



# From Giant Robots to Mobile Money Platforms: The Rise of ICT Services in Developing Countries

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Information and communications technology (ICT) is rapidly establishing itself as part of the societal fabric in the developing world. The momentum of success hinges on creating solutions that address critical societal problems in a market-appropriate way.

A few years ago, traffic robots – humanoid and more than 22 feet tall – began to take over Kinshasa, the capital of the Democratic Republic of Congo (DRC) and the third largest city on the continent of Africa. The robots are made by Thereze Izay’s company Women’s Tech, who convinced the city government to place the robots on congested crossings in a city of eroding infrastructure and perennial traffic problems. With lights on their arms, a rotating chest, and cameras as eyes connected (via a 3G network) with the local police station, they achieved what traffic signals manned by the police could not: changing driver behavior to the benefit of a more bearable traffic flow for daily commuters.

I personally haven’t seen the robots, but accounts from colleagues who have brought out the expectations placed in these robots. Journalists reported that locals praise the robots in endearing human terms, being “happy” with the robots’ work. The local government in Kinshasa is rolling out more, improved versions of the traffic robots.

If you aren’t familiar with developing countries, your first question might be, Why not traffic lights? And why would the police enforce traffic signals in the first place? Traffic management is a complex problem and efficient traffic regulation requires an adequate infrastructure, including reliable traffic lights and maintenance. The pressures of urbanization combined with an already eroding infrastructure are the root cause of many traffic challenges in developing market urban

areas. Driver behavior becomes a challenge in most urban areas, especially fueled by the multitude of vehicle types, from brash private buses competing for customers to people pushing jerry cans shipping water on hard-to-maneuver carts.

The traffic robot story is interesting, because it introduces a context-specific solution to an existing and well-known problem. Robots are obviously not an African invention, but the local engineering group “Women’s Tech” that conceived and implemented this solution had the hypothesis that robots could make a difference in Kinshasa and perform better than traffic signals enforced by the police. Often police are frowned upon across many developing countries, due to high degrees of corruption.

This solution might work in Kinshasa, DRC, but might not be applicable to Nairobi, Kenya. The DRC and Kenya are culturally and geopolitically two very different countries with different societal structures, despite both being part of Africa. Africa is a continent with an astounding cultural diversity, yet is often conceptually misunderstood as one country. But what we do observe across the continent is the desire to solve societal issues through technology that’s deployed in a market-appropriate way.

## Finding Context-Specific Solutions

We are, in my opinion, at a pivotal point in history with respect to Internet-enabled technology in the developing markets. The increasing

accessibility of the Internet and deeper penetration has led to China and India together reaching 1 billion subscribers in 2015, with no end in sight. Mobile channels dominate the developing markets. Africa will reach 1 billion mobile phone subscribers in 2020, and more than half of the subscriber base will have access to smartphones.

Within the next decade, India is going to have the world's youngest workforce, overtaking China. To reap the demographic dividend, India will have to accelerate their populace's skills development. India is experiencing an exponential increase in information and communications technology (ICT)-enabled startups, and given India's investments in ICT skills over the last two decades, it's easy to imagine that the country's youth will become the programming workshop of the world. Also, India could be the first country in the world to drive economic growth through ICT services that aren't yet invented.

Internet-enabled services today stem from more developed countries and are geared towards addressing the needs of the middle class. The initial public offering (IPO) of Alibaba in China and the explosive growth of e-commerce in India are merely a hint of the commercial possibilities of developing countries with large domestic markets. The promise of a global middle class, however, is yet to materialize as the emerging middle class in the developing world signifies a positive trend of a significant part of the population emerging out of poverty into an economically volatile, low-income class that's subject to significant societal problems, such as lack of access to basic services. The role and importance of the Internet and Internet-enabled services in the developing world – especially in light of significant societal problems – deserves to be discussed with care. Will ICT-enabled services positively affect the lives of those who live in economically volatile circumstances?

### Solving Challenges through Insight

Currently, the most obvious challenge is commercially viable services, as it remains difficult to deliver services at a cost point that's appropriate for a local market, where the majority of the population lives on \$10–20 a day. But cost is only one aspect of service delivery.

Another often-overlooked aspect is market appropriateness. For example, US healthcare expenditures amount to about \$10,000 per patient; the equivalent in East Africa is approximately \$200 per patient. Thus, every service delivered in the market must take into account a factor of 10 in reduction for delivering the same service. This could be handled through technology that radically simplifies delivery at the same quality. Think of a device that's manufactured for the developing market at a much lower cost point than for the OECD market; the kind of fabled material of the reverse innovation debate from a few years ago. Another approach, however, is the invention of transformative service delivery models that are more suitable in the market under consideration.

### An E-Commerce Example

Let's look into some simple examples of successful market adaptations of ICT-enabled services. In 2009, I moved to India from the US. At that time, India had about 60 million Internet subscribers – more than France has today. Over the last six years, the number of subscribers has grown by a factor of 4.5, which implies that there are more Internet users in India than in the US, at a penetration rate of only 20 percent compared to 87 percent in the US. This is an indicator of the domestic market size, and even if we estimate that only 50 percent of the existing Indian market would be inclined to engage in e-commerce, 2009 should have had a significant enough number of potential customers buying goods over the Internet. However, six years ago this market was nascent at best.

