The Leapfrog Engine:

*Internet Enabled Mobile Phones will Drive Economic Growth in the Developing World*

Nelson M. Rosario
Chicago-Kent College of Law
Law of Nationbuilding
Introduction

According to the consulting firm AT Kearney, as of 2012 there are 3.2 billion mobile phone subscribers in the world. Similarly, according to Cisco, a computer networking company, there are roughly 7 billion global mobile devices and connections as of 2013. Only twenty-one percent of the 7 billion global mobile devices, or 1.47 billion devices, are what could be considered “smart devices” as opposed to “feature phones.”

The tremendous number of mobile phones in the world has led to “mobile signals [covering] some 90 percent of the world’s poor, and there are on average, more than 89 cell-phone accounts for every 100 people living in a developing country.” The place where mobile phone penetration has been the weakest, Africa, still has a mobile penetration rate of fifty-five percent. By contrast, Africa has an Internet penetration rate of sixteen percent. The battle to bring mobile phones is on the path to victory, but the battle to bring the same kind of coverage for access to the internet in the developing world is still under way. Why is there such a stark difference between mobile phone penetration and internet penetration?

---

3 Id.
4 “Smart devices” are what could be considered “smart phones” which are capable of downloading and running applications, or “apps,” such as Facebook, Twitter, Snapchat, or Foursquare developed by third-party developers. By contrast, feature phones are typically incapable of downloading third-party applications and instead rely upon software that is loaded on the phone by the manufacturer at the time the phone is shipped.
5 Jake Kendall and Rodger Voorhies, The Mobile-Finance Revolution: How Cell Phones Can Spur Development, 93 FOREIGN AFFAIRS 2, (March/April 2014), at 10 (discussing the introduction of banking services, and other financial services, in the developing world through users accessing these services via their mobile phones).
The numbers from the Cisco report tell us that only twenty-one percent of the world’s phones are smart phones able to connect to the internet. This in part explains the disparity in the internet penetration in the world, but does not tell the whole story. This paper aims to answer the following questions: what are people in the developing world doing with their phones; what would the economic impact of internet enable mobile phones be on the developing world; what sort of infrastructure would be required to bring the population of the developing world onto the mobile internet through their phones; and what are the public policy considerations to keep in mind to ensure adoption of internet enabled mobile phones?

The thesis of this paper is that accelerating the adoption of internet enabled mobile phones (“IEMPs”) will bolster economic development and democratization in the developing world. This idea that IEMPS will foster economic growth falls is within a more general theory of economic development known as “leapfrog economics.”

Part I of this article starts by looking at the mobile phone itself and how it is used in the developing world. Mobile phones, and more broadly information communication technologies (“ICTs”), have long been touted as engines of economic growth, and their wholesale adoption was viewed as promising to spur leapfrog economic development for societies. This promise has been unfulfilled for a variety of reasons, but a new leapfrog engine has taken its place, IEMPs.

Part II of the article continues exploring how mobile phones are used in the developing world by considering several examples of how people use their phones. Given the low number of IEMPs in the developing world the discussion focuses on regular mobile phones used for traditional

---

8 See infra II.B.
9 Robert Davison et al., Technology Leapfrogging in Developing Countries – An Inevitable Luxury?, 1 THE ELECTRONIC JOURNAL ON INFORMATION SYSTEMS IN DEVELOPING COUNTRIES, 5, 1-10, (2000) https://www.ejisdc.org/ojs2/index.php/ejisdc/article/view/5/5 (introducing the concept of “technology leapfrogging” as it relates to information and communication technologies in the developing world).
communication methods.

Part III explores the thesis of the article that accelerating the adoption of IEMPs will bolster economic development and democratization in the developing world. The section begins by briefly explaining traditional theories of economic development, and then further explaining why they are inapplicable solutions to development in the developing world. The section then introduces the idea of leapfrog economics as the preferred method of economic development.

After explaining the theory of leapfrog economics this part of the article continues by looking at three potential businesses which could greatly benefit from the adoption of IEMPs. It explores examples of business plans that address the market for each service and explains how it can contribute to economic development.

Part IV then explores the technological infrastructure necessary to ensure that widespread adoption of IEMPs is possible. It lays out a preferred path of development to put in place the infrastructure necessary for IEMPs adoption.

Finally, Part V discusses public policy considerations that governments of the developing world must consider when trying to achieve widespread adoption of IEMPs. The chief concern is that governments in the developing world will inadvertently legislate away the benefits of IEMPs and stall the potential economic growth associated with their adoption. Over-reliance on old methods of promoting economic growth could easily hamper this leapfrogging event.

The article explains the benefits of IEMPs contrasted against the failed revolution of traditional mobile phones. The article also explains the conditions necessary to achieve full benefit from the widespread adoption of IEMPs. Leapfrog economics is offered up as a solution to administer and leverage the technical, and societal, benefits offered by IEMPs.
I. The Leapfrog Engine

The world’s first phone call from a mobile phone was placed over forty years ago from a Motorola engineer to Bell Labs headquarters in New Jersey. Since that time mobile phones have become ubiquitous in the developed world. Mobile phones permeate almost every social interaction, the way business is conducted, and how people receive their information. This experience until recently was foreign in the developing world, but that has largely changed. Given that many people on the planet already have access to a mobile phone, whether it be through an individual subscription, or through access to a subscription shared by multiple people it is instructive first to take a look at how individuals use mobile phones in the developing world to help us better frame how individuals would use those same phones if they were IEMPs.

In 2008, Nokia was the largest mobile phone company on the planet by market share with over thirty-eight percent of the global market. At that time Nokia employed a “user anthropologist” named Jan Chipchase whose job was “to peer into the lives of other people, accumulating as much knowledge as possible about human behavior so that he can feed helpful bits of information back to the company.” Mr. Chipchase was interviewed by The New York Times

---

about his job in 2008. The interviewer was able to find his interview subject in Ghana through the use of a mobile phone for directions.14 This type of real-time communication for something as simple as arranging a meeting was not available until recently in much of the developing world.

The interview took place in Accra, the busy and still developing capital of Ghana. Mr. Chipcase shared a story of recently meeting Buddhist monks in Mongolia who had mobile phones. Even though Mr. Chipcase was a Nokia employee, the monks he met had better Nokia phones than he did. During his conversation with the monks one of the monks took his phone and “switch[ed] on the Bluetooth. And he then data-mines my phone for all its content, all my photographs and so on, which is absolutely fine, but it’s kind of a scene where you think, I’m here, I’m so away from everything and yet they’re so technically literate. . . .”15

Mr. Chipchase’s story is illustrative of some of the challenges and opportunities that exist in the developing world, and how a leapfrog engine like IEMPs can accelerate economic development in those countries. The fact that the story is now six years old does not diminish its relevance.

At the time of the New York Times story there were roughly 3 billion people worldwide without access to a mobile phone.16 As of today there are roughly as many cell-phone accounts as there are people worldwide without one.

http://www.nytimes.com/2008/04/13/magazine/13anthropology-t.html?pagewanted=all&_r=1& (discussing the role and duties of a Nokia user anthropologist whose job is to try and figure out how developed world companies will get developing world citizens to purchase their mobile phones).

14 Id.
15 Id.
16 Id.
are people, depending on the numbers one looks at. Conversely, there are only 1.47 billion people with IEMPs.

II. Mobile phone usage in the developing world

Nokia employed Mr. Chipchase to figure out how to sell mobile phones to people in the developing world. Despite different economic conditions, people use their mobile phones in the developing world for the same types of reasons, personal and business, as people in the developed world. What is likely more common in the developing world is the communal use of mobile phones. This section explores the various uses of mobile phones, and also looks at some of the benefits to users of mobile phones in the developing world.

