with its aspirations of achieving middle income status."⁵

The business environment remains another major stumbling block. Transparency International suggests that rampant corruption prevents long-term success in Kenya. In its recent Corruption Perception Index, Kenya clocked in at 136 (out of the 177 countries measured).⁶ This data is validated by the World Bank's Doing Business ranking, which places Kenya in the bottom 30 percent of evaluated countries along with the likes of Bangladesh, Uganda, and Iran.⁷

The case writer observed several instances of kitu kidogo (the request for "something small" by government officials) during taxi rides to and from Nairobi's Kenyatta International Airport. While the financial exchange was small, these incidents are indicative of a greater problem of graft that increases political risk and scares off investors. In spite of CNN's recent claim that Nairobi is in the top ten emerging markets to launch a start up, long-term development remains challenging.⁸

THE ORIGINS OF KENYA'S TECH ECOSYSTEM

Regardless of these roadblocks, many argue that Kenya has reached an inflection point. In the same report cited above, the World Bank calls Kenya's economic growth "robust". Today, the country is Africa's ninth largest economy and is growing at a respectable rate of over 5 percent.⁹ Supported by a new, progressive constitution, Kenya has positioned itself as the anchor of East Africa. While conventional poverty indicators like GDP per capita may tell a different story, Kenya appears to be vaulting forward.

⁴ CIA World Factbook, Washington, DC: Central Intelligence Agency, 2013.

⁵ "Kenya Economic Update," *World Bank*, June 2014, Accessed October 27, 2014, http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/07/08/000016351_20140708091208/Rendere d/PDF/892690WP0P14810ssue0100Final0June14.pdf.

⁶ Corruption Perception Index, Washington, DC: Transparency International, 2013.

⁷ Doing Business Indicators Online, Washington, DC: World Bank, 2014.

⁸ Peter Shadbolt, "Starting a business? Here are the 10 best emerging cities to launch your startup," *CNN*, October 13, 2014, Accessed October 28, 2014, <http://edition.cnn.com/2014/10/13/tech/10-best-emerging-market-start-up-cities/>.

⁹ "Kenya Economic Update," *World Bank*.

It has been suggested that much of Kenya's recent growth is associated with the country's love affair with technology and the country's strong service sector.¹⁰ Like many other African countries, Kenya has been able to leapfrog historical barriers to development like wired communication lines and outdated energy infrastructure. Leapfrogging can be defined as accelerating development by skipping inferior technologies and embracing more efficient, more advanced solutions to everyday needs.

Using modern technologies to overcome barriers is Kenya's specialty. A quick look at the country's impressive cell phone network and one begins to understand the impact of leapfrogging in Kenya. Three out of every four Kenyans own a cell phone.¹¹ They use these devices—which range from basic SMS clunkers to sophisticated smartphones—not only to communicate but also to conduct business. In her landmark book, *The Bright Continent*, Nigerian-American author Dayo Olopade suggests, "Cell phone adoption in Africa is best described by thinking of a hockey stick—the shape of the graph plotting the sharp increase in new users over the past decade." The incredible penetration of cell phones throughout Sub-Saharan Africa is truly revolutionary. **Exhibit 2 depicts the rapid growth of cell phone penetration in Kenya.**

Several studies point out how technologies like cell phones have transformative effects on other industries as well including the financial services sector. The success of M-PESA is the most obvious example. Originally designed as a way for microfinance institutions to collect loan payments, M-PESA became an overnight sensation when users co-opted the technology to not only pay for loans but transfer funds. M-PESA offers an African-engineered mobile money and payment system to the masses. Instead of relying on traditional methods of transferring funds through couriers or money guards, Kenyans can now send up to 70,000 shillings (around \$775) with the touch of a few buttons.¹² M-PESA has rapidly lowered transaction costs across the country. The service facilitates trade and improves access to finance. Today, over \$20 million flows through M-PESA each day.¹³

What's even more exciting is how M-PESA has opened up new opportunities and markets in Kenya. A few years ago, a set of entrepreneurs formed Kopo Kopo after they manipulated M-PESA's API to allow for consumer-to-business (C2B) payments.¹⁴ As discussed later in the case, Kopo Kopo is changing the game when it comes to mobile payments in Kenya. Consumers can now use their cell phone with the M-PESA app to

¹⁰ Mwangi S. Kimenyi and Josephine Kibe, "Africa's Powerhouse," *The Brookings Institution*, January 6, 2014, Accessed November 14, 2014, <http://www.brookings.edu/research/opinions/2013/12/30-kenya-economy-kimenyi>.

¹¹ Julia Manske, "Innovations out of Africa: The emergence, challenges and potential of the Kenyan Tech Ecosystem," *Vodafone Institute for Society and Communications*, 2014, Accessed October 8, 2014, http://www.vodafone-institut.de/uploads/media/1404_VFI_Report_Innovations_out_of_Africa.pdf.

¹² Julia Manske, "Innovations out of Africa."

¹³ Dayo Olopade, *The Bright Continent* (New York: Houghton Mifflin Harcourt, 2014), 92.

¹⁴ According to Wikipedia: "An application programming interface (API) is a set of routines, protocols, and tools for building software applications."

pay for a coffee at Pete's or at one of the 12,000-plus merchants using the Kopo Kopo service. Developed countries are playing catch-up in the mobile payments space. A November 2014 *Economist* article suggests the mobile payment marketplace in the United States is estimated to reach \$17 billion by 2019. But this market is still underdeveloped, with new players like Apple Pay and Snapcash only now entering the field.¹⁵ In contrast, M-PESA has been around for seven years. The same article refers to M-PESA as the "granddaddy" of mobile payments, an area where Kenya is clearly the first mover. **Exhibit 3 profiles a variety of companies now using the M-PESA application to streamline their operations.**

In addition to widespread cell phone penetration and mobile payment capabilities, physical infrastructure plays a role in the rise of Kenya's innovation and technology ecosystem. "July 23, 2009 changed everything," quips Hersman, referring to the launch of the SEACOM fiber-optic cable.¹⁶ **Exhibit 4 illustrates the impact of new undersea cables on East Africa.** Almost overnight Kenya's Internet speed and capabilities exploded. Brian Herlihy, CEO of the SEACOM project, called the 10,000-mile-long cable a breakthrough.

Today is a historic day for Africa and marks the dawn of a new era for communications between the continent and the rest of the world. Our tireless efforts of the past 24 months have come to fruition, and we are proud to be the first to provide affordable, high quality broadband capacity and experience to east African economies.¹⁷

Technologies like cell phones and high-speed Internet not only connect Kenya to the world economy but help level the playing field. Information deserts plagued Africa for centuries. Without access to information on prices in the big city, farmers were restricted to local markets and sick Kenyans had to rely on whatever healthcare knowledge was available in their local clinics. Today, information is plentiful. From the bustling streets of central Nairobi to small villages of the Rift Valley, information flows freely more than ever before. Farmers can access market information on their cell phones with apps like M-Farm and families can receive maternal health updates from services provided by organizations like Medic Mobile. The walls are coming down.

Fueled by cell phones and fiber optics, Kenya is set to take off even further. But as Hersman will be quick to note, technology is nothing without smart, motivated people. Before it even opened its doors, the iHub workspace aimed to bridge the gap between digital and physical worlds. Today it's easy to take the iHub for granted, but less than five years ago this type of open technology lab was an aberration in Kenya.

¹⁵ "The cheque is in the tweet," *The Economist*, November 22, 2014, Accessed November 30, 2014, <http://www.economist.com/news/finance-and-economics/21633884-sending-and-receiving-money-your-smartphone-getting-easier-cheque>.

¹⁶ Erik Hersman, Interview by Owen Sanderson.

¹⁷ "Seacom Goes Live," *Cisco Press Release*, July 23, 2009, Accessed October 27, 2014, http://newsroom.cisco.com/dlls/2009/prod_072209.html.

LAUNCHING AN IDEA: INCUBATING THE IHUB

Hersman got his start in Kenya's tech ecosystem in 2005 when he launched his blog *WhiteAfrican*. The blog, and his subsequent work on a website showcasing African innovation and ingenuity called *AfriGadget*, linked Hersman to Kenya's budding technology community. Hersman gained even more traction in 2007 and 2008 as a founding member of Ushahidi, a non-profit technology company with a focus on collecting and visualizing data from the crowd. Ushahidi's open-source software has been used to map crises worldwide in over 150 countries, notably in Kenya during the 2007-2008 election violence, in Haiti during the height of the 7.0 magnitude earthquake, and most recently, during the humanitarian crisis in Syria.

