Journal *of* African Development 2017, 19(1):160–167

Transforming Rural Africa— Economics, Technology and Governance

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AFEA/ASSA Luncheon Speech
January 4th, 2016
San Francisco

Acknowledgements: I thank the entire NYU Abu Dhabi Center for Technology and Economic Development (CTED) team, the NYU Abu Dhabi Research Institute, the International Growth Center (IGC), anonymous donors, and Templeton Foundation for their help and generosity. All errors are mine.

Introduction

Mr. President and colleagues at the African Finance and Economics Association (AFEA), fellow economists and social scientists, I am extremely grateful for the opportunity to be here to give this keynote address at this wonderful luncheon. I have been a member of AFEA for N years where N is very large. I am happy to see the organization getting stronger and, as I mentioned before, I am extremely honored to be giving this address.

The topic today is a central one in Economics in this era. It is the question of the economic development of Africa's rural areas. A large number of Africans still reside in areas which are relatively rural and agricultural. Many remain very poor despite increases in world standards of living over the past several decades and very high growth rates in many African nations more recently. A fundamental question in the Economics of Development is the question of what will transform these areas into high producing technologically sophisticated economies.

The question of economic transformation or structural change, or more specifically, industrialization is receiving a good deal of attention within the profession. Several years ago a new Think Tank, the African Center for Economic Transformation (ACET), was created with the sole purpose of studying and documenting transformation in Africa. The African Development Bank in its flagship publication, the African Economic Outlook, has signaled this through their titles which were "Regional development … at the heart of Africa's structural transformation," in 2015; "Structural Transformation and Natural Resources," in

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2014 and "Global Value Chains and Africa's Industrialization," in 2013. The UN Economic Commission for Africa (UNECA) had "Industrialization through Trade" as its most recent flagship publication. Within the academic literature there are also many papers, usually in the macro development area, focused on structural change and re-working with modern tools and data earlier expositions of Arthur Lewis from the 1950's and '60's.

Before proceeding, let me share with you two small anecdotes which I find important as it often shapes my own views on the current debates on African economic development, and, as you will see, are motivating examples for what I am going to talk about today.

The first was about 5 or 6 years ago. I was invited to give a keynote address at the African Econometrics Association meetings in Abuja, Nigeria. The organizers were very gracious, treated me with great attention to details on transport arrangements. All was set, I arrived at the Abuja airport and I looked around for the driver who, I was told, would be holding a big card with my name on it waiting at the arrivals area. I looked and looked for this person and found nobody. Nigeria was on the news then—I think there had been some muggings at the Mutala Muhammad Airport in Lagos, so I was a bit nervous but since I grew up in neighboring Ghana, I left the airport and acted as local as I could and got myself a cab to the venue. After the very great conference, I was driven back by the driver to the airport and I asked him why he did not pick me up on arrival. He looked at me and said "Oga, they told me that a big person was going to give a keynote address at this important conference so I thought it was a white man." I laughed at that but moved on.

In the second anecdote, I recall at the Ghana at 50 celebrations when I was Vice Provost at New York University, going to Accra to talk to a minister about how we could help Ghana celebrate with our film and literature faculty, etc. I am a Ghanaian, and I introduced myself as such, I recall in the local language. I was there with two administrative assistants, both white Americans. Anytime I said anything I noticed the minister responding not to me but to my assistants and asking them follow-up questions. I recall saying something slightly rude to the minister to get him to pay any attention to me.

So, what do these two anecdotes have to do with the talk today? Too often, with economic development in Africa we look for solutions outside of the continent. Africa must learn from the small Asian Tigers, then learn from China, and a few years ago I noticed a call for proposals where Africa was being asked to learn from Brazil. Inside the continent itself are what I believe are answers to many of the riddles of African Economic Development. It is to this that I turn now.

I will begin by describing the lessons we can learn from a hugely successful economic transformation that occurred a little over a century ago in my home country Ghana, a transformation which continues to provide benefits to the economy today.

Next, I will describe a more recent success story whose full potential is still being developed. In one specific case, we are able to measure its impact, and it is large.

Finally, I will discuss some work my team is beginning in rural Africa which is harnessing traditional governance systems and learning from them to help in the economic transformation process.

Economics: The Cocoa Revolution in Ghana

I will proceed with a quick summary of a work in progress monograph project I am working on with Professor Emmanuel Akyeampong of Harvard University's History department. Cocoa, from which we get chocolate, was called the "food of the Gods." After Columbus and this discovery was brought to Europe. In need of places to grow the cocoa crop, many European

nations and their firms tried plantation style agriculture in places as diverse as Mozambique, Sao Tome and Principe, Angola and Equatorial Guinea.