A. Personal interpersonal communications

Mobile phones facilitate interpersonal communication in a practically unrivaled manner. Discussions concerning personal matters are obvious topics, but any type of information may be exchanged. Mobile phones allow individuals in the developing world to “obtain information immediately and on a regular basis, rather than waiting for weekly radio broadcasts, newspapers, or letters.” It is no surprise then that the utility of mobile phones has been readily realized in the developing world. What may come as a surprise is that “as a family’s income grows — from

---

17 See e.g. AT Kearney, supra note 1; Cisco, supra note 2.
18 Cisco, supra note 2.
19 Employed is the appropriate word to use here, because Nokia is no longer in the business of selling phones worldwide. In fact, Nokia is now relegated to only selling phones in India until 2015. The rapid demise of the former largest phone maker on the planet is indicative of the commodification of the mobile phone market, and actually one of the historical conditions necessary for making widespread adoption of IEMPs an economically feasible proposition. See http://qz.com/202602/nokia-will-continue-to-make-phones-but-only-in-india-only-for-12-months-and-only-because-it-has-no-choice/ (discussing Nokia’s continued existence making phones in India because of a tax dispute with the Indian government).
20 Rashid and Elder, supra note 11.
$1 per day to $4, for example — their spending on [information communication technologies] increases faster than spending in any other category, including health, education and housing.”

B. Business communications

Mobile phones have also had a large impact on business communications in the developing world. Access to information instantaneously lowers search costs for consumers who previously had to travel to a market personally, or listen to a weekly radio broadcast. As an example, when mobile phones were introduced in Niger it reduced the dispersion of grain costs by ten percent. Given these cost savings it should not be surprising that “[p]eople making a dollar a day can’t afford a cellphone, but if they start making more profit in their farming, you can bet they’ll buy a phone as a next step.”

The business impact is not limited to individuals. The introduction of mobile phones allows businesses to “improve[e] communication between firms and their suppliers; mobile phones can enable firms to manage their supply chains more effectively, streamline their production processes, and engage in new activities.” Similarly, a study in Senegal found that farmers who used mobile phones to communicate prices were able to command a fifteen percent increase in their profits. This is in line with a study discussed in the New York Times article which noted the effect on business stating “[a] 2005 London Business School study extrapolated the effect

---

22 Corbett, supra note 13.
23 Aker and Mbiti, supra note 21 at 215-217.
24 Id. at 217.
25 Corbett, supra note 13.
26 Aker and Mbiti, supra note 21 at 219.
27 Rashid and Elder, supra note 20 at 5.
even further, concluding that for every additional 10 mobile phones per 100 people, a country’s G.D.P. rises 0.5 percent.”

One of the biggest benefits of a mobile phone is that it acts as an anchor point for an individual or business. “Jan Chipchase and his user-research colleagues at Nokia can rattle off example upon example of the cellphone’s ability to increase people’s productivity and well-being, mostly because of the simple fact that they can be reached.”

Mobile phones have allowed people in the developing world to enjoy improved reliable communication, greater access to information, cost savings in business transactions, and experience a fixed sense of place.

III. Internet-enabled mobile phones stimulate economic development

The widespread adoption of IEMPs spurring economic development does not fall neatly within a traditional theory of economic development. The many positive network effects that are made

---

28 Corbett, supra note 13.
29 Id.
30 Traditional theories of economic development are often implemented in a top down approach from a central government in the hopes of creating the framework in which economies can grow and thrive. See e.g. Ricardo Contreras, III. Competing Theories of Economic Development, 9 Transnat’l L. & Contemp. Probs. 93 (1999) (discussing the structuralist theory of economic development which required governmental intervention to overcome structural impediments to development and to create modern economies; the linear stages of growth model of economic development which required a massive injection of capital paired with public sector investment; the neo-Marxist model of economic development which relied on self-sufficient development among developing countries irrespective of developed countries).
31 Network effects mean the amount of additional economic activity created by the increased adoption of IEMPs. Network effects are commonly seen in markets where an increase in users of one standard leads to a positive acquisition loop of additional users to that standard. This has occurred most commonly in the world of software and hardware. See e.g. Michael I. Krauss, Regulation vs. Markets in the Development of Standards, 3 S. Cal. Interdisc. L.J. 781 (1994) (discussing the adoption of particular technical standards in consumer technology after sufficient market inertia compelled enough consumers to elect the adopted technology); but see John T. Soma and Kevin B. Davis, Network Effects In Technology Markets: Applying The Lessons Of Intel And Microsoft To Future
possible by IEMPs allow for the adoption of such technology to improve an economy greatly. This section discusses prior theories of economic development, argues that those theories are inapplicable here, explains leapfrog economics, and communicates business plans for theoretical businesses which could greatly benefit from IEMPs.

A. Inapplicable theories of economic development

Given the level of advancement that has occurred worldwide since the introduction of the Internet it would be to the detriment of the developing world to attempt to develop economically according to the methods and history of the developed world. Accordingly, existing theories of economic development do not do a good job of explaining how IEMPs may help societies leapfrog into the developed world, because these theories do not accommodate economic development driven by technology leapfrogging the way widespread adoption of IEMPs promises.

1. Rostow’s five stages of development

One of the principal theories of economic development is W.W. Rostow’s five stages of development. According to Rostow a society goes through five stages before it is considered a fully developed economy. Those five stages are: the traditional society, preconditions for take-off, take-off, drive to maturity, and the age of high mass consumption. Rostow formulates these five stages by looking at the historical growth of the United States, Western European countries, and post-Meji Japan.

---

The first stage is that of a traditional society with limited sophistication in its economy where the majority of individuals are engaged in agricultural activities. The second stage lays the groundwork for the third stage take-off, and often corresponds with reliance upon resource exportation to raise economic activity in the country. The third stage is characterized by the beginnings of country-wide industrialization and acquisition of power by modernizing voices. The fourth stage, or drive to maturity, is characterized by growth in new sectors to deal with the new found wealth. Lastly, the age of high consumption is a full-blown western style democracy and economy where growth is consistent and western notions of property rights, individualism, and economic freedom are firmly entrenched.

The five stages model is not relevant to the adoption of IEMPs, because the adoption of IEMPs is supposed to foster the leapfrogging of some of these stages of growth. There are, however, certain preconditions and structural reforms which are important to the five stages model which must be adopted for IEMPs to have their maximum impact on society.

2. **The Washington Consensus**

The second theory of economic development is known as the “Washington Consensus.” The Washington Consensus is characterized by ten policy prescriptions that encapsulated the U.S. Government’s views on growth for Latin America in the late eighties. The prescriptions are as follows: 1) fiscal discipline avoiding budget deficits unless used for productive infrastructure investment; 2) focus public expenditures on education, health, and infrastructure; 3) reform tax regimes focused on a broad tax base and limited marginal tax rates; 4) tailor interest rates to be

---

33 Id. at 4.
34 Id. at 4-7.
35 Id. at 7.
36 Id. at 8-11.
37 Id. at 11-14.
market-determined focused on promoting productive investment and limiting government deficits; 5) focus exchange rates on expanding exports; 6) liberalize trade policy; 7) encourage foreign direct investment to bolster needs in capital, skills, and expertise; 8) increase privatization as long as it is competitive; 9) deregulate the business cycle; and 10) secure private property rights. 38

The Washington Consensus contains policy prescriptions for economic development that are relevant to maximizing the use of IEMPs, but by and large the theory falls short. Too many of the policy prescriptions result in delayed benefits, if any at all, that do not properly take advantage of the network benefits afforded by widespread adoption of IEMPs. Similar to the five stages model, certain components of the Washington Consensus are useful for leapfrog economics.

