



Leveraging Mobile Technology to Drive Sustainability in Agriculture in Emerging Markets

Dow Sustainability Fellows Program
University of Michigan, Ann Arbor

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Abstract

In an era where raw materials are becoming scarcer and ecosystems are being degraded, agricultural companies must prioritize supply chain sustainability. Many U.S. firms leverage information management systems to reduce resource use and improve value chain sustainability. Our project explores existing technological advancements and their application in developing markets throughout the world. Our analysis shows that with the growth of 3G mobile networks worldwide, opportunity exists to incentivize companies and NGOs to use technology solutions to both create financial value and address sustainability challenges.

Project Context and Problem Statement

In an era where raw materials are becoming scarcer and ecosystems are being degraded throughout the world, companies must prioritize supply chain sustainability. Consumers, governments and communities throughout the world are looking to corporations to become leaders and take responsibility for what happens throughout their value chains. While many companies are taking steps to address these challenges, there remains a vast opportunity to create innovative solutions through the use of technology. With the advent of 3G mobile and other technology infrastructures in the developing world, an opportunity exists for companies to leverage the use of relatively cheap information sourcing management systems to better monitor and intervene in their supply chains, even among 2nd and 3rd tier suppliers.

Project Methodology

1. Assessment of Agriculture's Impact on Sustainability in Emerging Markets

The first phase involved identifying sustainability risks and social risks experienced by agricultural stakeholders in emerging markets. We conducted primary research with agricultural stakeholders in emerging markets and secondary research using online sources. The primary goal was to both understand the agriculture-related sustainability challenges that existed in emerging markets and identifying opportunities for why they can be addressed. The team's initial inclination was to research specific agricultural value chains to assess sustainability risks and other traits. However, after extensive

research we found that many value chains were facing similar risks. We therefore focused on taking a more holistic approach during this phase.

2. *Primary and Secondary Research on Emerging Mobile Technologies in Agriculture*

During this phase, our team researched ongoing mobile technology solutions and identified current practices that are both effective and ineffective from a sustainability and a value-creation perspective. We attempted to isolate technologies that would produce value for both large multi-nationals and smallholder farmers. We also focused on technologies that had the best chance of being rolled out in emerging markets. We conducted this research through both primary and secondary sources and evaluated the impact on emerging markets through additional secondary research.

3. *Recommendations for Improved Implementation of Technologies that Improve Sustainability in Agricultural Supply Chains*

The final phase of the project involved combining insights from the first two phases to produce recommendations for agricultural stakeholders in emerging markets. We attempted to leverage our multidisciplinary perspective to offer recommendations that will ideally drive positive change and help multi-nationals, NGOs, smallholder farmers, local governments and others to find common goals and invest in technologies that will drive sustainability in the global agriculture industry.

Our Team

Alex Papo – MBA/MS in Environmental Science

Alex has a background in international development, including two years managing international development projects that facilitated agricultural value chains in emerging markets. Alex is currently focused on helping large companies drive sustainability throughout their business operations. He has spent time working with Dow Chemical, Danaher Corporation and General Motors on projects focused on driving corporate sustainability and social impact.

Ursula Jessee – MBA/MS in Environmental Policy

Prior to graduate school, Ursula Jessee was President of an international development consulting company, where she consulted private sector, NGO and government clients on agricultural and economic policies in emerging markets. In school, Ursula has focused on developing social impact ventures to provide improved livelihoods for disadvantaged populations in emerging markets. She has spent time with Dow Chemical, Kraft and Booz and Company, primarily working on projects that help companies create a competitive advantage through sustainability.

Aditi Moorthy – MS in Environmental Science/MS in Applied Economics

Aditi was born in India and is in a joint program at the University of Michigan. She has an extensive background researching agriculture's impact on society and conducting product life-cycle assessments to better understand product sustainability risks. She has spent time working with Dow Chemical and the Rocky Mountain Institute.