According to Ushahidi, its mission is simple: "Change the way information flows in the world and empower people to make an impact with open source technologies, cross-sector partnerships, and ground-breaking ventures." After its initial success in 2007 and 2008, Ushahidi's software caught the attention of the Omidyar Network (an impact investor) and Hivos (a Dutch NGO). With access to donor funding, Ushahidi expanded its reach worldwide. To date, over 60,000 maps have been plotted on the company's open-source software.¹⁸

The unanticipated success of Ushahidi thrust Hersman into the limelight. The blogger was now a household name from Nairobi to Silicon Valley. Harnessing this brand power, Hersman gathered a group of close friends, colleagues, and local entrepreneurs to talk about next steps. "There was a clear gap in the market," Hersman remembers. Technology was thriving in Kenya, but human capital remained underdeveloped. While Nairobi did have a growing tech community, it was virtual. They needed a physical space to interact, collaborate, and gain more respect and attention from the outside world. The move from the cloud to the ground was all about bringing Kenya's collection of bloggers, coders, and budding entrepreneurs together, according to Hersman. "It all started with the idea of getting cool people into a cool place with the goal of having something cool happen."¹⁹

Riyaz Bachani, a member of the iHub advisory council, was there from the start. He recalls the iHub began as an email mailing list. "In Kenya, the techies weren't talking to each other and were drifting apart." So Bachani, Hersman, and others leveraged the initial mailing list, known as "Skunkworks", to bring folks together. Through meet-ups and conferences codenamed "BarCamps", Kenya's tech community began to evolve—quickly. Bachani: "We soon realized we needed a permanent place for the community to go to."²⁰

¹⁸ Ushahidi.com, Accessed October 27, 2014, <http://www.usahidi.com>.

¹⁹ Erik Hersman, Interview by Owen Sanderson.

²⁰ Riyaz Bachani, Interview by Owen Sanderson, In person, Nairobi, Kenya, January 9, 2015.

Leveraging his growing network, Hersman's team wrangled up seed funding. Familiar with Ushahidi, the Omidyar Network and Hivos were some of the first supporters to jump onboard. Hersman secured a lease for 3,700 square feet at the Bishop Magua Center, a commercial building located in the Kilimani District of Nairobi. Inspired by successful co-working spaces across the world, the team went to work transforming the sterile office block into an interactive hive. They threw bright green paint on the walls, installed a snappy Internet connection, and imported a slick Italian espresso machine. **Exhibit 5 offers pictures of the iHub complex and the first layout design drafted by Fady Rostom and Kwame Nyongo.**

The team also committed itself to acknowledging and integrating Kenya's local needs. A few months before Hersman and his team unveiled the iHub, he wrote the following on his blog *WhiteAfrican*: "The iHub is what we as a tech community make it. It is a blank canvas, a big open room with a great view and wonderful location, but still an empty room that needs some input from people within the community to design, and create a culture around."

In March 2010, the iHub opened its doors. The team held its breath. Would their investment rally Kenya's tech community together? Could it help catalyze a new class of technologists working to spur economic growth nationwide? Becky Wanjiku, another member of the iHub advisory council, remembers the excitement and apprehension during the early days. "We thought, okay, we've got a great idea, but will people use the space?"²¹ But come they did.

READY, SET, GO: THE IHUB TAKES OFF

At first, Hersman and his team focused on developing the iHub's reputation as a community connector. As any successful entrepreneur in Silicon Valley will tell you, networks matter. Your network is a skeleton key to idea-generation, partnerships, and with luck, funding.

Since day one, the iHub has attempted to strengthen networks in Kenya. It thinks of itself as a town square for Nairobi's tech-savvy (and soon-to-be tech-savvy) citizen. At the iHub, the coder can meet the mentor who can meet the venture capitalist. More than anything else, the iHub was designed "to enable people...to find each other and the partners they need to grow," Hersman underscores.²²

The iHub meets this mission by doing more than providing an open workspace for Kenya's techies. It hosts conferences, provides trainings, and offers opportunities for techpreneurs to pitch their ideas in front of potential funders. To date, the iHub has put on over 550 events, from small workshops to large conferences like Tech4Africa and

²¹ Becky Wanjiku, Interview by Owen Sanderson, In person, Nairobi, Kenya, July 15, 2014.

²² Erik Hersman, Interview by Owen Sanderson.

Pivot East.²³ The iHub itself has grown physically as well. What started as 3,700 square feet on the fourth floor, now spills out onto four separate floors in the Bishop Magua Center. As of 2014, the iHub complex is associated with a mobile phone incubator sponsored by the World Bank (m:lab), a UI/UX lab for user experience testing (UXLab), a funding and accelerator program (Savannah Fund), and a self-sustaining consulting firm (iHub Research and iHub Consulting).

Even more telling is the other like-minded organizations who are flocking to Bishop Magua, and Kilimani in general. Two floors down from the iHub are the offices of GSMA (an association of mobile operators), FrontlineSMS (an SMS software service), and the Praekelt Foundation (an incubator for mobile technology). Complimentary organizations like Nailab and 88mph have set up shop in Bishop Magua or close by.

Even more encouraging is Konza City, Kenya's forthcoming grand technopolis located about 100 miles south of Nairobi. The brainchild of Kenya's Ministry of Information and Communications and the International Finance Corporation (IFC), Konza underscores Kenya's attraction to technology-driven growth. A key part of the government's Vision 2030 strategic plan, Konza aims to bring employment and economic opportunity to thousands of Kenyans. The goal is to create a self-sustaining city anchored by a cluster of knowledge industries like telecom, life sciences, and business process outsourcing (BPO). When looking at Konza, the iHub see itself as a test laboratory, showing would-be investors that Kenya is committed to building a technology-driven service industry.²⁴

Konza is at the heart of Silicon Savannah, a term coined by journalist Alex Perry in his 2011 *TIME* article and quickly coopted by Konza (and the Kenyan government). As Perry notes, "Kenya's love for IT has earned it the nickname Silicon Savanna(h). The moniker neatly encapsulates the themes of its rising influence on global technology: mobile and rural and filling some wide-open spaces in infrastructure and democracy."²⁵ It appears that the nickname is here to stay.

But over time, the iHub has built more than just networks, copycats, and catchy slogans. After four years, several successful organizations have passed through the iHub including Kopo Kopo and Ma3route.

Kopo Kopo is arguably the most well known iHub alumnus. While officially launched in Boulder, Colorado at the 2010 Unreasonable Institute, Kopo Kopo established its central operations out of the iHub. Its core product taps into the vast M-PESA network to process consumer-to-business (C2B) payments. Today, consumers can use their M-

²³ Tech4Africa is a web and emerging technology conference, bringing global perspectives to the African context with events in Kenya, Nigeria, and South Africa. Pivot East is East Africa's premier mobile startups pitching competition and conference showcasing region's 25 top startups.

²⁴ Stephanie Findlay, "Welcome to the 'Silicon Savannah'," *Canadian Business* 86, no. 11/12 (2013): 51-52. Academic Search Premier, EBSCOhost (Accessed October 8, 2014).

²⁵ Alex Perry, "Silicon Savanna: Mobile Phones Transform Africa," *Time*, June 30, 2011, Accessed October 3, 2014, <http://content.time.com/time/magazine/article/0,9171,2080702-2,00.html>.

PESA-equipped cell phone to pay for goods and services at over 12,000 merchants in Kenya. Kopo Kopo is truly revolutionary in the mobile payments space.

In a recent interview, Ben Lyon, Kibet Yegon, and Dylan Higgins of Kopo Kopo underscored the impact of the iHub: “You can't beat this community. We are constantly revitalized by the energy at the iHub....At any given time, the iHub is full of people that are experts in every link in the value chain (e.g. product development, marketing, fundraising, sales, etc.). The community is iHub's strongest asset.”²⁶ While Kopo Kopo has since graduated from the iHub's space, it attributes some of its success to its start at the technology hub.

Ma3route, a mobile/web/SMS platform that helps citizens to share and access info about transport in Nairobi, is another success story. Anyone who spends time in Kenya will have a lot to say about traffic in its capital city. Nairobi's narrow streets and limited sidewalks make navigating the city quite dangerous. The lack of pavement markings including double yellow lines adds to the chaos. And good luck spotting a traffic light (or even stop sign)—they barely exist. Most drivers feel their way through intersections, an experience not for the faint of heart. The best way to describe driving in Nairobi is through the voice of one of its taxi drivers, Jimmy: “Kenyan style”.

Ma3route provides users with information on congestion throughout the city, aiming to improve the outrageous Kenyan commute. In addition to easing traffic for Kenyans, Ma3route is focused on analyzing and interpreting transport data and trends with the goal of helping city planners and local authorities in emerging economies like Kenya design better, more efficient cities.

COMMUNITY FIRST: THE IHUB BUSINESS MODEL

The success of Kopo Kopo and Ma3route emphasizes the ultimate mission of the iHub—build a stronger tech community in Kenya with the ability to catapult a handful of startups onto the mass consumer market. Hersman sees these organizations as proof that the iHub's secret sauce is working. The iHub's underlying business model mixes philanthropic dollars with incremental revenue from associated services and fees. The iHub uses these funding streams to educate the individual, connect the investor, and enrich Kenya's overall tech ecosystem.

When the iHub launched in 2010, its core operations were completely covered by donor dollars from the likes of the Omidyar Network and Hivos.²⁷ However, over the last four years, the iHub's management team has successfully transitioned away from purely grants and sponsorship to a mixed revenue model. As of 2014, zero percent of its revenue comes from core grants and sponsorship. Instead, the iHub is funded by key

²⁶ Jessica Colaco, “iHubber: Kopo Kopo, Inc,” *iHub Blog*, May 13, 2011, Accessed November 2, 2014, <http://community.ihub.co.ke/blogs/3133/the-ihubber-profiles>.