B. The Leapfrog concept

This paper suggests that the most effective form of economic development for the developing world is a concept known as “leapfrogging.” A 2000 discussion paper by information technology professors Robert Davison, Doug Vogel, Roger Harris, and international planning professional Noel Jones (“Davison”) discusses the concept of leapfrogging: “the specific use of [information technology] to accelerate development and promote economic growth is often referred to as technology leapfrogging.” 39 The idea is to use new technology in an area where the previous

---


version of that technology had not yet been implemented. The Davison paper discussed how technology leapfrogging via the deployment of ICTs played out in several developing countries around the world. It offered specific examples of technology leapfrogging as well as some considerations for widespread deployment of ICTs such as the need for sufficient training and consideration of the social context.

The Davison paper portrays an excitement about the possibilities created by the adoption of ICTs in the developing world. This type of excitement continues today with respect to the adoption of mobile phones in the developing world. Just recently, Jake Kendall and Rodger Voorhies, of the Bill and Melinda Gates Foundation, published an article on the possibilities opened by the introduction of mobile finance in the developing world. One of the problems that companies have had up to this point in delivering services to the global poor is finding a business model that is profitable. Kendall and Voorhies’ excitement is due to the ability of “mobile-based financial tools [] to dramatically lower the costs of delivering banking services to the poor.” The authors discuss the fact that up until recently banks have had difficulty figuring out a business model to deliver services to the global poor that was profitable. This is the area where the mobile phone can operate as a leapfrog engine. The Davison paper, however, offers a word of caution about

40 Id. at 2.  
41 Id. at 5-6 (discussing the establishment of Egypt’s Information Highway, the establishment of the Malaysian Multimedia Super Corridor, the establishment of the Canada’s International Development Research Centre, the use of ICTs in conjunction with Bangladesh’s Grameen Bank, the effort to link Laos to the internet, the development of Mongolian telecommunications networks, a telephone-based computer network in Sierra Leone, and an exchange deployed in Ghana to facilitate the sharing of health information).  
42 Id. at 4-5.  
43 Jake Kendall and Rodger Voorhies, The Mobile-Finance Revolution: How Cell Phones Can Spur Development, 93 FOREIGN AFFAIRS 2, (March/April 2014), at 9-13 (discussing the introduction of banking services, and other financial services, in the developing world through users accessing these services via their mobile phones).  
44 Id. at 9. (discussing the fact that poor people “are not profitable customers, so banks and other service providers do not reach them.”).  
45 Id. at 10.  
46 Id. at 9.
leapfrogging, and that is “leapfrogging is not an ad hoc kind of activity. There does need to be a compelling vision about the purpose of leapfrogging.”

This paper does not propose a top down vision for the spread of IEMPs adoption, but instead puts forward an idea of “leapfrog economics” that executes from the top down through government action, and the bottom up through citizen adoption, at the same time. The idea is to implement government action which lays the necessary infrastructure for decentralized individual economic actors to utilize their surrounding infrastructure to engage in economic activity which has high impact network effects. The government action in question may be a combination of infrastructure investment and policies which encourage foreign direct investment into the needed infrastructure schemes. Appropriate deregulatory actions should be taken to facilitate both the construction of needed infrastructure and the creation of local businesses which rely upon the needed infrastructure. These actions taken together should put in place the necessary conditions for countries to skip part of the traditional five stages timeline, and leapfrog their development.

IEMPs are an excellent candidate technology for leveraging the power of leapfrog economics because IEMPs can take advantage of a decentralized network, in this case cellular towers and independent economic actors, which is a key component to leapfrog economics. The actual leapfrogging is the building of “the infrastructure, [and] the rapid growth of decentralized, ad-hoc, flexible networks.” This is in part the top-down component, whereas the adoption of

---

47 Davison at 7.
48 Indeed a grand vision to push for IEMP adoption from the top-down may have the counter intuitive effect of preventing development, as opposed to a more natural organic adoption of IEMPs from the ground-up. See Section V infra.
IEMPs by independent economic actors that utilize this network is the bottom-up component. Individuals would build businesses on top of that network, as well as increase economic activity due to lower transaction costs.

The success of a leapfrogging strategy pursued by a country is not a given. The Davison paper discussed ICTs as a potential leapfrog engine, and ICTs never quite took off and fueled the economic rise of the developing world. Indeed, one of the principal failures with respect to the adoption of ICTs was the requirement for developing countries to continually upgrade their technologies to stay up to speed with their developed world counterparts.\(^50\) This upgrade requirement was cost-prohibitive for many countries which had extremely limited capital resources, because of the massive capital expenditures required for building out ICT networks. Mobile phones, that is non-Internet enabled mobile phones, were similarly held out as a leapfrog engine after ICTs. The mobile phone revolution did not pan out. As the Economist explained in 2008 while discussing a World Bank report, mobile phones are not much good if there is not access to consistent electricity, or decent sanitation.\(^51\) This is a valid point; the building up of basic infrastructure, however, is often a catch-22 for countries with low levels of economic activity.

IEMPs are a different technology altogether from phones used solely for telephony, and ICTs. Compared to ICTs, widespread adoption of IEMPs is not cost-prohibitive, because IEMPs and their key components, the internet connection, camera, and apps, are well on their way to

\(^{50}\) Bosah Ebo, Cyberimperialism?: Global Relations in the New Electronic Frontier, 73 (2001).

\(^{51}\) The Limits of Leapfrogging, THE ECONOMIST (Feb. 7, 2008) [http://www.economist.com/node/10650775](http://www.economist.com/node/10650775) (discussing the potential of mobile phones to spawn economic development in developing countries, but the serious problem of basic infrastructure needs in the same developing countries, such as roads, sanitation, and education).
becoming commodities affordable for almost anyone.\textsuperscript{52} As the Jan Chipchase story shows
developed world companies have been focused on selling smartphones to the developing world for some time now. Contrast the cost of widespread adoption of IEMPs, with the cost of building out a wired internet infrastructure, which requires massive capital investment in technology and human capital, and the difference between the two approaches is quite apparent.

To fully leverage the potential of IEMPs to foster economic development this article suggests that countries immediately build the latest cellular tower networks, namely 4G LTE cellular tower network, instead of less cost-prohibitive versions such as a 3G cellular tower network. This process of building out a 4G LTE cellular tower network has already begun in the developing world. China and India committed in 2011 to build up a 4G LTE network in their respective countries despite an existing limited 3G network.\textsuperscript{53}

Three example businesses are listed below in business sectors where IEMPs may be used as leapfrog engines that drive leapfrog economics and showcase how entrepreneurs could harness IEMPs to grow their businesses: mobile phone app development; tourism; and handcrafted goods.

\textbf{C. Three business sectors that can capitalize on internet access}

These three industries, mobile phone app development, tourism, and handcrafted goods were selected for three principal reasons. First, each industry can leverage access to the internet afforded by IEMPs. Second, they are industries which have low barriers to entry, with minimal

\textsuperscript{52} Andrew Nusca, \textit{The era of smartphone commodification has begun}, ZDNet.com (Jul. 22, 2013) http://www.zdnet.com/the-era-of-smartphone-commodification-has-begun-7000018375/ (discussing the idea that smart phones have reached their commodity inflection point).

\textsuperscript{53} Lee Chyen Yee and Devidutta Tripathy, \textit{China, India embrace LTE tech for 4G LTE networks}, Reuters (Nov. 17, 2011) http://in.reuters.com/article/2011/11/17/idINIndia-60582520111117 (discussing China and India’s proposal to build a 4G LTE network even though their respective levels of 3G adoption have been disappointing).
capital requirements, as well as low institutional requirements. Third, they are industries which can benefit greatly from local knowledge.