Why a Multidisciplinary Approach is Needed

School of Business – Business Feasibility is Critical to Ensuring Large-Scale Impact

- Corporations, governments, NGOs and farmers all have a goal of increasing value in agricultural supply chains
- Profitable solutions will ensure more widespread adoption

School of Natural Resources and Environment – Effective Sustainability Interventions Require Accurate Scientific Conclusions

- An understanding of biology, ecology and geology is required in order to design effective interventions

Environmental Policy Track, School of Natural Resources and Environment – Public Policy Largely Impacts Global Food Systems

- Food production is often viewed as a “public good” and systems must be designed to help feed local populations
- Technology should help smallholders take advantage of government-driven subsidies and tax incentives

School of Economics, Applied Economics – Global Economics drives Local, Regional and Transnational Agriculture Industries

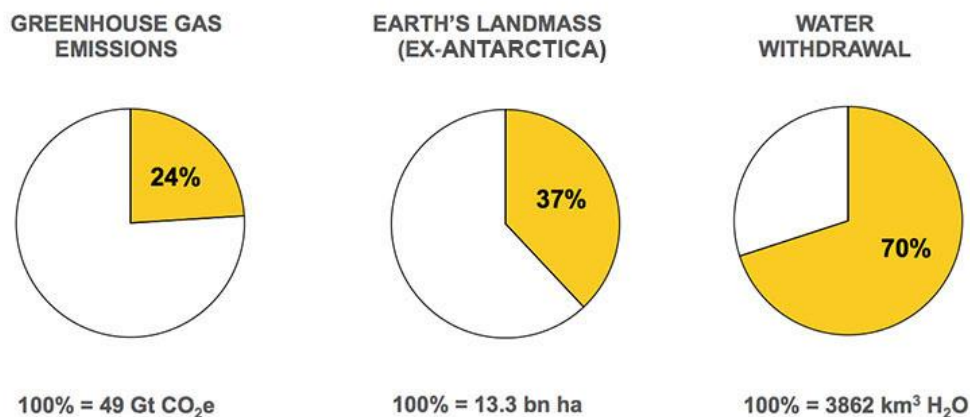
- Agriculture markets are largely impacted by micro and microeconomic factors and solutions must account for the effects of these drivers

Overview of the Global Agriculture Industry’s Sustainability Challenges

There are numerous sustainability challenges that result from industrial agriculture. Agriculture leads to pollution, nitrification, increased emissions, pollution, soil degradation, and water depletion. The world resources institute table below demonstrates the impact that agriculture has on greenhouse gas emissions, earth’s landmass, and water withdrawal. The good news is that many of these challenges can be addressed through agricultural innovations.

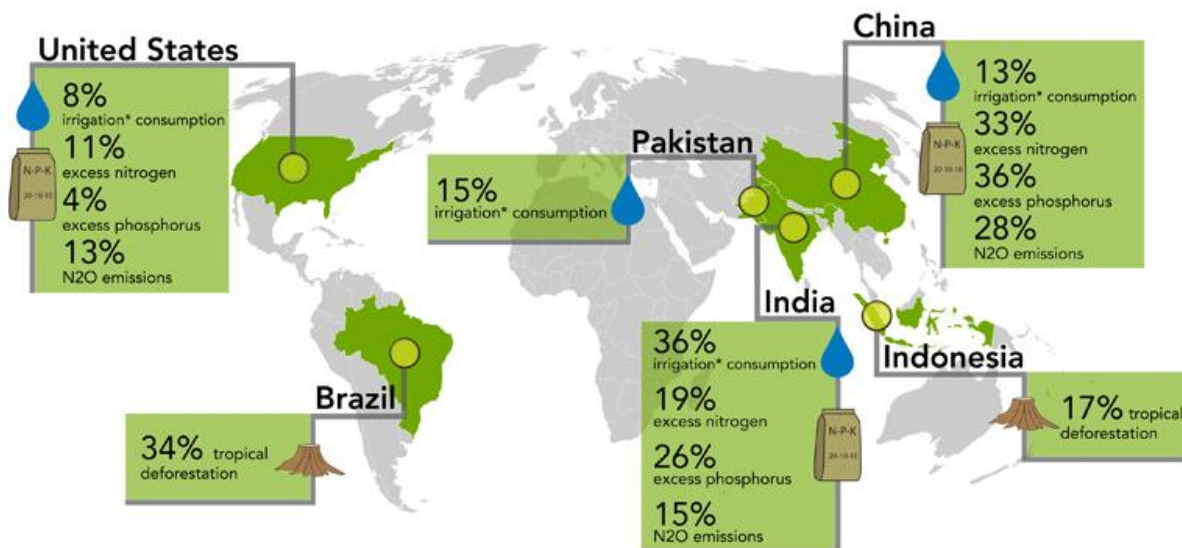
Figure 1: The Global Agriculture Industry’s Impact on Sustainability is Immense¹