²⁷ Erik Hersman, Interview by Owen Sanderson.

corporate partnership, earned revenue through programmatic grants, and earned revenue through contracts. **Exhibit 6 provides more details on the iHub’s financials.**

Today, corporate partnerships account for 16 percent of revenue. In addition to providing core funding these donors attract additional capital, lend thought leadership, and amplify global awareness of the iHub’s impact. Consider the laundry list of associated partners at the iHub—which range from Google to Microsoft, Nokia to Samsung, Safaricom to Zuku—and one begins to understand the magnitude of international support.²⁸

The remaining 84 percent of the iHub’s revenue comes from direct funds.²⁹ iHub Research, iHub Consulting, and the UXLab are three revenue generating divisions of the iHub complex. They are designed to improve the iHub’s reach and ensure long-term sustainability of its operations. iHub Research conducts deep-dive investigatory projects for non-profits and for-profits alike. Past clients include the World Bank, Google, and even Pete’s Coffee. iHub Consulting moves beyond the desk research and quantitative surveys conducted by iHub Research. Founded a year after its older sibling, iHub Consulting focuses on connecting African freelancers to training and business opportunities. Finally, the UXLab supports local Kenyan businesses looking to glean insights into their customers’ wants and needs. It is the first user experience lab of its kind in Sub-Saharan Africa according to its Design Lead, Mark Kamau.³⁰

In addition to these services, the iHub charges certain individuals for use of its facilities. It maintains three service levels—white, green, and red (**see Exhibit 7 for a detailed table on the costs and benefits of each level**). A red membership offers affiliates full access to iHub support services (like printing and photocopying), server space on the iHub supercomputer, and special privileges with corporate partners. Unlike white and green memberships, red members incur a modest fee (currently less than \$200 per year). True to the founders’ intent, membership is a very small proportion of the iHub’s top line revenue. Hersman notes, “The advisory council...specifically chose not to charge membership fees...because we thought that people with the most time and best ideas, wouldn’t have the money to burn on space membership.”³¹

Critics argue that the iHub’s overreliance on philanthropic support is not sustainable. Other comparable tech labs and open workspaces in the developed world like the lauded Impact Hub network tend to balance the books with straight revenue from membership fees and value-added products like incubation, education, and consulting services.³² At first glance, it is not clear why this approach cannot work in the African context.

²⁸ Erik Hersman, Interview by Owen Sanderson.

²⁹ Erik Hersman, Interview by Owen Sanderson.

³⁰ Mark Kamau, Interview by Owen Sanderson, In person, Nairobi, Kenya, January 8, 2015.

³¹ Erik Hersman, Interview by Owen Sanderson.

³² Michel Bachmann, “How the Hub Found Its Center,” *Stanford Social Innovation Review*, vol. 12, no. 1 (Winter 2014): 22-27. ProQuest (Accessed November 30, 2014), 27.

Others suggest that NGO money (including some of the funds powering the iHub) in Kenya's tech ecosystem manipulates success by picking winners and losers. "Donor money can create precarious dependency within an economy," notes Jessica Hatcher in a *Wired* article titled "Hype around NGO-funded apps is stifling Africa's innovation".³³

Hatcher is not alone. Mbwana Alliy, Managing Partner at the Savannah Fund, cautions that aid money can distort Kenya's ecosystem. Unlike investor funding, donor money is goal-specific and lacks the flexibility of an equity investment. While philanthropic support is sometimes a necessary ingredient, it is not designed to help businesses scale.³⁴ Savannah Fund makes scale a priority. It targets the missing middle, through investments between \$25,000 and \$500,000 with the goal of creating both jobs and profit.

Hersman, a General Partner at Alliy's Savannah Fund, takes the middle road. He suggests that tech labs like the iHub serve an important role, and in certain cases, it is acceptable to be a loss leader.³⁵ The iHub targets a wide customer segment. This includes small and growing businesses willing to pay a fee to young techpreneurs with limited means to pay for access to a world-class facility like the iHub. Which begs an immediate question: How can the iHub remain effective with its outreach and sustainable with its business model?

SCALING UP: OTHER REVENUE GENERATING INITIATIVES

Instead of obsessing on top-line revenue through iHub user fees, Hersman and his team follow a different approach focused on developing a series of commercial side ventures. These ventures are designed to cross-subsidize important initiatives like the iHub. More importantly for Hersman, these ventures lie between the software and hardware worlds.

The most notable projects include BRCK and Gearbox. BRCK is a small, battery-powered Internet device designed to bridge connectivity to the last mile. Gearbox is a makerspace, a coworking space similar to the iHub but with an emphasis on engineering-oriented pursuits like 3-D printing, small-scale robotics, and local manufacturing.



Table A provides a summary of Hersman's new initiatives:

³³ Jessica Hatcher, "Hype around NGO-funded apps is stifling Africa's innovation," *Wired*, June 10, 2014, Accessed October 3, 2014, http://www.wired.co.uk/news/archive/2014-06/10/silicon-savannah?fb_comment_id=fb_c_611042079010024_611617345619164_611617345619164#f165e0052.

³⁴ Mbwana Alliy, "Silicon Savannah [Kenya] – Must be careful of Hype," *Savannah Fund – Waterhole*, June 16, 2014, Accessed October 3, 2014, <http://savannah.vc/2014/06/16/silicon-savannah-kenya-must-be-careful-of-hype/#.VC7unyldU7t>.

³⁵ Erik Hersman, Interview by Owen Sanderson.

Table A: Select iHub-Associated Ventures

	BRCK	Gearbox
Picture:		
Description:	Internet modem and router	Makerspace
Tagline:	“Go anywhere, do anything, self-powered, mobile WiFi device”	“Open makerspace for design and rapid prototyping”
Pricepoint:	\$199 per device	Unknown
Target Audience:	Engineers and entrepreneurs	Engineers and entrepreneurs
Designed & Prototyped:	Kenya	Kenya
Funding:	Venture capital (For-profit)	Philanthropic capital (Non-profit)

SCALING UP: BRCK

The BRCK started as a Kickstarter campaign in 2012 (**Exhibit 8 offers pictures of the BRCK**).³⁶ As a long-time resident in East Africa, Hersman was keenly aware of the challenges of connectivity in Africa and the need for a stable, reliable Internet connection. As the BRCK team explains via Kickstarter:

The idea behind BRCK is that all kinds of jobs require steady connectivity, even when infrastructure is spotty due to wireless connections that come and go, intermittent power, or devices that can’t share connections. Seeing this, we set out to redesign connectivity for the world we live in—Africa. As we laid out what such a device would look like—physically robust, able to connect to multiple networks, a hub for all local devices, enough backup power to survive a blackout—we realized that the way the entire world is connecting to the web is changing. We no longer only get online via desktops in our office, we have multiple devices, and we are all constantly on the move. So we designed the BRCK for the changing way we connect to the web around the world, from cafe-hoppers in San Francisco to struggling coders in Nairobi.³⁷

Born in Africa and built in Austin, Texas with parts sourced from China, the BRCK is a global product designed to meet the challenges of today’s digital economy, with a

³⁶ Kickstarter is a global crowdfunding platform aimed at linking money with creative ideas.

³⁷ “BRCK – Your backup generator for the Internet,” *Kickstarter*, Accessed November 2, 2014, <https://www.kickstarter.com/projects/1776324009/brck-your-backup-generator-for-the-internet>.

special emphasis on the needs of Kenya's tech ecosystem. The device has become the darling of both local entrepreneurs and international investors. The *Wall Street Journal* featured a story on Hersman's little black box, calling it a product tailored to the continent's needs. It notes, "BRCK is betting the future of technology innovation is on the African continent—and that there is money to be made addressing the technological needs of the so-called 'bottom billion'".³⁸

SCALING UP: GEARBOX

Like the iHub, Gearbox started with a need to marry the digital to the physical. Instead of just thinking and talking about an idea, makerspaces provide members the tools to design, build, and test their innovations.³⁹ A center for manufacturing, makerspaces experienced a boom in the United States in late noughties but have yet to take off in Africa. Hersman is looking to be a first mover in this space.

Maker Faire Africa, the seed of the African makerspace movement and the birthplace of the idea to build a permanent makerspace called Gearbox, launched operations in 2009. Maker Faire is an annual conference that brings together leaders in Africa's nascent engineering ecosystem. From Ghana to Kenya, Maker Faire Africa hopes to "see challenges as opportunities to invent, and invention as a means to proving African ingenuity."⁴⁰ Along with Emeka Okafor, an active blogger and contributor to *AfriGadget*, Hersman kicked off the first Maker Faire in Ghana. To date, the organization has hosted three fairs with a fourth scheduled for December 2014 in Johannesburg, South Africa.