In addition, the timing is right for these industries to take advantage of IEMPs, for the following reasons: the rise of integrated communications, the rise of cloud computing, and the ease with which people are able to send money abroad. The rise of integrated communications refers to two separate items. The first is the rise and adoption of communications over the internet such as widespread email adoption, as well as the use of instant messaging services. The second is the penetration of mobile phone usage around the world. The rise of cloud computing refers to the ability of individuals and companies both to store data in the cloud, and to harness the processing power of multiple computers via the cloud. The ease with which people are able to send money abroad refers to the diversity of payment mechanisms. Today the technical infrastructure exists where people assume that their transactions over the internet are secure. PayPal, Western Union, every major bank, as well as other companies, and new crypto-currencies, allow for people to take advantage of this infrastructure and send money almost

54 Low institutional requirements refers to the fact that minimal infrastructure beyond the internet enabling infrastructure needs to be in place in the home country. This is contrasted with infrastructure requirements behind trying to start for example a car manufacturer, or an airline, which requires a high level of government involvement, regulatory framework, and societal conditions which would make the endeavor feasible.


56 See supra notes 1, 2, and 6

57 Cloud computing takes advantage of the distributed nature of the internet to allow companies to store data around the world in servers away from each other. See http://www.webopedia.com/Term/C/cloud_computing.html (definition of cloud computing as “a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications.”).

58 Crypto-currencies refers to the rise since 2009 of decentralized, deflationary “currencies” that exist solely in a peer to peer network. The most common example, and industry leader, is Bitcoin. Surprisingly, Bitcoin has a higher adoption rate in the country of Kenya than it does in the United States probably because of the lower level of trust in the Kenyan currency amongst Kenyans. See Why does Kenya lead the world in Mobile Money? The Economist (May 27, 2013) http://www.economist.com/blogs/economist-explains/2013/05/economist-explains-18 (discussing
anywhere on the planet. Indeed, mobile banking has already proven a huge boon to the
developing world.\textsuperscript{59} In particular, Myanmar, which only recently allowed foreign investment in
2012, is in the middle of mobile banking leapfrogging traditional banking to the benefit of its
population.\textsuperscript{60}

Similarly, the technology industry in the developing world more generally is beginning to take
hold. For example, the World Bank recently reported that the continent of Africa is home to
approximately ninety tech hubs, consisting of clusters of homegrown technology companies.\textsuperscript{61}
All of these factors taken together put in place the conditions necessary for the success of the
three ventures listed below.

1. Mobile phone app development

As noted earlier, the proposed leapfrog engine is the IEMP. These types of phones are capable of
downloading applications developed by third-parties separate from the phone manufacturers.\textsuperscript{62}
App development by locals is a low cost enterprise which could be utilized in the developing
world given the local expertise with respect to problems that afflict a village, or town. Local app

\begin{thebibliography}{9}
\bibitem{59} Supra notes 36-39.
(discussing the growth of mobile banking in Myanmar, but noting the requirement for a strong mobile phone
infrastructure to fulfill the promise of mobile banking).
\bibitem{61} Tim Kelly, \textit{Tech hubs across Africa: Which will be the legacy-makers?}, \textit{THE WORLD BANK} (Apr. 30, 2014)
(discussing the rise of technology clusters across the continent of Africa as proof that technology entrepreneurship
is beginning to take hold in many African nations).
\bibitem{62} Supra note 4.
\end{thebibliography}
development companies are already starting to appear in the developing world, so this business plan is timely.\textsuperscript{63}

\textit{a) Company description}

Imagine a business named “PriceIt!” where users can share with each other prices of goods offered at a local market. Users and vendors would be able to upload prices of goods into the PriceIt! system where they would be viewable by users. When a user or vendor enters prices into the PriceIt! system the price information the system would use geolocation\textsuperscript{64} techniques so that the price information would be geotagged\textsuperscript{65} allowing the user of PriceIt! to view the location of the good on a map with the corresponding price for that good. When the PriceIt! user opens the app they will see a newsfeed of prices for goods from their surrounding area. This newsfeed could be customized so that the user will only see prices of goods that are of interest to them personally. This business would be funded by advertising where ads could appear in a sidebar, as they do on many websites, or elsewhere in the app. In addition, all of the data produced by the application could be hosted online in a cloud computing system, such as Amazon Web Services.\textsuperscript{66}

\textit{b) Market Analysis}


\textsuperscript{64} “Geolocation” refers to the ability to take the geographic information associated with a device (phone, tablet, laptop), and add the geographic information to different particular information (such as files, pictures, and audio) at a specific moment in time. \textit{See What is geolocation? – A Word Definition from the Webopedia Computer Dictionary}, available at \url{http://www.webopedia.com/TERM/G/geolocation.html} (last visited April. 19, 2014).

\textsuperscript{65} “Geotagged” refers to the process of adding geographic location metadata to information shared online so that the tagged information is accessible in a mapping application. Geotagging most commonly refers to adding geographic data to photographs, but need not be limited to that particular use. \textit{See What is geotagging? - A Word Definition From The Webopedia Computer Dictionary}, available at \url{http://www.webopedia.com/TERM/G/geotagging.html} (last visited April. 19, 2014).

\textsuperscript{66} Webopedia, \textit{supra} note 56.
The app would be useful for grocery shoppers that need access to current information on vendor prices. Additionally, it would help decrease the amount of time needed to go to a market and peruse vendors and their wares to determine the best price. The developed world does not have a large need for this app because the majority of food purchased in the developed world is purchased at supermarkets. Supermarkets have penetrated developing markets, but that penetration has been incomplete so far. This is especially true in non-urban areas of the developing world.

This type of business would be extremely competitive because of the value it would provide to consumers by providing them updated information on pricing of goods. The information would be real-time as soon as the user or vendor uploads the pricing information to the service. Users can then verify the information, or edit it as prices change. These time savings for consumers in these areas would be potentially huge especially for women who are the principal purchasers of food. This time saving would allow women in these countries to focus on other tasks that need to be completed, and potentially open their days up for education or other endeavors.

c) Service Line

The typical use case is where a user opens the application on the user’s phone, and is presented with a web-feed of prices of nearby goods. The app shows on a map where a particular vendor is located with the corresponding prices for goods that the vendor is offering for sale. Users can then validate price information as well as organize the price information they choose to receive.

---

67 Although western style grocery stores have begun to penetrate the developing world they are still largely a developed world phenomenon. See generally Thomas Reardon and Ashok Gulati, The Supermarket Revolution in Developing Countries Policies for “Competitiveness with Inclusiveness”, INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE, Policy Brief 2 (June 2008) http://www.ifpri.org/sites/default/files/publications/bp002.pdf.
68 “Use cases are simple descriptions of a system’s functions from the bird’s eye view of the users.” Use cases are essential for software engineers to design their systems and ensure that every scenario which may be encountered by a user is accounted for and thought through. See Alan Dennis et al., SYSTEMS ANALYSIS DESIGN UML VERSION 2.0: AN OBJECT-ORIENTED APPROACH 166-168 (3rd ed. 2009).
through the web-feed. For example, if a user only needs to purchase meat at the market, because
for example they have a garden at home, they can denote this in a preferences setting for the app.
The product would need to be seamless in its interface, making it easy to use, so as to help
replace current modes of communication such as texting and calling.

d) Low capital barriers to entry

One of the benefits of this type of business is that there are very low capital barriers to entry in
the mobile app market. All a person needs is a laptop, and an internet connection to build a
business that could be used by millions of people. Similarly, for users to be able to take
advantage of the service they only need an IEMP. This low cost advantage will accelerate the
adoption of the business thereby increasing its chances of success.