Agriculture’s Share of Global Environmental Impact (2010)



Water is becoming scarcer in the poorest parts of the world and agriculture accounts for 70% of water usage around the world.² With the challenge of increasing populations and finding ways to feed the growing populations there are good to need to be innovations with regards to reducing water usage in agriculture. The best way to intervene and reduce water usage is to reduce water waste. According to the WWF agriculture wastes 60% or 1,500 trillion liters, of the 2,500 trillion liters of water it uses each year.³ The WWF cites that the three main reasons for water waste are “leaky irrigation systems, wasteful field application methods, cultivation of thirsty crops not suited to the environment.”⁴ These three areas of waste offer an opportunity for improvement. However, not only does agriculture use a lot of water but it also pollutes bodies of water through nitrification, the run off of phosphate and nitrogen, which are elements that are heavily used in agriculture. The nitrification of bodies of water leads to hypoxic zones also known as “dead zones”, which areas that lack oxygen and result in the killing off of fish populations. The table below shows the amount of water consumed by irrigation, polluted by nitrogen and phosphorus, and other impacts of agriculture around the globe.

Figure 2: Agriculture Industry’s Impact on Sustainability throughout the World⁵



The heavy use of pesticides also pollutes nearby water streams and soils. Pesticides not only pollute bodies of water but also kill off good organisms including insects that are not pests and soil microorganisms.⁶

Figure 1 above also indicates that industrial agriculture also is responsible for 24% of all carbon emissions.⁷ Management practices result in these emissions ranging from fertilizer application to manure storage.⁸ As more forests are burnt down in order to make space for agriculture the carbon in the trees is released. Deforestation also results in erosion. Land erosion has multiple negative effects including a reduction in soil fertility, a loss of arable land, sedimentation of bodies of water, which can reduce fish populations, and flooding.⁹

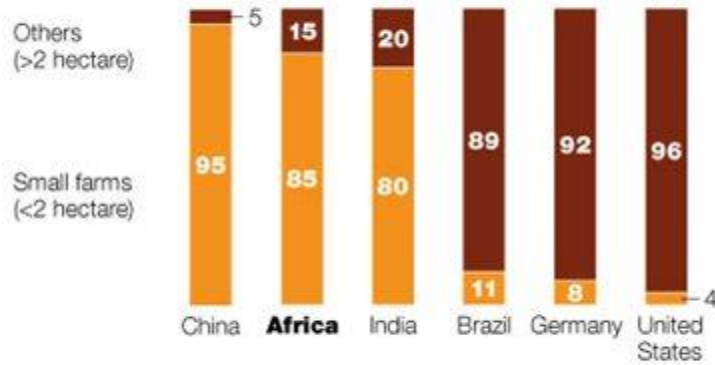
The Agriculture Industry's Impact on Sustainability in Emerging Markets

For emerging market countries, agriculture-related sustainability challenges are often even more apparent and have a larger impact on society than in developed nations. There are several drivers for this disparity, from a lack of infrastructure to the scarcity of technical expertise in more advanced farming techniques. In addition, government regulations that promote sustainability in agriculture are not as common in these countries as the primary goal is often to generate enough food as efficiently as possible to feed a fast growing population.