Ghana was under the rule of the British around the late 1800's and indeed could be considered as a conflict nation as the British were fighting the Ashanti nation at that time. There were some small European firms trying to grow Cocoa at that time, again primarily plantation style. The records seem to indicate that the British did not want cocoa to grow in Ghana—then the Gold Coast—perhaps preferring coffee. A carpenter named Tetteh Quarshie around 1876—79 "smuggled in" some cocoa beans after seeing it being grown in Fernando Po (currently Equatorial Guinea). Because of the consistent demand for cocoa beans from the Europeans, the locals had the incentive to experiment with the production of cocoa and develop the technology and the systems to enable success.

- They were not produced in the European plantation style. Instead, they used indigenous fertilizer methods Pro-Ka ("Rot and Touch" or mulching), they produced the cocoa with local crops (plantains, cassava, etc.).
- They figured out financing schemes (trees take 5-7 years to mature). The local Akwapim Ridge traders provided financing and were effectively the local "Wall Street bankers" of the time.
- They introduced innovative labor contracts and share cropping schemes, many which are still in existence today (Abunu ("broken into two") and Abusa ("broken into 3").

To this day, many farmers do not have the sweet tooth for cocoa and it is not consumed much. When it was introduced many did not know the use of it. As it came during the time of the introduction of the motor car many probably thought it was an ingredient in gasoline. Despite the lack of understanding of the final use of cocoa the locals created a vast industry, and Ghana at one point was producing 1/3 of the world's output; it still remains the number 2 producer and cocoa remains one of the top foreign exchange earners in the country. The success of African farms is more surprising given the failure of many of the European farms, which used the standard European technology.

The moral of this story, in my opinion, is that when there is consistent demand for a product, the local African entrepreneur, just as entrepreneurs everywhere, will rise to the occasion and innovate and transform to seize the opportunities offered.

Technology: The African Mobile Revolution

A second success story that many have discussed is of course the mobile phone revolution. Today, mobile cellular telephone subscriptions have been rising at an exponential rate. The uptake by the locals of the mobile telephone services has been impressive.

Like the story of cocoa just mentioned, mobile technologies appeared at a time when state control was weakening and it was apparent that the fixed line telephones were not being effectively managed by local state-run companies. Private entrepreneurs, in many cases, were responsible for the impressive growth. It is instructive to look at one example, taken from Nyarko (2016), being written under a Templeton Foundation grant.

Strive Masiyiwa is an African businessman and can be considered a Christian radical given his very strong religious beliefs and his close connections with the youth of Africa through his Facebook pages and other media. He was born in the then Rhodesia in the early 1960's. Around Ian Smith's Universal Declaration of Independence in 1965, he fled to Zambia and many of his relatives were imprisoned in Rhodesia. He then migrated for further education to Scotland and the University of Wales. Later, he returned home to the new Zimbabwe after the

victory against Ian Smith and the white minority government. His initial attempts at forming a mobile phone company were resisted by the state phone company monopoly, the Zimbabwe Post and Telecommunications Company (ZPTC). His company Econet was formed in 1993. After many legal fights and appeals to the Zimbabwe Constitutional Court, he was finally allowed to start his business.

He moved with his family to South Africa after the year 2000 and has formed an African multinational company, and as of 2015, this company has operations in Botswana, Lesotho, Kenya, Burundi, a 3G license in New Zealand and is the only African-based company with a telecom license in the UK.

Again, the moral of the story here is that if there is consistent demand—here mobile phone service markets—our entrepreneurs will rise to the occasion and do what it takes to avail themselves of the opportunities presented. Mo Ibrahim, Aliko Dangote, Magatte Wade, Juliana Rotich, Tony Elumelu are similar examples.

Measuring the Impact of the Mobile Phone Revolution

In the paper "Price Information, Inter-Village Networks, and 'Bargaining Spillovers:' Experimental Evidence from Ghana" by Hildenbrandt, Nyarko, Romagnoli and Soldani (2016), we study the impact of mobile phones in one particular situation. This is not meant to be a definitive statement on the impact of mobile phones, instead it merely illustrates its potential in the context of one explicit and fully worked out situation. Yet, this is important as there have been a large number of papers which show no impact of mobile phones.