The principal cost for this business is the laptop used for programming. Prices for laptops range
from country to country, but as an example in Kenya a laptop capable of running the necessary
software69 may range between 26,000 and 36,000 Kenyan Shillings, which converts to between
$300 and $400.70 This price would be between thirty-five and fifty percent of the Kenyan GNI
per capita71 of $860 in 2012 numbers.72 This is a large percentage of a person’s income in
Kenya, however, every business requires capital investment, and if multiple people went into this

69 The development software used to create Android and iPhone applications is free so these programs are no
additional cost to the entrepreneur. See https://developer.apple.com/xcode/downloads/ (free download for the
XCode development software to build iOS apps which are iPhone compatible); and
71 “GNI per capita” is the Gross National Income of a country converted to US dollars. This economic indicator is
known as the “Atlas Method” and is used to formulate numbers that are meaningful across countries allowing for
comparisons to be made. See http://data.worldbank.org/indicator/NY.GNP.PCAP.CD (defining GNI per capita and
explaining its usefulness as a measure of economic activity comparable across borders).
72 http://data.worldbank.org/country/kenya#cp_wdi (showcasing the world development indicator numbers for
Kenya as produced by the World Bank).
business together the percentage of each individual income drops dramatically. Additionally, grants from the government may be able to offset this cost.

\[ e) \quad \text{Local knowledge leads to local solutions} \]

Local knowledge is indispensable in solving local problems, and this type of problem, as well as this type of industry, is inherently local in nature. A developed world app company would have extreme difficulty coming in to a developing world market and trying to solve local problems such as prices at a local market. The exception to this seems to be communication applications such as Twitter, Snapchat, WhatsApp, and Facebook.

\[ f) \quad \text{Economic Impact} \]

The economic impact of mobile application development is not immediately apparent. On the one hand, the jobs that would be added are high value jobs, such as computer programmers, but on the other hand there will not necessarily need to be a lot of these jobs created for these companies to be successful. The biggest gains in this area could be in both the distribution and aggregation of price information that the app would fulfill. As mentioned previously, the spread of such information has a large impact for vendors and consumers alike.

Business success in this area could serve as an example for other entrepreneurs to start similar ventures. This sort of success could build on itself producing network effects felt through the economy.

\[ \text{73 The capital requirements for this business are low by comparison to larger businesses such as starting a trucking company, traditional manufacturing company, or say a television station. That said, the capital requirements (both monetary and human capital) are not overly abundant in the developing world, which is part of why the developing world is the developing world. At some point the right person with the right skill set, or access to the necessary financing would have to start or fund these businesses, otherwise, it is turtles all the way down.} \]

\[ \text{74 See infra Section V.B.1.} \]

\[ \text{75 For example, Facebook purchased Instagram for$100 million dollars when Instagram had only thirteen employees. See http://www.dailymail.co.uk/news/article-2127343/Facebook-buys-Instagram-13-employees-share-100m-CEO-Kevin-Systrom-set-make-400m.html} \]

\[ \text{76 Supra notes 21 and 22.} \]
2. **Tourism**

The next industry that could greatly benefit from IEMPs is the tourism industry. An example business would be a tourism company which offered custom tours through the Internet to tourists.

*a) Company Description*

Imagine a business called *See Mongolia*. The company would offer customizable tours to tourists looking for an authentic travel experience. Users would log on to the website for the company and be able to choose tours that were in line with the experiences they wished to accrue in the destination country. This type of tourism would be locally sourced, authentic, and adaptable.

The tour owner would be able to upload photos of tour locations to the internet via the IEMP and to input descriptions and pricing information for tours via the IEMP. In essence, the tour owner would have a content creation engine for the online presence of his tourism business on his person at all times.

*b) Market Analysis*

The company would facilitate tourism for foreigners by offering tours that meet requirements foreign tourists might have, but are not known to locals. For example, a user could contact the local tour operator and request a tour of a known cultural site, such as the Buddhist temple in Jan Chipchase’s story, and the tour operator can make the necessary arrangements to set the tour up. This direct access between tourist and tour operator will lower costs associated with planning trips. The company would target tourists in the developed world who are already using the internet to plan their trips.

---

c) Service Line

The only requirement for this business would be a website, or blog, which housed the company information. So, a tourist would be able to visit the website, or blog, of the company and peruse the tours the company offered. This user experience would not deviate at all from how most people browse the internet already.

d) Low technical barriers to entry

Here the barriers to entry are very low. The company needs to build a website which would detail the tours offered with corresponding photos and videos. Using an IEMP for communication and as a camera is intuitive and easy. The difficulty for this business, as well as the mobile app development business, is the requirement for someone to build a website. This potential hurdle may be overcome by either finding a local web programmer, who is probably in high demand and therefore expensive, or by using a blogging service with built-in templates in a “what you see is what you get interface.” After the startup costs for the necessary technology acquisition most of the costs associated with this business would be related to local tourism licenses and salaries for employees.

e) Economic Impact

The economic impact of these types of tourism focused businesses is potentially very large. According to the World Travel & Tourism Council in 2013 travel and tourism contributed US

---

78 Examples of such blogging services which are extremely easy to use and setup are WordPress, Blogger, Tumbler, and Medium. Additionally, any of these companies could substitute a website for a Facebook page, which may have the added bonus of increasing the likelihood of exposure for their businesses among developed world audiences who regularly use Facebook. See e.g. http://thenextweb.com/apps/2013/08/16/best-blogging-services/.

79 “What you see is what you get interface” refers to a program editor which allows you to edit documents, web pages for example, and the way that the document appears to you on your screen as you edit the document is how it will look when it is finalized and published. This approach to document editing provides for an easier and more intuitive editing experience. See http://www.webopedia.com/TERM/W/WYSIWYG.html.
$2.2 trillion dollars to the world economy.\textsuperscript{80} See Mongolia would create multiple high paying jobs, such as tour operators, web designers, and the like.

Additionally, with increased tourism come positive network effects on the surrounding area. Tourists typically purchase small handicrafts when they visit locations and often stop at local restaurants to eat. For example, 4.7 million new jobs were created worldwide as a result of tourist activity in 2013.\textsuperscript{81} Thus raising the amount of tourism in an area can have a large positive impact on economic growth in that area. This is not without cost, though, as increased numbers of tourists can degrade the environment.

\textit{f) Local knowledge can communicate appealing “authentic” experiences to travelers}

The competitive advantage that this business has over tourism companies established outside of the country is that the tours offered through this service would have a greater sense of authenticity and likely lower cost. The local knowledge also helps to raise the value proposition of the offered tour.

3. **Handcrafted goods**

The last industry that would benefit greatly from IEMPs is the handcrafted goods industry. This industry is exceedingly local in nature and may produce high value economic returns for the laborers involved if they can find access to the right market for their goods. The right market for their goods in this instance would be web surfers from the developed world who are willing to pay a premium price for authentic handicrafts.

\textit{a) Company Description}

\textsuperscript{80} World Tourism & Travel Council, \textit{Economic Impact Research} \url{http://www.wttc.org/research/economic-impact-research/}.

\textsuperscript{81} \textit{Id.}
Imagine a company called “Best Goods” which functions as an online marketplace for local producers to list their goods for sale on the internet. Many such businesses exist in this space already, but they are focused on the developed world market.⁸² Best Goods would function as a similar marketplace that allows sellers in the developing world to list their goods for sale to internet users opening up access to local markets. Advertising and listing fees would be the primary revenue sources for this type of business.

b) Market Analysis

The principal benefit offered by this business would be allowing access to local markets which were previously only accessible by traveling to these countries. This decrease in the amount of money it takes to access these markets would be a huge selling point for users in the developed world who either have been to these countries, but cannot afford a return trip at the moment, or would like to travel to these countries, but cannot afford at trip at the moment. A variety of goods would be offered for sale only limited by the feasibility of shipping the goods around the world.⁸³

c) Service and Product Line

There are two typical use-cases: how a user would browse the service, and how a local supplier would use the service. Users would open the website and browse for goods that might interest them. Part of the benefit of using this existing marketplace model is that it is already familiar to developed world internet users and would likely lead to quicker adoption of the business. Once

---

⁸² Companies like Etsy, Ebay, and Amazon offer sellers great autonomy in their ability to list items on the respective services for sale. Etsy in particular is focused on building “a marketplace where people around the world connect to buy and sell unique goods. Our mission is to re-imagine commerce in ways that build a more fulfilling and lasting world.” [https://www.etsy.com/about?ref=ft_about](https://www.etsy.com/about?ref=ft_about).