Hersman is a vocal proponent of Maker Faire Africa and hopes to bring the movement to Kenya, permanently. Again supported by the success of the Ushahidi and the iHub, Hersman has curated a powerful group of supporters from Massachusetts Institute of Technology to a Kenyan automobile startup called Mobius Motors. Leaning on this rich network, Hersman wants to launch Gearbox in Nairobi, a lab like the iHub focused on the collision of design, engineering, electronics, fabrication, and arts & crafts. Paul Birkelo, one of Gearbox's first employees, sees great promise. Gearbox is designed to "up Kenya's standard of professionalism" in the manufacturing sector. As Birkelo suggests, "We want to see more unique innovations started by local Africa companies."⁴¹

Hersman agrees. "We see Gearbox as the on-ramp for more industrial manufacturing to happen in Kenya."⁴² Mobius Motors, with its goal of manufacturing an affordable,

³⁸ Heidi Vogt, "Africa's Challenges Are Tech Startups' Opportunities," *Wall Street Journal*, July 11, 2014, Accessed October 3, 2014, <http://blogs.wsj.com/frontiers/2014/07/11/africas-challenges-are-tech-startups-opportunities/>.

³⁹ Jon Evans, "We Have Entered the Golden Age of Hardware Hacking," *Tech Crunch*, September 27, 2014, Accessed October 8, 2014, <http://techcrunch.com/2014/09/27/we-have-entered-the-golden-age-of-hardware-hacking/>.

⁴⁰ "Maker Manifesto," *Maker Faire Africa*, Accessed November 2, 2014, <http://makerfaireafrica.com/maker-manifesto/>.

⁴¹ Paul Birkelo, Interview by Owen Sanderson, In person, Nairobi, Kenya, January 9, 2015.

⁴² Erik Hersman, "Getting Gear for Gearbox," *WhiteAfrican Blog*, October 18, 2014, Accessed November 2, 2014, <http://whiteafrican.com/2014/10/18/getting-gear-for-gearbox/>.

durable sports utility vehicle (SUV) for the African mass market, is a great example of the result of innovative African thinkers with engineering capabilities. But Hersman hopes that Mobius is not an anomaly.

Author Dayo Olopade cites *kanju* culture as a springboard to Africa's recent Cinderella story. *Kanju*, the Nigerian Yoruba word for "to rush or make haste", is best described as the tremendous drive to make something out of little or nothing. Olopade calls it "the specific creativity born from African difficulty".⁴³ *Kanju* is the fuel for African makerspaces like Gearbox. Hersman notes that Kenya has its own breed of *kanju* called *jua kali* (literally "hot sun"). *Jua kali* is at the heart of Gearbox, and frankly, all of Hersman's many ventures in the Silicon Savannah.

BEYOND THE IHUB: THE EFFICACY OF THE ECOSYSTEM

The idea that technology at large can catalyze growth is not new. Proponents of Information and Communication Technologies for Development, fondly known as ICT4D, have long extolled the virtues of leveraging technology as a means to elevate national economic development. infoDev, the World Bank's innovation and entrepreneurship initiative, recently released a report suggesting that "technology innovation and growth-oriented entrepreneurship" are strongly tied to the development of a knowledge-based economy and total economic activity and growth.⁴⁴

In the case of Kenya, mobile telephony offers a strong case for the link between technology and growth. As noted above, cell phones facilitate communication, reduce transaction costs, and ultimately, improve efficiency. According to a widely cited study by Leonard Waverman, Meloria Meschi, and Melvyn Fuss, a 1 percent increase in mobile penetration leads to a 0.6 percent increase in national growth rates.⁴⁵ They note, "We find that mobile telephony has a positive and (statistically) significant impact on economic growth, and this impact may be twice as large in developing countries compared to developed countries."⁴⁶ A 2012 Deloitte report advances Waverman's findings even further, suggesting mobile connectivity, particularly data and Internet services, increases national productivity.⁴⁷ With a mobile penetration rate of over 75 percent, Kenya is poised to capitalize on these statistical trends.

⁴³ Olopade 20.

⁴⁴ infoDev, "The Business Models of mLabs and mHubs: An Evaluation of infoDev's Mobile Innovation Support Pilots," *The World Bank*, 2014, Accessed October 8, 2014, http://www.infodev.org/infodev-files/mlab_mhub_business_model_full.pdf, 16.

⁴⁵ Olopade 99-100.

⁴⁶ Leonard Waverman, Meloria Meschi, and Melvyn Fuss, "The Impact of Telecoms on Economic Growth in Developing Countries," in *Africa: The Impact of Mobile Phones, The Vodaphone Policy Paper Series*, no. 2 (2005), 11.

⁴⁷ Deloitte, "What is the impact of mobile telephony on economic growth?" November 2012, Accessed November 14, 2014, <http://www.gsma.com/publicpolicy/wp-content/uploads/2012/11/gsma-deloitte-impact-mobile-telephony-economic-growth.pdf>.

But how does a workspace like the iHub, a physical device like BRCK, or a manufacturing space like Gearbox contribute to Kenya's overall development? While the link between technology (specifically mobile telephony) and development is robust, measuring the efficacy of Kenya's tech ecosystem is not as straightforward. It is difficult to capture the spillover effects from Hersman's ventures on Kenya's overall economic growth. That said, three key trends seem to articulate the impact of the tech ecosystem, and most certainly the iHub and its associated initiatives have played a role. These include: (1) increased foreign direct investment, (2) decreased poverty levels, and, while less quantifiable, (3) a marked increase in technology as part of the country's long-term plan.

First, the increase in FDI inflows signals a renewed interest in investing in Kenya. In 2007 Kenya celebrated a record year in foreign direct investment inflows. That year, FDI represented 2.7 percent of the country's GDP.⁴⁸ While this excitement was short-lived—FDI contracted the following years—FDI is back on the rise. In lockstep with the development of Kenya's tech ecosystem, FDI projects into Kenya increased at a CAGR of more than 40% between 2007 and 2013, and last year FDI inflows launched Kenya to the second highest number of FDI projects in Sub Saharan Africa after South Africa.⁴⁹ On the ground, these flows are evident. The entire city of Nairobi seems under construction with makeshift wooden scaffolding blanketing the majority of buildings around the iHub complex.

Second, poverty rates in Kenya appear to be shrinking. The last official poverty index was conducted in 2005. At that time approximately 50 percent of Kenyans lived under the official poverty line. Today, reports suggest that Kenya's poverty level stands between 34 and 42 percent.⁵⁰ A growing, or more accurately striving, middle class is developing in Africa. The African Development Bank estimates the middle class contains upwards of 350 million people, 34 percent of the continent's population.⁵¹ This population is primed to take advantage of the iHub's services and stimulate even more growth.

Third, technology is now a major part of Kenya's thrust forward. The government's strategic plan, Vision 2030, relies heavily on technology to propel the Kenyan economy up the value chain. Konza City is the most obvious example of Kenya's commitment to technology-driven development, but this policy goes beyond the glimmering

⁴⁸ KPMG, "Kenya – Country Profile," 2012, Accessed November 30, 2014, <https://www.kpmg.com/Africa/en/KPMG-in-Africa/Documents/Kenya.pdf>, 10.

⁴⁹ EY, "EY's attractiveness survey, Africa 2014: Executing growth," 2014, Accessed November 14, 2014, [http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/\\$FILE/EY-attractiveness-africa-2014.pdf](http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/$FILE/EY-attractiveness-africa-2014.pdf)

⁵⁰ "Time for Kenya to Shift Gears to Accelerate Growth and Reduce Poverty," *World Bank*.

⁵¹ African Development Bank, "The Middle of the Pyramid: Dynamics of the Middle Class in Africa," April 20, 2011, Accessed November 14, 2014, http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/The%20Middle%20of%20the%20Pyramid_The%20Middle%20of%20the%20Pyramid.pdf.

technopolis.⁵² In 2013, the ICT sector represented 12.1 percent of Kenya's GDP, up from 8.9 percent in 2006.⁵³ This increase is not happenstance, but clearly intentional. Kenyan President Uhuru Kenyatta considers ICT central to the country's development, "ICT is no longer a luxury but a powerful tool to transform and improve the lives of Kenyans at large."⁵⁴ In the same report, Kenya's ICT Authority points to incubators like the iHub as a "key driver" of the country's rapid development.⁵⁵

So while it is hard to say definitively that Hersman's ventures are inextricably linked to the country's upward trajectory, it appears there are strong indications that incubators like the iHub influence significant spillover effects.

NEXT STEPS

Hersman: "I've said for a long time that I think we in Africa have an advantage in making things. It's a culture that's never been lost, and we're used to improvising, adapting and overcoming challenges that come our way. This is our first foray into that meeting of the worlds between high-tech and low-tech making, and I've not been this excited about something for a long time."⁵⁶

As Hersman settled up his tab at Pete's (via M-PESA, of course) the same series of questions swirled around in his mind. How could his team continue to support Kenya's promising tech ecosystem and attract new interest and investment to the so-called Silicon Savannah? How might the iHub continue to support real transformational change while remaining sustainable? And what new venture would promote economic development at large while cross-subsidizing East Africa's premier technology hub?

More specifically, Hersman wondered where to place his immense energies in the short-term. BRCK held the promise of energizing new international investment into Kenya's manufacturing and hardware market. On the other hand, Gearbox was more aligned with Hersman's past successes at the iHub and its associated spaces. He gritted his teeth at the thought of choosing just one.