One of the earliest papers showing the positive impact of mobile phones is Jensen (2007). This was an experiment with fishermen in the Indian state of Kerala. The mobile phone was used to provide price alerts via SMS indicating the price of fish in various markets on the coast. By obtaining information on where to sell their fish, the fishermen were able to substantially avoid wastage and increase their profits. While Goyal (2010) and Svensson and Yanagizawa (2009) obtained similar positive results, a large number of recent papers have shown little or no impact of price alerts delivered via mobile phones. Aker and Mbiti (2010) in their survey paper "Mobile Phones and Economic Development in Africa" seem generally negative about the possibility of strong impact. Carmody (2012), Fafchamps and Minten, Courtois and Subervie (2012) all find little to no effect on price alerts.

Hildenbrandt, Nyarko, Romagnoli and Soldani (2016) worked with a technology and agricultural service provider company, Esoko, in a 2-year study to determine the impact of the mobile phone price alerts.

It may be important at this stage to recall some of the basic facts of African rural agriculture. Farmers often live very far from the main markets and road transport is hampered by extremely bad or non-existent roads. Farmers sell primarily to traders (middlemen—often women). These traders travel to the farms or rural areas to buy the crop from the farmers and then transport them to the urban areas to re-sell. Farmers often complain that they are being cheated by the traders. There is the obvious information asymmetry here—the traders know the urban prices very well while the farmers do not. They often do not have friends or acquaintances in the cities to tell them the market prices, and they do not know how hard it would be to sell their own goods directly in the city markets. This seems to suggest an obvious possible role for mobile phones—to send farmers text alerts on prices of their produce in the urban and regional markets. That is precisely what the company Esoko does.

Hildenbrandt, Nyarko, Romagnoli and Soldani (2016) performed a randomized control trial experiment with 1,000 farmers in 100 villages over a 2-year period in the northern part

of the Volta Region. Half were given the price alerts while the other half were not. There was a baseline, midline and endline survey, as well as monthly surveys. The experiment was designed to determine whether the price alerts enabled farmers to bargain more favorably and garner higher prices from traders. In that work, it was found that after accounting for spillovers, the price alerts led to a 9% increase in prices for the treatment group. The direct return on investment was of the order of 200%. The paper goes into the details of how all this was measured. It also illustrates bargaining externalities which were discovered—traders who encountered treatment farmers and who could not distinguish treatment from control group farmers ended up paying higher prices to all farmers. This produces an unintended benefit to control group farmers. In addition, if this effect was not taken into account there would have been an erroneous conclusion that the price alerts did not have an impact.

Governance

We now come to the third section of our talk—Governance. We have taken a bet on our quickly expanding rural areas. Many places which are small hamlets are fast becoming little towns as the forces of demography unfold. We are particularly interested in rural and traditional governance, aided by technology.

Our first activity was to ensure that we are in the rural areas listening to the rural people. We built a research center in a village or small town in a relatively impoverished area of Ghana (in Ashanti Region). We have deployed there a battery of mobile phone-based apps which we believe could be scaled up to other rural areas.

The area has a traditional African governance structure for the most part. There is a chief who is in charge of a territory of approximately 5,589 sq. km (representing about 3% of the landmass of Ghana). Most of the land of the area is in principle the property of the chief with farmers leasing the land from the chief. It is an area whose lineage of chiefs runs some 300 years or so. They are a very proud and independent people, relatively important in Ghana until the British took over the country in the defeat of the Ashanti in 1901.

The first tool we deployed for governance was the simple GPS (Global Positioning System) capability of the mobile phone. This enabled us to map out the land, people's farms, key landmarks, and more. Although many may think of this as a trivial issue in the age of Google, it turns out that the geographic data for this area was very sparse with Google and Bing maps showing limited and sometimes incorrect data for the area.

When we first started our research in our study area we looked for maps, but could not find many. The most useful one was hand-drawn by a local who had an advanced degree from abroad but was not retired in the village. As mentioned earlier, the Google and Bing maps were incomplete and often unreliable. We therefore developed some mobile phone apps which enabled one to take GPS coordinates of points, or to map out the boundary farms. The app was created with a user-friendly interface for the poorly educated rural farmers to be able to use with training from our team.

The apps enabled the farmers to map out points and use either an image, audio or a typed note to describe the item or area being mapped. All of this was done on the mobile phone with easy to understand icons. There were also preset icons which enabled the farmers to tap the icon to designate what the item was—a farm, a road, a river, a town or "other." All of this data was stored within shape files organized by the open source program QGIS (or Quantum GIS by Open Source Geospatial Foundation (OSGeo)). We then uploaded this onto a web page via an html link to make all of the data visible and accessible on the webpage. After quite some work and with the involvement of many farmers, we finally created an electronic map which

served as a database for the resources of the community. From the paper maps we started with when we began our project, we have created digital maps.