⁸³ Shipping is a genuine concern for this business model, however, if Amazon is serious about its use of drones to deliver goods then a small drone could depart from an urban center in the developing world and pick up the handcrafted good in the rural area to bring it back to the urban area for shipping by FedEx or UPS. See [http://www.cnn.com/2013/12/02/tech/innovation/amazon-drones-questions/](http://www.cnn.com/2013/12/02/tech/innovation/amazon-drones-questions/).
they found an item that they liked they could add it to a shopping cart for purchase and proceed to their shipping options. Alternatively, a supplier would use the service like suppliers presently do for services like Amazon, Ebay, and Etsy. The supplier creates an account and uploads the terms of purchase for their item. The use of an IEMP would allow a supplier to take pictures with their IEMP and upload them to a listing from the site of production lending to the authenticity and appeal of their products. The supplier can also use their IEMP to enter in the product description and any other information about the product.

\[\text{d) Internet access cuts out existing middlemen}\]

The benefit of IEMPs in this context is that it provides direct access to consumers in the developed world at the lowest cost possible. There already exists a business which provides this service, Ten Thousand Villages,\(^{84}\) but Ten Thousand Villages sells its goods through brick and mortar stores in the United States which adds costs that could be eliminated by this model. Additionally, a marketplace controlled by local residents would increase the feeling of ownership and buy-in experienced by local producers.\(^{85}\)

\[\text{e) Low logistical barriers to entry}\]

The barriers to entry for this business are also quite low. The development of the online marketplace software would be the most time-consuming and cost-intensive part of the endeavor. This could be financed as a collaborative effort by a group of residents who pool their resources to hire a developer to build the marketplace, or a business could see the potential posed by the handicrafts and build the marketplace themselves.

\(^{84}\) Ten Thousand Villages sells developing world handicrafts “by establishing a sustainable market for handmade products in North America, and building long term buying relationships in places where skilled artisan partners lack opportunities for stable income.” [https://www.tenthousandvillages.com/about-us](https://www.tenthousandvillages.com/about-us)

\(^{85}\) Ensuring that individuals “buy-in” to a concept, and take ownership of that concept, is key to any project’s success.
A large logistical barrier to the success of this business is order fulfillment and the delivery of the physical goods. When a developed country customer places an order through the marketplace and wants the order delivered to the United States from Uganda this is a challenge. One possible course of action is for the merchant to travel to the nearest city which has access to the services of FedEx or UPS.\textsuperscript{86} Traveling to the nearest city with FedEx or UPS service would add additional cost and time to the fulfillment of orders and likely diminish the entrepreneur’s profit margin. This additional cost could be priced into the product, or alternatively the entrepreneur could explain the shipping delays and difficulties to the customers on the product pages in the market adding even more authenticity to the goods.\textsuperscript{87} Additionally, this logistical problem could have a spillover effect where a neighbor notices that the members of the community are regularly making a trip to the nearest city with FedEx or UPS to ship their goods, and that neighbor might then be incentivized to start an intermediate delivery service transporting the goods to the nearest city with FedEx or UPS service.

\textit{f) Economic Impact}

The economic impact of this type of business would be very large. First, high value software engineering jobs would be created as well as business operations jobs to handle the marketplace infrastructure. Second, local suppliers of the handicraft goods would have access to a much

\textsuperscript{86} FedEx provides service to 209 countries and territories, whereas UPS provides service to 246 countries and territories. Notable exceptions to this coverage are places like Cuba, North Korea, and Myanmar. See http://www.fedex.com/gb/tracking/codes.html (listing the country codes for all of the countries that FedEx delivers to); http://www.ups.com/worldshiphelp/WS14/ENU/AppHelp/Codes/Country_Territory_and_Currency_Codes.htm (listing the country codes for all of the countries that UPS delivers to).

\textsuperscript{87} The assumption this article makes is that one of the selling points of these handmade goods is their authenticity attributed to their manufacture in the developing world. Customers willing to pay a premium for purchasing goods produced by locals in the developing world are likely the kinds of customers who would appreciate the logistical problems inherent in shipping goods from the developing world, and may even be willing to pay more because of those logistical problems.
larger market than they do currently which would potentially provide a much more stable source of income.

The network effects of this business would be significant: as the business grows it would become a more and more trusted source for purchasing these goods which would drive more customers to the website and drive down the customer acquisition costs for local suppliers.\textsuperscript{88} The success of the craftsman in a community would encourage other craftsman in the community to join the market increasing the vitality of the market.

\textit{g) Intrinsic native expertise drives the value of the goods}

The competitive advantage for these businesses is their native expertise with these goods as well as their ability to build those goods according to traditional aesthetics. This creates a much higher value proposition for consumers.\textsuperscript{89} As previously mentioned users of the service would not need to travel to these countries to acquire the goods.

4. The common factors for internet driven success shared by the app development, tourism, and handicrafts industries

These three businesses, app development, tourism, and handcrafted goods, share certain attributes that will allow them to be successful engines for growth in their home countries. Those attributes are: low barriers to entry; benefit of local knowledge; and potential positive network effects on their communities.

Each of the three proposed businesses would be able to take advantage of low barriers to entry. The entrepreneurs, and their customers, in question would be able to conduct the majority of

\textsuperscript{88} The customer acquisition costs for the merchants would fall because they would not need to spend as much money getting information to potential customers who would know to look for their goods on the website.

\textsuperscript{89} Facebook, \textit{Weaving Connections}, Vimeo (Feb. 2, 2014), \url{https://vimeo.com/85668603} (explaining how a high end antique chair upholsterer from Philadelphia, PA traveled to Kenya and ended up constructing an antique chair involving beadwork from the villagers in Kenya).
their business via their IEMPs. Whether it was the testing, or use, of their applications, the booking of interesting tours while on vacation, ordering handicrafts or uploading images to a service. All these things could be accomplished through the use of IEMPs.

The businesses in question would greatly benefit from local knowledge. App developers are well aware of the problems that plague people in the locations they live. The same knowledge of what is near and dear to one’s heart helps an individual run a more authentic tourism business, or market a unique style of handicraft native to one’s hometown.

The last attribute of these businesses is that they have the potential to produce many positive collateral benefits for their communities. When individuals see the success of their fellow citizens who have employed their IEMPs to help power their businesses they will be more likely to try and start a business of their own. That business may fill a need that is complementary to one of the businesses highlighted above, or the new business may be in an entirely different industry. For example, there might be increased business for local restaurants that are along the tours prepared by See Mongolia. Additionally, the entrepreneurs who start the aforementioned businesses, if successful, will be able to spend more money in their communities, and hopefully create jobs for their fellow citizens.

This trifecta of positive multipliers will help ensure the success of these industries. This success is not guaranteed because each business faces two principles hurdles infrastructure requirements, and public policy considerations. The next two sections look at these hurdles in turn and offer solutions to ensure that businesses such as these can be successful.

IV. Infrastructure requirements
The first hurdle to IEMPs as drivers of economic growth relates to technical infrastructure requirements for IEMPs. If the right technological infrastructure is not in place then the best laid business plans for any industry dependent on IEMPs will not bear fruit.

This article describes a prescription for infrastructure requirements in the developing world. In particular, developing countries should focus on building up as quickly as possible what are known as 4G LTE infrastructure so that would be entrepreneurs can best leverage their IEMPs.

A. Proposed infrastructure

For the developing world to best leverage the power of the IEMP as a leapfrog engine, which takes advantage of leapfrog economics, developing countries need to take ambitious steps to build up the necessary infrastructure to support a broad base of IEMP users. Additionally, and just as crucially, developing countries need to increase the funding of science, technology, engineering, and math (“STEM”) curriculums in their countries. This STEM education will be vital to further the development of industries ancillary to those proposed above, as well as ensuring that any achieved economic growth is sustainable as technology advances.