⁵² Chris Edwards, "Promise Takes Root in the 'Technological Desert'," *Engineering & Technology*, no. 5 (2013): 38-41. Academic Search Premier, EBSCOhost (Accessed October 8, 2014), 41.

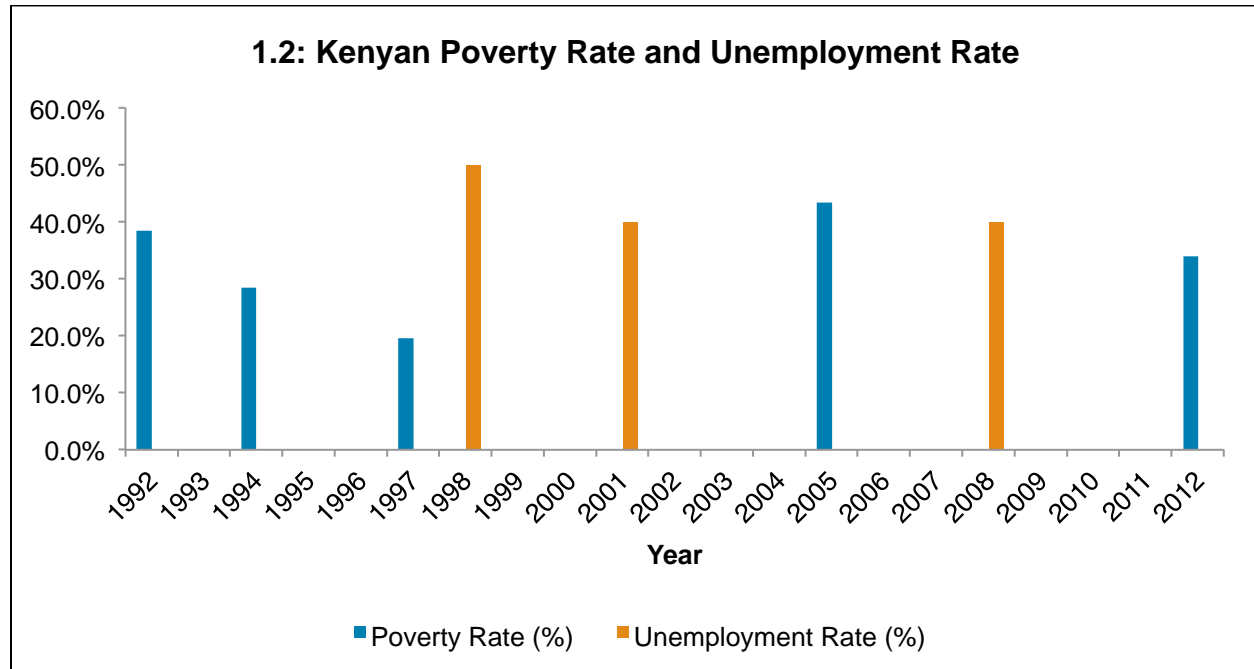
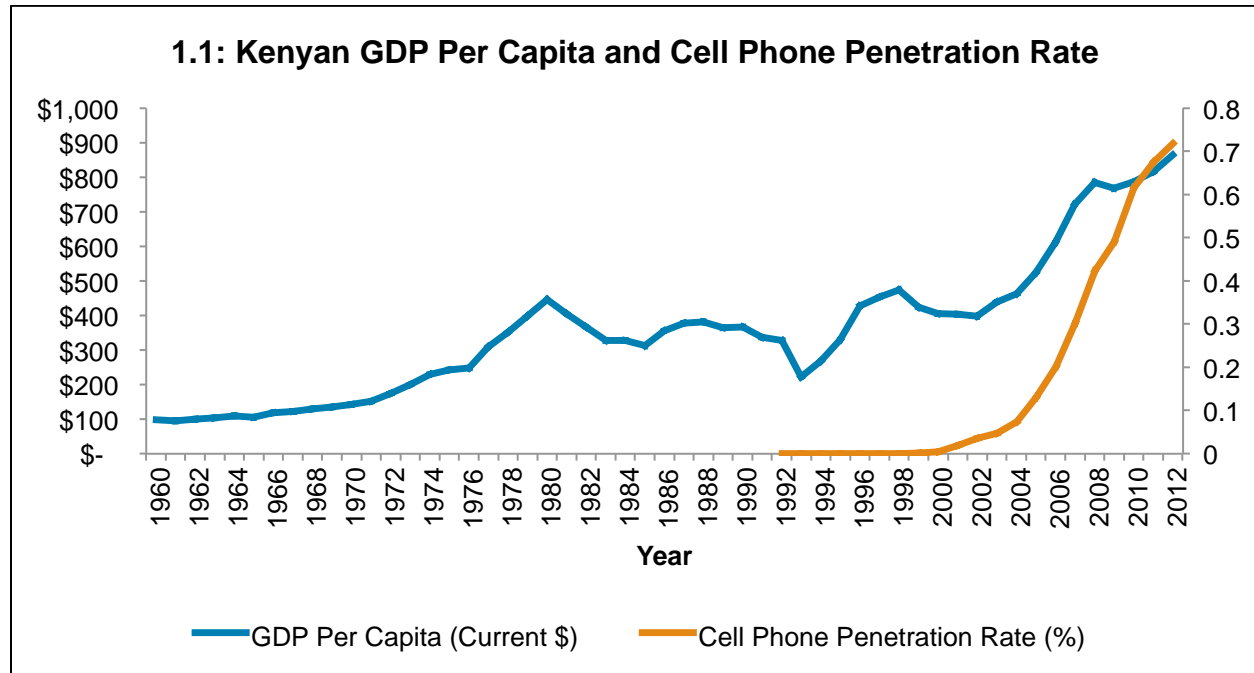
⁵³ IDC Government Insights, "Breaking the Barriers with Technology: A Special Report on the Kenyan ICT Market," April 2014, Accessed November 14, 2014, http://www.connected.go.ke/wp-content/uploads/2014/04/ICTA-Whitepaper_Final-100414.pdf.

⁵⁴ IDC Government Insights, "Breaking the Barriers with Technology."

⁵⁵ IDC Government Insights, "Breaking the Barriers with Technology."

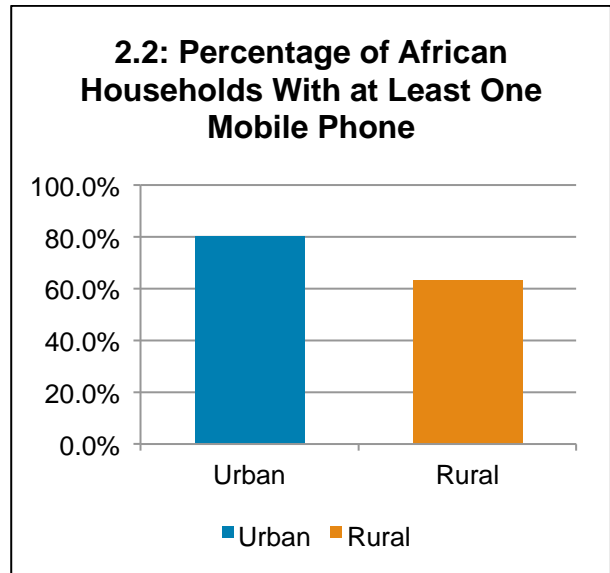
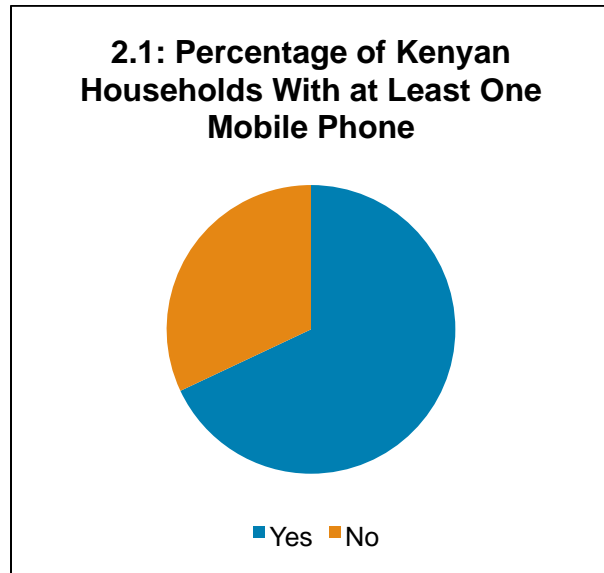
⁵⁶ Erik Hersman, "Launching Gearbox, A Kenyan Makerspace," *WhiteAfrican Blog*, September 9, 2013, Accessed November 2, 2014, <http://whiteafrican.com/2013/09/09/launching-gearbox-a-kenyan-makerspace/>.