The differences between agricultural practices in developed markets, such as the United States, and emerging markets, such as Sub-Saharan Africa, are stark. In fact, “one third of humanity is fed through an estimated 500 million smallholder farms [and in] Asia and sub-Saharan Africa the dependence is even higher, where small farms produce about 80% of the food consumed.”¹⁰ On the other hand, the agriculture industry in the United States has undergone massive consolidation as the number of farms has decreased by over 66% in the past 50 years.¹¹ This development was primarily driven by the rapid introduction of new farming technology and techniques, often termed the “Green Revolution.” The differences in the distribution of farm sizes based on region can be seen in Figure 3.

Figure 3: Distribution of Farms by Region¹²

Distribution of farms by size, % of land holdings

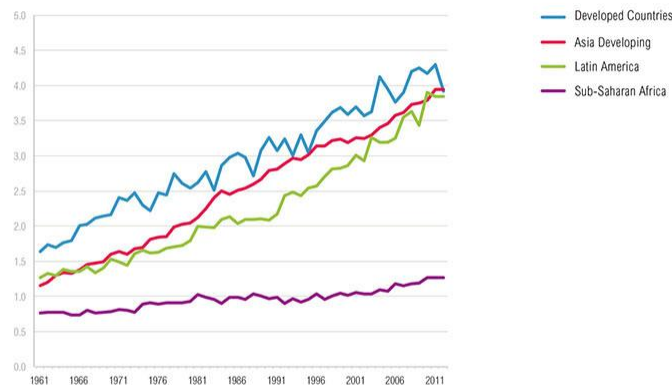


Source: *World Census of Agriculture*, various years, Food and Agricultural Organization of the United Nations

Since the latter parts of the 20th century, emerging markets have begun to experience a similar transformation. This transition has been slower in places such as Sub-Saharan Africa due to the lack of infrastructure and markets through which to transfer improved farming practices, genetically modified crops and technology (see Figure 4). Thus the agriculture industry in most emerging market countries are still made up of a large number of farms that are “managed by families with limited technical and mechanical support and with poor access to finance.”¹³

Figure 4: Improved Cereal Production in Sub-Saharan Africa Lags Other Markets¹⁴

Cereal Yields (in metric tons per hectare)