These maps were then used as the centerpiece of the new governance systems of the area, referred to as a Traditional Area, under the jurisdiction of the chief ("Omanhene" in the local language). Through additional help from the Government, a Customary Lands Secretariat was created to govern the purchase of lands from those interested in farming or developing agro-businesses in the area.

Mobile phones were then given to some farmers who used them to map out the boundaries of their farms. Those were collected into a central database, which then enabled one to see the distribution of farm lots in the Traditional Area. Each of the farms was tagged by the crop or crops grown on the farm. This in turn enabled one to see the distribution of crops farmed across the entire Traditional Area. On the maps one could see the Pineapple, Yam, Groundnut, Plantain, and Cocoa—the principal crops grown in the area as well as other less significant crops.

The apps also enabled one to map out the local markets that the farmers used for selling their crops and the roads they took to transport them to the market. Therefore, the tools developed enabled a mapping of the output market network for the agricultural crops grown in the area. When we were mapping out the farmlands upon request of the farmers, we also give them a drone image of their farms. This, with agric extension officers, provides them with new perspectives on their farms, indicating the portions which are unused or not productively used, and indicators for best land management practices.

In many papers like the FAO (2003) agricultural extension workers run by the government Ministry of Food and Agriculture are thought of as ineffective or overstretched, not helping much with improving farmer livelihoods. Our experience was radically different; we found the agricultural extension workers motivated and very eager to apply their skills in helping farmers. We also met with many farmers who praised the extension agents. We employed these extension agents in helping us with our measurement activities, particularly in our GPS mapping exercises. The extension agents are the ones the farmers reach out to with problems, and we also reached out to them to help us deploy our apps and to engage more farmers.

Typically, the agricultural extension officers perform surveys of farms every several years—sometimes every decade. Hand-drawn maps of farms are often used, with fairly laborious methods used in randomly picking a "cut" of the farm—an area which will be watched and measured to get an estimate of the output from the farm. In particular, a random area of say 10 meters by 10 meters is chosen. The output from that patch of land, the cut, is carefully measured. The output from that patch is then extrapolated to the size of the entire farm to get an estimate of the output of the entire farm. That farm was itself chosen at random from the district or region, so a second extrapolation, perhaps with data from a few other random farms, is used to obtain district-level estimates of food production.

This process is very time consuming and labor intensive, which may explain why it is done so infrequently. With our mobile phone apps, we can significantly cut the time in which these surveys are performed. We can obtain boundaries of the farms fairly easily and it is easy to generate the random cut from the farm. The use of the mobile phone app, therefore, makes these agricultural censuses easier to perform. By implementing technology, we hope to enable the censuses to take place much more often than currently practiced. We are deploying these apps in our study areas in the coming months.

In addition to the random surveys, the phones have "forms" that enable farmers to click icons and enter numbers to indicate their output or sales of crops on a daily or weekly basis. This provides year-round farm data collection.

This section is one on governance. We have shown how our mobile apps may help in governance by identifying farms, which are needed for collection of land rents as well as

to measure the output of farms to enable help to be provided to the farmers and for general economic management, as needed.

Related to this we have also developed apps which can allow trades to take place between buyers and sellers. Many farmers we meet complain that they are unable to find buyers for their produce, and some attribute this to the dismal state of their farms and fortunes. These digital markets on the phone are of course a precursor to fully-fledged commodities exchanges, which is expected in the country by 2018.

Conclusion

Recently the literature on African economic development has stressed structural change as the driver of transformation in the economies of nations. Our work has stressed looking within the African nations themselves for sources or drivers of innovation. We have argued here that incentives are important—we spoke about the rural economic revolution that occurred in Ghana with the arrival of cocoa production more than a century ago. This was the "Economics" in the title of this talk. We then discussed the huge potential of technology, and particularly mobile phone-based technologies. We indicated some of the work of this author on mobile phone apps for mapping and agriculture in rural areas. This was the "technology" in the title. Finally, we discussed governance and, in particular, showed many ways in which technology could help with governance. The mapping apps help the chief to manage lands and land rents, while the agricultural apps help in measuring output and in generating customers and markets for the small holder farmers.

The right economic incentives with technology and appropriate governance could result in the transformation of African rural areas from the current low productivity states into engines of innovation development and innovation. Rural areas, or those soon to become cities through demographic forces and immigration, could become an important driver in the development, transformation and even industrialization of many African nations.

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