EXHIBIT 1: KEY DEVELOPMENT INDICATORS IN KENYA OVER TIME⁵⁷



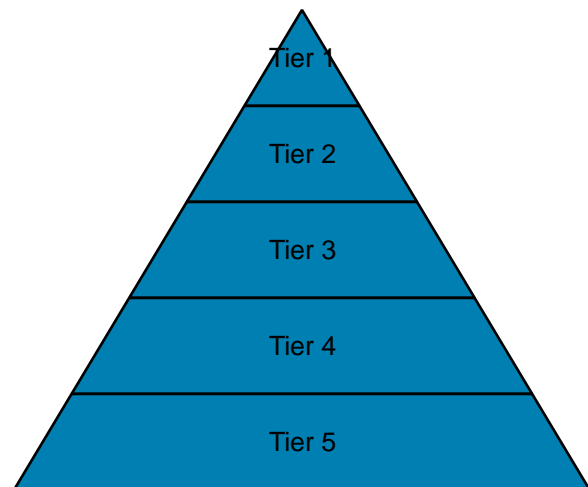
⁵⁷ World Development Indicators Online (WDI), Washington, DC: World Bank, 2013.

EXHIBIT 2: CELL PHONE PENETRATION IN AFRICA⁵⁸



2.3: Market Segmentation – Percentage of African Households With at Least One Mobile Phone:

Tier 1 – Richest 20%:	80%
Tier 2 – Fourth 20%:	72%
Tier 3 – Middle 20%:	68%
Tier 4 – Second 20%:	62%
Tier 5 – Poorest 20%:	55%



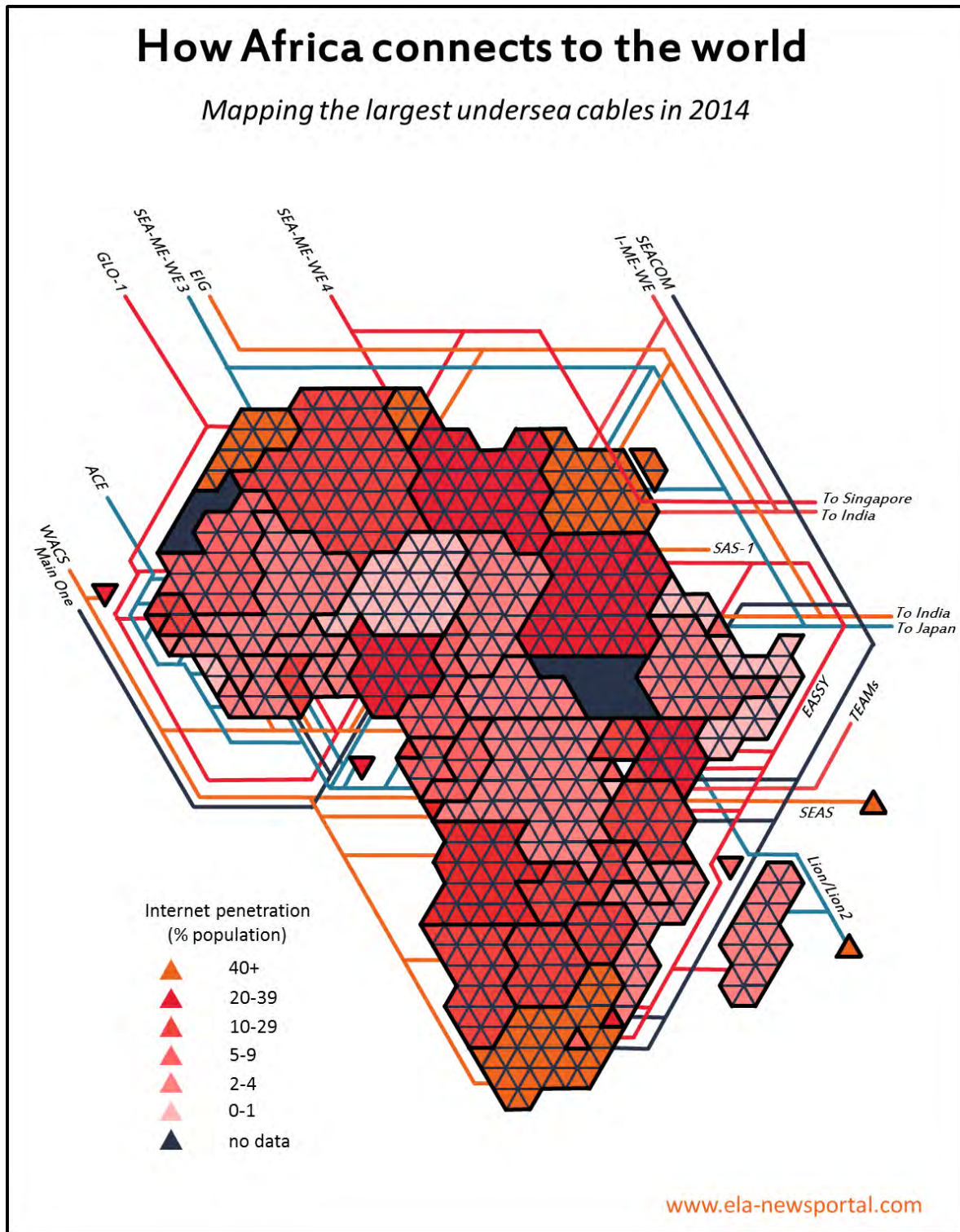
⁵⁸ Bob Tortora, "Africa Continues Going Mobile," *Gallup*, May 1, 2014, Accessed November 14, 2014, <http://www.gallup.com/poll/168797/africa-continues-going-mobile.aspx>.

EXHIBIT 3: PROFILES OF COMPANIES USING M-PESA APPLICATION

iCow
SMS-based farmer information service
iCow is a subscription based information service that provides Kenyan dairy farmers tips and advice on how best to handle their cows for maximum yield. The service is integrated with the M-PESA platform, allowing customers to purchase information in the same way they would purchase airtime.
http://www.icow.co.ke/

Kopo Kopo
Consumer-to-business payments interface
Kopo Kopo piggybacks off of the M-PESA platform to provide a channel between businesses and consumers. Similar to Square or Venmo in the United States without the need for a bank account, Kopo Kopo describes itself as the “gold standard for merchant payments” with over 10,000 merchants in Kenya and plans to expand to Rwanda and Tanzania.
http://kopokopo.com/

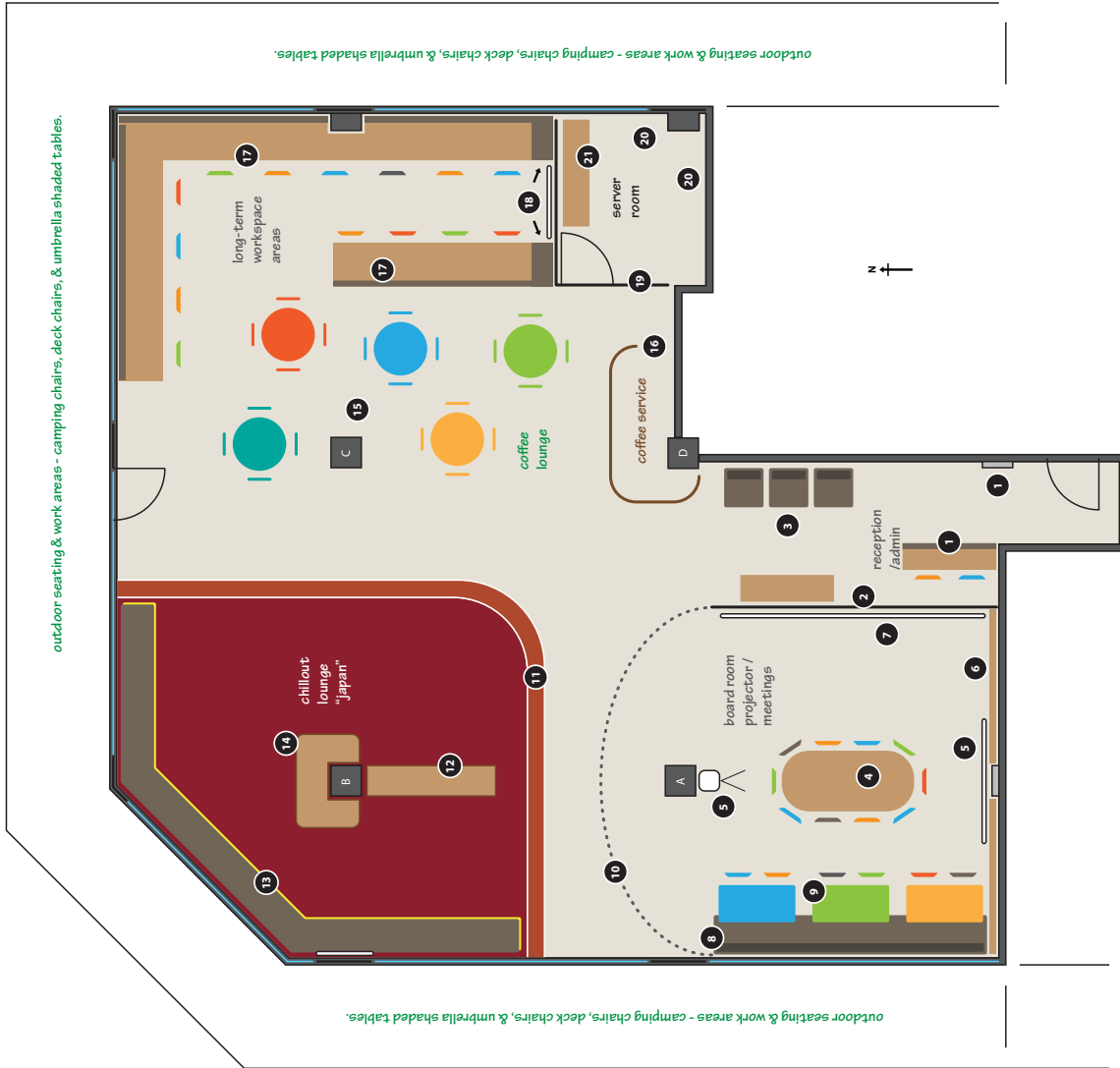
M-KOPA
Pay-as-you-go solar energy
M-KOPA is a solar energy technology company targeting off-grid users in Sub-Saharan Africa. It uses mobile payments routed through the M-PESA service to offer consumer financing for home solar lighting systems. This proprietary, patented technology platform uses an embedded GSM+ SIM card in the solar system to process mobile payments, revolutionizing asset financing in emerging markets.
http://www.m-kopa.com/