1. 4G LTE should be adopted

For developing countries to truly leapfrog they should not build up networks 3G networks that will need to be upgraded in the near future. This approach would defeat the entire purpose of  

---

90 See Section IV.B.1.
91 3G is the dominant wireless standard specified by the International Telecommunications Union (“ITU”) used in the developed world. The technology is based off of many of the early wireless standards such as Global System for Mobile Communications (“GSM”) the predominant standard everywhere but the United States, and Code Division Multiple Access (“CDMA”), the predominant standard in the United States. See http://www.webopedia.com/TERM/3/3G.html.
leapfrogging. Instead, the developing world should focus on putting in place levers, economic and legislative, to incentivize private industry to build up 4G LTE networks in their country. Pricing for a 4G LTE compatible cellular tower is not easy to come by, however, in 2012 there was a sale of a large group of cellular towers by T-Mobile which helps illustrate how expensive one of these towers might be. T-Mobile sold the exclusive rights to 7,200 towers over a period of twenty-eight years to cellular tower company Crown Castle for $2.4 billion dollars. Assuming that there was a premium added to the price of each tower for the exclusive use of the towers for twenty-eight years, the price per tower is probably somewhere close to $150,000. In addition, these towers likely cost more to build because they were in the United States, so a cell tower in the developing world might cost somewhere between $75,000-$100,000.

This is a large capital investment to undertake in the developing world, and in truth, multiple cellular towers must be constructed to achieve coverage significant enough to have a large impact on the economy of a country. Despite this high capital cost, if a developed world country received the proper incentives, even a $10 million dollar investment would result in one hundred 4G LTE cellular towers being constructed. One hundred cellular towers may not provide much

---

92 See Davison and Ebo supra.
93 4G LTE is a wireless standard developed in part by the International Telecommunications Union meant to replace the existing 3G standard in place in many parts of the developed world. 4G LTE promises higher internet speeds for IEMPS, and consists of three principal connection standards: Long Term Evolution (“LTE”), Ultra Mobile Broadband (“UMB”), and IEEE 802.16 (“WiMax”). See http://www.webopedia.com/TERM/4/4G_LTE.html.
94 Chloe Albanesius, T-Mobile Sells Towers for $2.4B to Boost 4G LTE LTE Network, PCMag.com (Sep. 28, 2012) http://www.pcmag.com/article2/0,2817,2410313,00.asp (discussing the sale by T-Mobile to Crown Castle and T-Mobile's intention to use the proceeds of the sale to build up its 4G LTE network).
95 $2.4 billion dollars divided by 7,200 towers equates to approximately $333,333 dollars per tower. This price is assuredly above the cost of production for the towers. Additionally, the location of the towers also impacts their price as towers in urban areas naturally command a higher rate, because of the increased amount of demand for the towers. Therefore, it is not unreasonable to assume that the actual cost to build the towers is significantly smaller. To be on the safe side an estimate of $100,000 dollars is used.
coverage in a country like Nigeria\textsuperscript{96}, but it could cover a significant chunk of a country like Benin.\textsuperscript{97} A typical cellular tower has a range between twenty-two and forty-five miles that a cell phone is able to pick up its signal.\textsuperscript{98} There is not a fixed range for cellular towers because environmental factors impact both the range and capacity for these towers.

A country does not need to be covered in 4G LTE cellular towers for this plan to be successful. There are two technological reasons why a limited number of 4G LTE cellular towers would be needed. The first reason, is that most IEMPs come with the capability of functioning as a mobile hotspot.\textsuperscript{99} In this sense, one mobile phone subscription would allow multiple individuals in a rural area to connect to the internet with devices that may not have a data plan of their own, but are still able to connect to a wireless network. The second reason, is that some companies have already begun deploying much smaller cellular broadcast devices known as “small cells,”\textsuperscript{100} to complement and spread their existing 4G LTE networks.\textsuperscript{101} This type of technology would be ideal in many hard to reach rural areas of the developing world. This would decrease the number of large cellular towers needed as a network could grow out much easier given the low footprint of these devices. Additionally, the small cells have a much lower power footprint, roughly

\textsuperscript{96} Nigeria has a total land area of 910,768 sq km, See https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html.
\textsuperscript{97} Benin has a total land area of 110,622 sq km, roughly 8.2 times smaller than Nigeria. See https://www.cia.gov/library/publications/the-world-factbook/geos/bn.html.
\textsuperscript{98} Bert Markgraf, \textit{How Far Can a Cell Tower Be for a Cellphone to Pick Up the Signal?}, Houston Chronicle.com (last accessed May 15, 2014) http://smallbusiness.chron.com/far-can-cell-tower-cellphone-pick-up-signal-32124.html (discussing the range of cellular towers, as well as their capacity, and the factors that impact the range and capacity).
\textsuperscript{99} Hotspots are small range WiFi networks that are broadcasts from mobile devices connected to a larger internet connection such as a cellular tower. See http://www.webopedia.com/TERM/H/hotspot.html.
\textsuperscript{100} David Chambers, \textit{What is a small cell or femtocell?}, ThinkSmallCell.com (Jan 14, 2012) http://www.thinksmallcell.com/System/what-is-a-small-cell-or-femtocell.html (small cells are “short range mobile phone basestations used to complement mobile phone service from larger macrocell towers.”).
comparable to a cordless phone. These two technologies, using an already connected IEMP, or a mobile base station as a potential range extender for the fixed cellular tower, are exactly the kinds of technologies that make leapfrogging possible and effective.

A widespread 4G LTE capable network would benefit the users of IEMPs in developing countries far more than a 3G network which would eventually need to be upgraded to 4G LTE. One benefit is that 4G LTE technology is simply faster than 3G technology. This increases the viability of the suggested businesses by making the experience using the businesses more enjoyable. Another benefit is a 4G LTE network will not need to be upgraded as soon as a 3G network, because the mobile phone carriers are all transitioning to 4G LTE per the direction of the Universal Mobile Telecommunication System. As the magazine PC World put it in 2013, “if you want to future-proof yourself, get a [4G LTE LTE] phone. [4G LTE LTE] coverage is only going to get better, and that's where the carriers are spending most of their money right now.”

There are several concerns that could hinder the development of a 4G LTE infrastructure. Access to reliable energy is one concern. A customer base large enough to make the economic endeavor of building a 4G LTE network from scratch is another concern. Lastly, a workforce sufficiently educated to maintain the network is a concern. The first two concerns are addressed in section V, and the last concern is addressed in the following section.

---

102 Chambers supra 81.
103 For example, Verizon’s 4G LTE service is nearly sixteen times faster than its 3G service in New York. See Neal Gompa, What is LTE?, EXTREMETECH.COM (Feb. 23, 2013) http://www.extremetech.com/mobile/110711-what-is-lte (explaining what 4G LTE LTE is and how a 4G LTE LTE network may be deployed).
104 Universal Mobile Telecommunication System is a global cooperative of multiple stakeholders which decide on the standards for companies to use in the cellular transmission technologies. See http://www.3gpp.org/technologies/keywords-acronyms/103-umts.
105 See Sascha Seagan, 3G vs. 4G LTE: What’s the Difference?, PCWORLD.COM (Dec. 6, 2013) http://www.pcmag.com/article2/0,2817,2399984,00.asp (discussing the various advantages of 4G LTE LTE phones versus existing 3G technology phones).
2. Science, technology, engineering, and math education spending needs to be increased

A critical component to this infrastructure prescription is that developing countries need to build up the STEM capabilities of their population. This is part of the top-down prong of leapfrog economics.