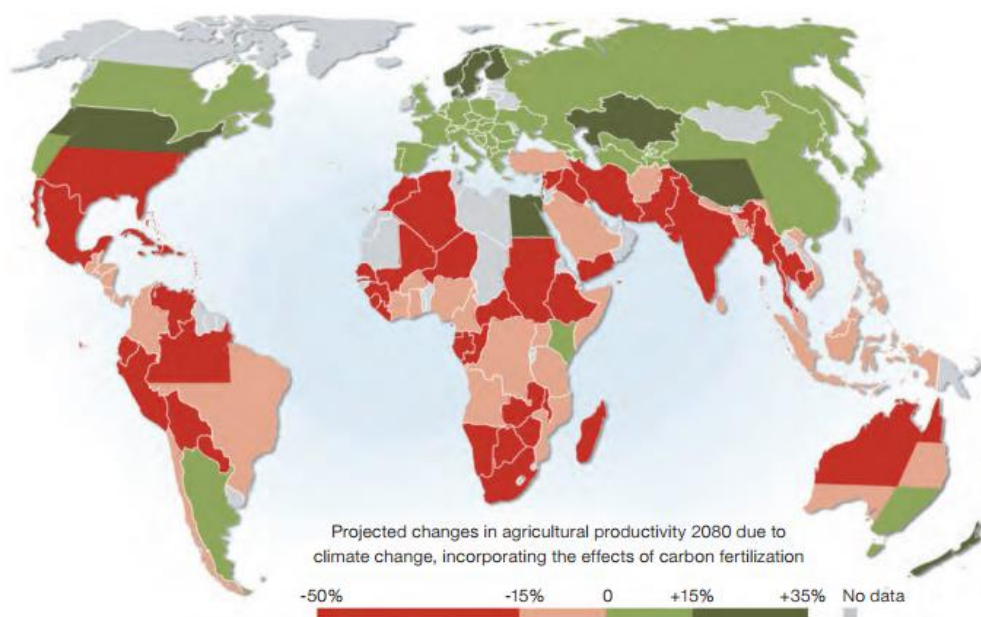


WORLD RESOURCES INSTITUTE

Sources: <http://ow.ly/rp1MN>

Smallholder farmers, who often grow crops to feed their own family, are much more exposed to sustainability challenges than large farmers that can diversify and hedge against such risks. For example clean water is often a limiting resource in emerging markets, where it is usually priced very low in developed countries.¹⁵ In addition, land degradation from over production, a lack of crop rotation or over fertilization are problems more often faced by poor farmers.¹⁶ Lastly, climate change is likely to have a much larger effect on these types of farmers and mitigation strategies are much harder to come by or implement (see Figure 5). With little to no profit margin for most farmers, it is essential to develop low-cost strategies that can bring economic value and reduce exposure to sustainability-related risks.

Figure 5: Impact of Climate Change on Agriculture by 2080¹⁷



On a macro level, many of the most environmentally unfriendly crops are grown in emerging market countries. These crops, such as soya and palm oil, often result in massive amounts of deforestation, land degradation and biodiversity loss.¹⁸ Runoff of nitrogen, phosphorus and other compounds is also a major growing concern in these markets as farmers begin to use more fertilizers and pesticides to grow crops more efficiently. In addition, experts estimate that in emerging markets 30-40% of all food turns into waste before it reaches the end consumer.¹⁹ These and other challenges make it clear that sustainability must be at the forefront of agricultural policies in emerging market countries. The goal will be to strike a balance between

feeding ever-growing populations while ensuring that agriculture will be sustainable for many years to come.

Technology has the Opportunity to Drive Sustainability in Agriculture in Emerging Markets

The agriculture industry in many emerging markets is ripe for innovation and could catch up to those of more developed countries within a few decades. An advantage that players in these markets hold is that they can learn from the successes and failures of the Green Revolutions in both the United States and Southeast Asia. In addition, the playing field is much different now with the drastic advancement in technology, changing consumer preferences and international trade resulting from globalization. These transformations, and in particular the rapid advancements in Internet and Cell Phone Technology (ICT) provide an opportunity to connect and serve the large number of agriculture industry players in emerging market countries to create value quicker than it may have taken 50 years ago. There is an opportunity to “leapfrog over costly and redundant technologies and make better use of existing tools and services.”²⁰

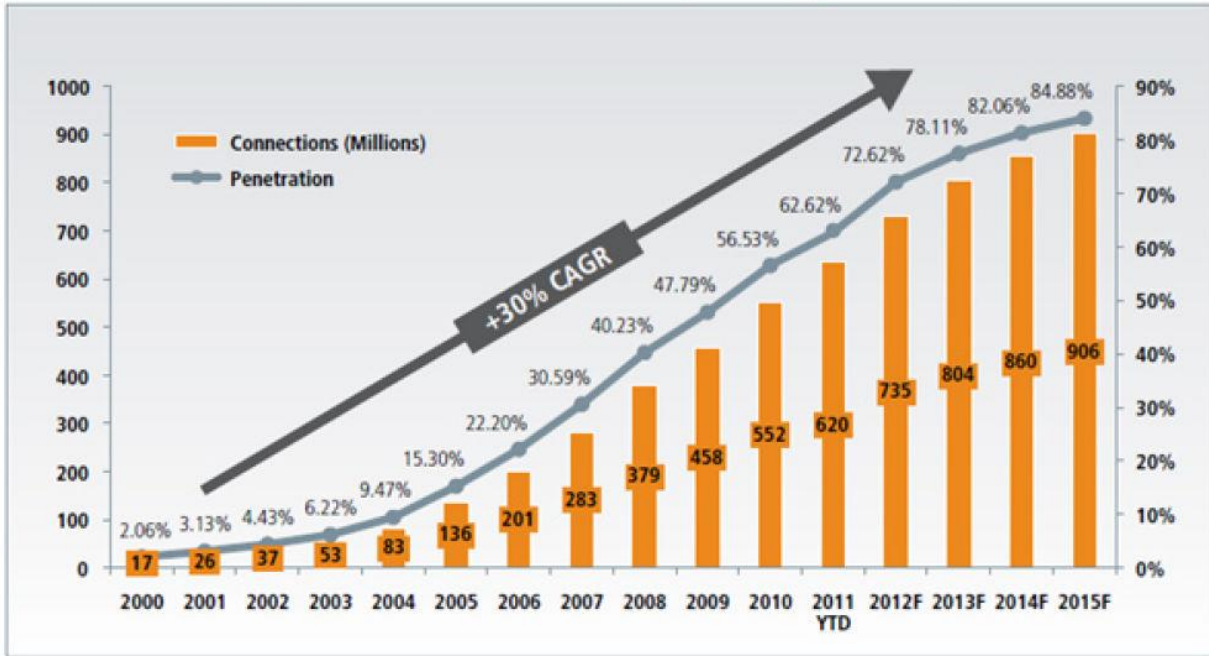
Opportunity 1 – Increased Connectivity Resulting from the Growth of the Global ICT Industry