⁵⁹ “The World Wide Web at 25: How Africa Connects,” eLearning Africa, March 12, 2014, Accessed November 14, 2014, http://www.elearning-africa.com/eLA_Newsportal/the-world-wide-web-at-25-how-africa-connects/.

EXHIBIT 5: PICTURES AND AN EARLY SKETCH OF THE EVOLUTION OF THE IHUB COMPLEX





- 1 Guest entry & authorization (automatic swiping or receptionist/administrator)
- 2 Semi-permanent partition wall (~2.5 m high) separator
- 3 Armchairs in waiting area, also for normal work/lounge use.
- 4 Current existing board-room table (seats 6 ~ 10)
- 5 Projector unit on Col. A & retractable/moveable screen
- 6 Cabinet storage units (0.75m high), eg. for video conferencing box, etc.
- 7 Whiteboard wall mounted on (2)
- 8 Continuous padded seat with backrest
- 9 Moveable tabletops
- 10 Retractable partition (opens to allow larger audience / surrounding workspace)
- 11 Two steps to elevated platform (steps risers to be used as cabinets/storage)
- 12 Library shelving (floor to 1m high, double sided)
- 13 Ground level cushion seats
- 14 Optional low-level table build around Col. B (0.55m high)
- 15 Open space, ideally used for mixed seating, can also be moved around as necessary.
- 16 Coffee table & sink, etc. etc. Design would be based on whether serviced or self-service.
- 17 Worktops for long-term peeps (similar to ARK setup), with elevated spongeboards.
- 18 Locker facilities & whiteboard / contboard.
- 19 Server room walling (~2.5m high), with ceiling / loft.
- 20 AC & server racks
- 21 Large storage cabinets

EXHIBIT 6: IHUB FINANCIALS⁶⁰

Revenue Sources	2010	2011	2012	2013	2014
Earned Programs & Projects Contract	-	-	-	-	28%
Earned Programs & Projects Grants	-	46%	51%	84%	56%
Core Corporate Partnerships	-	-	49%	16%	16%
Core Grants and Sponsorships	100%	54%	-	-	-

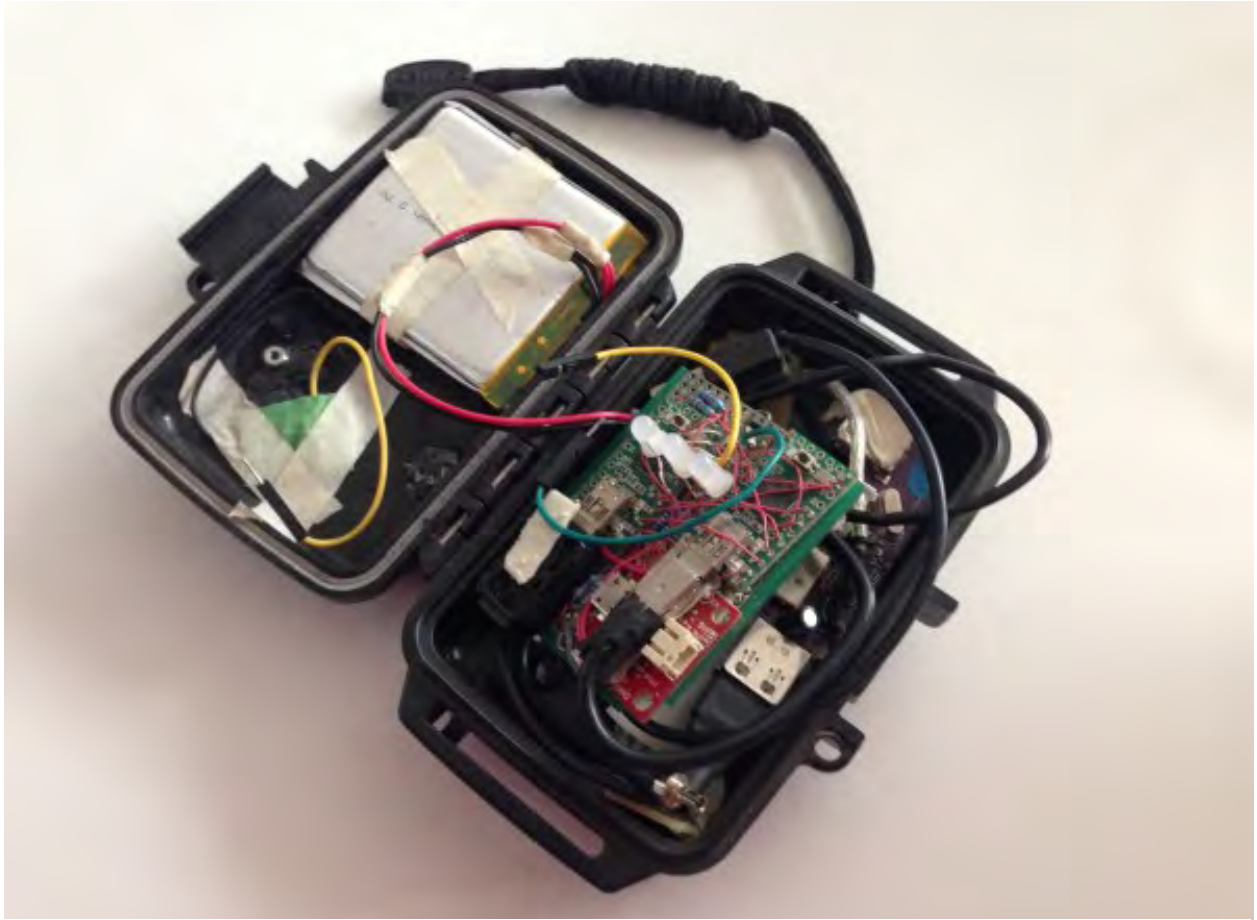
⁶⁰ Erik Hersman, Interview by Owen Sanderson.

EXHIBIT 7: TIERS OF IHUB MEMBERSHIP⁶¹

White	Green	Red
<p>Description: White membership is the first level of membership that all iHub members must go through. It is also the membership that the other memberships will default to after the arranged periods expire.</p>	<p>Description: Green membership will be offered to White members who apply for it. The prerequisite is that the member is involved in a project that has the following needs: (a) the applicant requires a physical location to work out of; (b) the applicant requires a source of other developers and designers to join the project; (c) the project will grow, create a minimal viable product or service, and is ready for help to scale.</p>	<p>Description: Red membership will be offered to Green members who have completed a six-month membership period and have a minimum viable product or service. The membership will be 12 months. A Red member who successfully leaves the iHub space as a formal start up will continue to be part of the Red membership as an iHub Net member.</p>
<p>Benefits:</p> <ul style="list-style-type: none"> ▪ Weekly newsletter ▪ Access to post on jobs board ▪ Entry into iHub space one day a week ▪ Invitation to events at the iHub 	<p>Benefits:</p> <ul style="list-style-type: none"> ▪ All of the White membership benefits ▪ Full access to the iHub space ▪ Publicly viewable web profile ▪ Invitation to Pivot East competition ▪ Use any of iHub initiative's services for non-commercial work ▪ Access to corporate partner events at the iHub 	<p>Benefits:</p> <ul style="list-style-type: none"> ▪ All of the Green membership benefits ▪ Office services such as photocopying and printing at subsidized prices ▪ Courier service ▪ 30 percent discount for use of the mLab Board room ▪ Access to the iHub's corporate partners and collaborative projects ▪ Advice on market research from iHub Research ▪ Product development and testing at iHub UXLab ▪ Server space for mobile and web application hosting from iHub Cluster computer
<p>Fee: Free</p>	<p>Fee: Free</p>	<p>Fee: Approximately \$200/year</p>

⁶¹ "Community Membership," *iHub*, Accessed November 16, 2014, <http://www.ihub.co.ke/community>.