Shopping online is the same in every country in the world. The customer selects the goods, pays, and receives the goods at his or her doorstep. The payment is online – that is, the consumer is required to trust online payment, which is for all practical purposes a non-issue in mature markets. In India, just like many other developing countries, cash is king.

The tipping point of e-commerce came about through a simple market adaptation. Flipkart.com started as an online bookstore and figured out remarkable delivery logistics in an environment overcrowded by vehicles and a lack of appropriate road infrastructure, and thus stood out with exceptional service quality. More importantly, they introduced the concept of cash-on-delivery. The Indian consumer could now pay with cash upon arrival of the physical goods after buying them online. Later, Flipkart.com also introduced card payment upon delivery through wireless card readers. Today, the company is valued at approximately \$10 billion and is competing effectively against e-commerce giant Amazon, who also introduced cash-on-delivery when they entered the market a few years ago. This example illustrates a simple service delivery model-based adaptation of a well-established Internet-enabled service by understanding the behavioral differences in-market.

Clearly, the adaptation to local market conditions introduced by Flipkart.com is relatively simple to implement. It doesn't "disrupt" the e-commerce model as such. The outcome has been transformative in this particular market and might well be in other markets, where customers exhibit similar apprehensions to online payment methods.

### Mobile-Enabled Financial Services

The second aspect is the delivery of a new kind of a service that suits local market conditions better, but fulfills the same need.

In the developed world, we take many services for granted that have

become essential to our daily lives, such as the availability of financial services. The majority of the population in developed countries has access to financial services such as savings, credit, insurance products, and also low-cost payments.

In contrast, 80 percent of adults in Sub-Saharan Africa are unbanked — that is, they have no access to formal banking and financial services. This doesn't imply that people aren't saving; the mechanisms of saving follow traditional models of hoarding cash, rotational schemes, community-based cooperatives, and so on. It's illustrative, though to understand the reasons and review some of the recent disruptive trends that ICT has brought to bear.

Financial institutions incur a risk by lending money, which on the other hand generates their income, assuming the borrower pays back with interest. Lending requires the bank to establish trust with their customers. Establishing risk might require a potential borrower to demonstrate their trustworthiness, among other means, through deposits into a bank account that then gives the bank the opportunity to observe financial behavior and calculate the risk for defaulting in case the customer requests a loan. This is, of course, a simplified view of the real world, but it works well for the rich and the middle class, with regular income, assets, and sufficient means of ensuring personal economic stability.

In the low-income sector of society, traditional retail banking struggles with multiple issues. Commercial strategies depend mostly on smaller deposits and transaction fees. Therefore, building relationship centers in sparsely populated rural areas, where the majority of the population resides increases transaction costs in a low-margin market, impacts commercial viability. Furthermore, how does a bank estimate the risk for customers who are economically volatile, with irregular income and a higher rate of financial transactions — and whose

assets ensure sustenance rather than growth?

Banks have been struggling with this question in developing markets for a long time. The rapid growth of mobile phone subscriptions in the region created a channel to reach individuals, no matter where they are. The first company to utilize this was Safaricom, now the largest and fastest-growing telecommunications company in East Africa with headquarters based in Nairobi, Kenya. Safaricom introduced a payment solution called M-Pesa as early as 2007. M-Pesa lets people transfer money peer-to-peer using SMS. Customers of this service only require a mobile phone subscription, which is almost exclusively on a prepaid basis. M-Pesa is based on a cash-in/cash-out model, where thousands of agents take cash from Safaricom subscribers and top-up their mobile M-Pesa account. This money can then be transferred to any other subscriber in network through an Unstructured Supplementary Service Data (USSD) application. Beyond the peer-to-peer model, a growing number of small and medium businesses accept M-Pesa, and so do utility companies.

M-Pesa by itself has tremendous value for the majority of the Kenyan population with no access to traditional financial services. Earning money in Nairobi and sending it to family “up-country” might have previously involved a multi-day trip and thus a loss of income; now money can be sent home via SMS. The individual receiving money on their cell phone can easily cash out at any given agent; these agents are mostly small shop owners. This is especially important during major life events, such as sickness, funerals, and paying school fees.

The service boasts over 10 million active users, and is becoming a payment platform backbone for other financial services. For example, Commercial Bank of Africa (a mid-size Kenyan bank) in collaboration with Safaricom, offers M-Shwari, a mobile financial service to create a deposit account, and

also requests for loans for Safaricom's mobile subscribers. M-Shwari implements Know-Your-Customer (KYC) using algorithms based on estimates of financial behavior derived from savings and M-Pesa data, and determines instantaneously individualized credit scores and credit limits for a customer requesting a loan. Given the number of transactions and the complexity of creating insights from soft financial data, this is as good a Big Data use case as it gets.