In the event that developed world companies bring in their expertise and infrastructure to construct the needed infrastructure in developing countries, local populations need to be able to secure jobs at the developed world company. This is why countries will need to bolster STEM education to meet new found demand for engineers. A set of economists developed a common standard by which to measure school quality, and this common standard showed that a difference of one standard deviation in test performance on STEM topics translated to a one percent increase in annual growth rate of GDP per capita.106

These infrastructure requirements are considerable, but not insurmountable if the right public policy framework is put into place in developing countries to facilitate the necessary investment in this infrastructure.

V. Public policy considerations

The public policy framework necessary to achieve the required technological infrastructure is two-pronged. The first prong involves legislative requirements, such as respect for the rule of law, and the appropriate amount of government oversight. The second prong is incentive schemes that attempt to create incentives to foster investment in infrastructure. Most importantly

---

is the prescription that governments do not over-regulate the issue, and smother development before it can build organically.\textsuperscript{107}

A. Legislative

In addition to the difference in technical infrastructure between the developed world and the developing world is a difference in legislative approaches to building infrastructure, from the role of government to types of existing legal regimes. Certain “western-style” concepts of property, as well as a light government footprint over any development program, are the key legislative components to this plan.

Certainty is a key component to investment.\textsuperscript{108} Accordingly, western-style property rights must be established, and respect for those property rights promoted for the proposed businesses to work, and the necessary investment in technical infrastructure to occur. Western-style property concepts are not common to every nation, and transitioning to a western-style system can cause unintended consequences, as well as hinder development itself.\textsuperscript{109} Respect for western-style property rights is necessary, however, because the knowledge that property rights will be honored by the legal system promotes reliance upon contracts, because breach of contract will be

\textsuperscript{107} The adoption of IEMPs and businesses that leverage them occurring organically is absolutely vital to the success of this economic development proposal. If adoption occurs organically it is much more likely that people will buy-in to the effects of the development, or the adoption will be seamless to the point where people do not even realize it is happening. This can be doubly important in countries where the citizenry does not hold the central government in high regard viewing it as corrupt or inept.

\textsuperscript{108} The level of certainty of a return on an investment corresponds to higher returns for higher risk projects. See generally James D. Gwartney et. al., MICROECONOMICS: PRIVATE AND PUBLIC CHOICE (12th ed. 2009).

\textsuperscript{109} Thomas Kelley, \textit{Unintended Consequences of Legal Westernization in Niger: Harming Contemporary Slaves by Reconceptualizing Property}, 56 Am. J. Comp. L. 999, 1006 (2008) (discussing how customs in Niger are not constructed upon the Western legal concept of private ownership and have inadvertently led to perilous situations for individuals who are slaves in Niger).
more costly.\textsuperscript{110} Similarly, strong western-style property rights will make it more costly not to perform a contract.\textsuperscript{111}

Although western-style property rights are not the dominant property system in many of the countries of the developing world\textsuperscript{112} integration of western-style property rights into the legal systems of these countries will help to ensure the success of IEMPs as the leapfrog engine of leapfrog economics. Similarly, contrary to many government regimes in the developing world, there needs to be a limited amount of government intrusion into the development process.

Developing world governments should focus on setting in place the conditions necessary for the bottom-up development engine, individual entrepreneurs leveraging IEMPs, but not be involved in picking winners and losers.

Specifically, governments should use their authority to create the necessary infrastructure conditions for individuals to fully realize the potential of IEMPs, but governments should leave the development of business and industries to market mechanisms. Given the scale involved with developing a 4G LTE network, similar to other national infrastructure projects like roads, deferring to government authority to create the incentives necessary to get the 4G LTE network built is appropriate.\textsuperscript{113} Conversely, market mechanisms would be more appropriate for determining what businesses should be started to meet the needs of local communities, because individuals are better positioned to efficiently allocate their limited resources to solving local problems.\textsuperscript{114}

\textsuperscript{111} \textit{Id.} at 201-205.
\textsuperscript{112} See supra note 109.
\textsuperscript{113} W. Phillips Shively, \textit{POWER \& CHOICE: AN INTRODUCTION TO POLITICAL SCIENCE} 142-145 (9th ed. 2005).
\textsuperscript{114} \textit{Id.} 142-147.
One affirmative action that government could take would be deregulatory actions as outlined in the Leapfrog Concept. The deregulation here would be focused on making it as easy as possible for small business owners to found businesses. The three businesses given as examples that could take advantage of IEMPs would benefit from easy filing processes, and limited regulation of their activities. Deregulation is not a guarantee to spur development, but some of the problems associated with deregulation, such as increased coordination costs, would likely not occur in this situation, because the 4G LTE network is being built from scratch. Similarly, deregulation in this context does not refer to the deregulation of an existing large scale industry with a few monopolistic players, so many of the corruption associated side effects of deregulation should not be an issue.

The next section considers different incentive schemes that could be pursued to try and entice companies to build the necessary 4G LTE network for widespread adoption of IEMPs.

B. Incentive schemes

Governments in the developing world have two different groups they can target to try and encourage investment infrastructure. The first group is citizens, or more likely groups of citizens, who can take advantage of grants and other subsidies to help cover the costs of building infrastructure. The second group consists of foreigners encouraged to invest in the country

---

115 See supra Section III.B.
116 Deregulation herein refers to the streamlining of business regulation, as well as the limiting on the amount of business regulation, in the hope that this encourages investment in certain business sectors.
through either foreign direct investment, or foreign portfolio investment. Additionally, governments in the developing world could build the 4G LTE networks themselves, however, this paper assumes that the capital investment necessary to achieve success in this area is beyond the reach of these countries.

1. **Infrastructure and business subsidies**

One approach that governments might employ would be the use of subsidies for citizens to start businesses that utilize IEMPs. The qualification for this subsidy would be whether the business utilized the internet in its operations in some manner. Similarly, subsidies in the form of government grants, or reduced rates for land leases, could be provided to citizens starting businesses with the goal of building up the needed 4G LTE network. What is more likely, is that governments will need to encourage foreign investment to bring in capital and expertise necessary for constructing the needed 4G LTE network.

2. **Subsidies for foreign investment**

Foreign investment in infrastructure projects is a common path chosen by countries to help develop their country’s infrastructure. When the domestic resources are insufficient to fulfill the needs of a development plan foreign investment may be used to fill that gap. The additional benefit of foreign investment for this plan is that the foreign companies involved bring with them the necessary financing of the infrastructure projects, and also the necessary technical expertise to execute the deployment of the needed 4G LTE network.

---


120 Gerald M. Meir, *International Trade and Development* 83-89 (1963) (discussing the often necessary role that foreign capital plays in furthering economic development).
Foreign investment is not always beneficial. Sometimes foreign investment can be correctly characterized as foreign extraction, and increase corruption in a country.\textsuperscript{121} This plan runs less of a risk of succumbing to that problem, because the infrastructure being built, a 4G LTE network, is really only beneficial for the citizens of the country in which it is built.

Regardless of whether governments subsidize investment in infrastructure by their domestic residents, or foreigners, government action to build up the necessary infrastructure is justified and needed.

\textbf{Conclusion: The rise of the yeoman internet entrepreneur}

The future of economic growth is intertwined with the internet. The lack of internet connectivity in the developing world is a serious hindrance to the developing world realizing its economic potential. The intermediate stage of widespread adoption of IEMPs through the development of a 4G LTE network would help countries position themselves to participate in the economy of the now. The people that can help their countries into that future are those leveraging IEMPs to leapfrog their economies from the ground up.

\textsuperscript{121} See generally Daron Acemoglu and James A. Robinson, \textit{Why Nations Fail: The Origins of Power, Prosperity, and Poverty}, 368-403 (2013) (discussing the historical legacy of foreign extraction of resources in the developing world and its lasting effect on institutions in those developing countries in the form of corrupt governments).