EXHIBIT 8: PICTURES OF THE EVOLUTION OF THE BRCK



BIBLIOGRAPHY

- African Development Bank. "The Middle of the Pyramid: Dynamics of the Middle Class in Africa." April 20, 2011. Accessed November 14, 2014. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/The%20Middle%20of%20the%20Pyramid_The%20Middle%20of%20the%20Pyramid.pdf.
- Alliy, Mbwana. "Silicon Savannah [Kenya] – Must be careful of Hype." *Savannah Fund – Waterhole*, June 16, 2014. Accessed October 3, 2014. <http://savannah.vc/2014/06/16/silicon-savannah-kenya-must-be-careful-of-hype/#.VC7unyldU7t>.
- Bachani, Riyaz. Interview by Owen Sanderson. In person. Nairobi, Kenya. January 9, 2015.
- Bachmann, Michel. "How the Hub Found Its Center." *Stanford Social Innovation Review*, vol. 12, no. 1 (Winter 2014): 22-27. ProQuest (Accessed November 30, 2014).
- Birkelo, Paul. Interview by Owen Sanderson. In person. Nairobi, Kenya. January 9, 2015.
- "BRCK – Your backup generator for the Internet." *Kickstarter*. Accessed November 2, 2014. <https://www.kickstarter.com/projects/1776324009/brck-your-backup-generator-for-the-internet>.
- "The cheque is in the tweet." *The Economist*, November 22, 2014. Accessed November 30, 2014. <http://www.economist.com/news/finance-and-economics/21633884-sending-and-receiving-money-your-smartphone-getting-easier-cheque>.
- CIA World Factbook. Washington, DC: Central Intelligence Agency, 2013.
- Colaco, Jessica. "iHubber: Kopo Kopo, Inc." *iHub Blog*, May 13, 2011. Accessed November 2, 2014. <http://community.ihub.co.ke/blogs/3133/the-ihubber-profiles>.
- "Community Membership." *iHub*. Accessed November 16, 2014. <http://www.ihub.co.ke/community>.
- Corruption Perception Index. Washington, DC: Transparency International, 2013.
- Deloitte. "What is the impact of mobile telephony on economic growth?" November 2012. Accessed November 14, 2014. <http://www.gsma.com/publicpolicy/wp-content/uploads/2012/11/gsma-deloitte-impact-mobile-telephony-economic-growth.pdf>.

Doing Business Indicators Online. Washington, DC: World Bank, 2014

Edwards, Chris. "Promise Takes Root in the 'Technological Desert'." *Engineering & Technology*, no. 5 (2013): 38-41. *Academic Search Premier, EBSCOhost* (Accessed October 8, 2014).

EY. "EY's attractiveness survey, Africa 2014: Executing growth." 2014. Accessed November 14, 2014. [http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/\\$FILE/EY-attractiveness-africa-2014.pdf](http://www.ey.com/Publication/vwLUAssets/EY-attractiveness-africa-2014/$FILE/EY-attractiveness-africa-2014.pdf).

Evans, Jon. "We Have Entered the Golden Age of Hardware Hacking." *Tech Crunch*, September 27, 2014. Accessed October 8, 2014. <http://techcrunch.com/2014/09/27/we-have-entered-the-golden-age-of-hardware-hacking/>.

Findlay, Stephanie. "Welcome to the 'Silicon Savannah'." *Canadian Business* 86, no. 11/12 (2013): 51-52. *Academic Search Premier, EBSCOhost* (Accessed October 8, 2014).

Hatcher, Jessica. "Hype around NGO-funded apps is stifling Africa's innovation." *Wired*, June 10, 2014. Accessed October 3, 2014. http://www.wired.co.uk/news/archive/2014-06/10/silicon-savannah?fb_comment_id=fbc_611042079010024_611617345619164_611617345619164#f165e0052.

Hersman, Erik. "A BRCK Journey." *WhiteAfrican Blog*, July 8, 2014. Accessed October 8, 2014. <http://whiteafrican.com/2014/07/08/a-brck-journey/>.

Hersman, Erik. "Getting Gear for Gearbox." *WhiteAfrican Blog*, October 18, 2014. Accessed November 2, 2014. <http://whiteafrican.com/2014/10/18/getting-gear-for-gearbox/>.

Hersman, Erik. "Launching Gearbox, A Kenyan Makerspace." *WhiteAfrican Blog*, September 9, 2013. Accessed November 2, 2014. <http://whiteafrican.com/2013/09/09/launching-gearbox-a-kenyan-makerspace/>.

Hersman, Erik. Interview by Owen Sanderson. Tape recording. Nairobi, Kenya. January 6, 2015.

"How is Technology Changing Kenya?" *World Have Your Say: BBC World Service*, September 23, 2014. Accessed October 8, 2014. <http://www.bbc.co.uk/programmes/p026s582>.

IDC Government Insights. "Breaking the Barriers with Technology: A Special Report on the Kenyan ICT Market." April 2014. Accessed November 14, 2014. http://www.connected.go.ke/wp-content/uploads/2014/04/ICTA-Whitepaper_Final-100414.pdf.

infoDev. "The Business Models of mLabs and mHubs: An Evaluation of infoDev's Mobile Innovation Support Pilots." The World Bank. 2014. Accessed October 8, 2014. http://www.infodev.org/infodev-files/mlab_mhub_business_model_full.pdf.

infoDev. "Transforming the East African ICT Sector by Creating a Business Engine for SMEs." The World Bank. 2011. Accessed October 8, 2014. http://www.infodev.org/infodev-files/resource/InfodevDocuments_1040.pdf.

Kamau, Mark. Interview by Owen Sanderson. In person. Nairobi, Kenya. January 8, 2015.

"Kenya Economic Update." *World Bank*. June 2014. Accessed October 27, 2014. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/07/08/00016351_20140708091208/Rendered/PDF/892690WP0P14810Issue0100Final0June14.pdf.

Kimenyi, Mwangi S. and Josephine Kibe. "Africa's Powerhouse." *The Brookings Institution*. January 6, 2014. Accessed November 14, 2014. <http://www.brookings.edu/research/opinions/2013/12/30-kenya-economy-kimenyi>.

KPMG. "Kenya – Country Profile." 2012. Accessed November 30, 2014. <https://www.kpmg.com/Africa/en/KPMG-in-Africa/Documents/Kenya.pdf>.

"Maker Manifesto." *Maker Faire Africa*. Accessed November 2, 2014. <http://makerfaireafrica.com/maker-manifesto/>.

Manske, Julia. "Innovations out of Africa: The emergence, challenges and potential of the Kenyan Tech Ecosystem." *Vodafone Institute for Society and Communications*. 2014. Accessed October 8, 2014. http://www.vodafone-institut.de/uploads/media/1404_VFI_Report_Innovations_out_of_Africa.pdf.

Olopade, Dayo. *The Bright Continent*. New York: Houghton Mifflin Harcourt, 2014.

"Maker Manifesto." *Maker Faire Africa*. Accessed November 2, 2014. <http://makerfaireafrica.com/maker-manifesto/>.

- Perry, Alex. "Silicon Savanna: Mobile Phones Transform Africa." *Time*, June 30, 2011. Accessed October 3, 2014. <http://content.time.com/time/magazine/article/0,9171,2080702-2,00.html>.
- "Seacom Goes Live." *Cisco Press Release*, July 23, 2009. Accessed October 27, 2014. http://newsroom.cisco.com/dlls/2009/prod_072209.html.
- Shadbolt, Peter. "Starting a business? Here are the 10 best emerging cities to launch your startup." *CNN*, October 13, 2014. Accessed October 28, 2014. <http://edition.cnn.com/2014/10/13/tech/10-best-emerging-market-start-up-cities/>.
- "Time for Kenya to Shift Gears to Accelerate Growth and Reduce Poverty." *World Bank*. June 17, 2013. Accessed November 14, 2014. <http://www.worldbank.org/en/news/press-release/2013/06/17/time-for-kenya-to-shift-gears-to-accelerate-growth-and-reduce-poverty>.
- Tortora, Bob. "Africa Continues Going Mobile." *Gallup*, May 1, 2014. Accessed November 14, 2014. <http://www.gallup.com/poll/168797/africa-continues-going-mobile.aspx>.
- Ushahidi.com. Accessed October 27, 2014. <http://www.usahidi.com>.
- Vogt, Heidi. "Africa's Challenges Are Tech Startups' Opportunities." *Wall Street Journal*, July 11, 2014. Accessed October 3, 2014. <http://blogs.wsj.com/frontiers/2014/07/11/africas-challenges-are-tech-startups-opportunities/>.
- Wanjiku, Becky. Interview by Owen Sanderson. In person. Nairobi, Kenya. July 15, 2014.
- Waverman, Leonard, Meloria Meschi, and Melvyn Fuss, "The Impact of Telecoms on Economic Growth in Developing Countries," in *Africa: The Impact of Mobile Phones*, The Vodaphone Policy Paper Series, no. 2 (2005): 10-19.
- World Development Indicators Online (WDI). Washington, DC: World Bank, 2013.
- The World Wide Web at 25: How Africa Connects." *eLearning Africa*, March 12, 2014. Accessed November 14, 2014. http://www.elearning-africa.com/eLA_Newsportal/the-world-wide-web-at-25-how-africa-connects/.