The disruption of the traditional financial services model through mobile payments is making its way across the continent and into large markets such as India and Bangladesh. Kenya's M-Pesa benefited from the fact that regulations around mobile money operators were generous and hence allowed a telecom to disrupt a space traditionally reserved for banks. In other countries, regulators are finding ways to support a regulated growth of mobile payment and banking services. BKash in Bangladesh, the country's fastest-growing mobile payment service, is a purpose-built company that's a subsidiary of a bank, and is required to use existing USSD channels from local mobile network operators. This approach, in comparison with M-Pesa, where the Telco owns the secure transaction channel, comes at a cost per transaction to BKash and leads to challenges in commercial viability. But I believe it's just a matter of time until the market, aided by regulation, will take care of the economics, especially in countries with a large domestic market.

One major aspect to appreciate is that mobile money has the potential to address a key societal challenge in a commercially viable way. It might just be here to stay, and many developing countries with similar socioeconomic characteristics are embracing the approach due to its potential impact on society. I'm hopeful that governments in this market will increasingly find suitable regulatory constructs that support these and other ICT-enabled innovations.

Ultimately, the real value of mobile money platforms will emerge with increasing the integration of other services, such as revenue collection, basic purchase, or asset financing. After all, cash-in/cash-out drives up the transaction cost, because agents must be supplied with the appropriate monetary funds. The more that services and enterprises become integrated with mobile payment platforms, the less the dependency on cash.

For example, in rural areas, access to energy is major challenge for public health. According to the World Health Organization, kerosene, wood, and coal cause respiratory diseases that kill over 1.5 million people, two thirds of those in Sub-Saharan Africa and southeast Asia alone. M-Kopa is a Nairobi-based enterprise that sells a solar-powered battery system across several East African countries. The system is sufficient to recharge cell phones, operate a radio, and provide lighting. The customer pays for the device using M-Pesa on a daily payment scheme, and owns the device after one year. The M-Kopa system comes with a Global System for Mobile communications (GSM)-enabled unit, which activates the device upon payment of a fixed deposit and allows M-Kopa to disable the unit in case of delinquent daily payments. Due to insights that M-Kopa has into the financial behavior of a customer, it has the option to create a mechanism that may help to offset potential challenges that a customer might experience.

### Perpetually Generating Insights

The common theme across many ICT-enabled solutions is the insight that we get from users. These topics are at times a bit contentious in the developed world, where customer insights that come from analyzing clicks, likes, and shares generate billions of dollars through targeted advertisement. In developing countries, there's an interesting twist to the insights and data story.

Our knowledge about user behavior in developing countries is limited, even though much progress has been made by economists applying randomized control trials to shed light on adoption of solutions for the underprivileged. But those studies by design aren't focused on leaving sustainable solutions behind. We must be more aggressive in creating commercially viable solutions and utilizing the data generated for the purpose of addressing societal needs.

We understand the desires and aspirations of individuals with a disposable income above a certain threshold, and this segment of society is similar across countries. We buy things for pleasure; invest money into the education of our children and into our health. These desires might not be any different for people who live under economically volatile circumstances, and the only difference might be regularity and the amount of disposable income. ICT-enabled services that cut across this spectrum, however, can provide us insight into the challenges of the sector.

Today, we still don't understand enough about consumer behavior in the developing world. I believe the more we're able to generate data about consumers through meaningful and market-appropriate solutions, the more we'll be able to create solutions that leverage actionable insights from data that could potentially drive individual behavioral changes or affect government policies. Circling back to traffic, we see tremendous challenges with road accidents in developing markets, to an extent that we could consider it a public health crisis. For example, in Kenya the age-adjusted death rate from traffic accidents is only marginally lower than the death rate from tuberculosis, both in the order of 30 per 100,000 people. Driving on Nairobi's roads will make you believe that poor road infrastructure might have something to do with that, and that fixing road width as well as potholes might ultimately save lives.

At the IBM Research Lab in Nairobi, we developed a technology that analyzes standard smartphone accelerators' and gyroscopes' signals using sophisticated machine learning algorithms to detect speedbumps and potholes while also estimating road width and driver behavior. To cover the entire city, we partnered with the Nairobi City Council to deploy this solution in garbage trucks, to create a road quality map of Nairobi, at the same time providing a utility to the city government via a fleet management solution for their waste-management fleet.

This solution is an example of quantifying driver behavior as a parameter of road distress, where drivers might avoid potholes at the risk of causing an accident in the maneuver. Generated road distress maps can at the same time influence city planning to alleviate the problem through systematic repairs of road infrastructure. We believe it's an example of a typical data and analytics play relevant to developing countries with similar challenges. □

In future installments of the "Developing World" department, we'll illustrate some of the innovations in the area of commercially viable ICT investigations for the developing markets. Our goal is to inspire scientists and engineers around the world to consider the use of ICT in solving societal problems. I believe there's much room for groundbreaking innovation, to the benefit of societies that are striving towards growth.

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