There are a number of reasons to why ICT advancements provide is such a large opportunity to drive innovation in agriculture in emerging markets. One primary reason is that these markets continue to consist of a very large number of players; as discussed above 500 million smallholder farms feed over 1/3 of the entire human population. The decentralized structure of agriculture in emerging markets has made it difficult to drive innovation, but one of the promises of ICT is that it will improve connectivity and information flows for smallholder farmers and cooperatives.²¹ But this is assuming that ICT will be widespread in these emerging market countries, and especially in rural regions of these countries where most smallholder farmers operate.

Fortunately, recent trends make the widespread adoption of ICT solutions in emerging market countries more favorable. According to a study conducted by Euromonitor International, “78% of the world’s households had a mobile phone in 2011, up from 20% in 2000.”²² Sub-Saharan Africa has the lowest penetration rate at 67%, but this is rising rapidly (Figure 6).^{23,24}

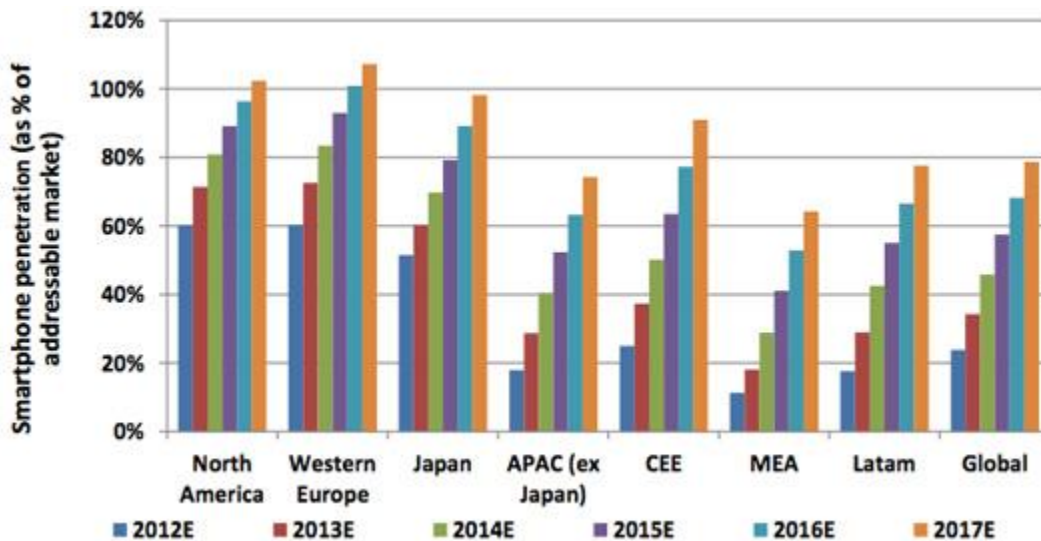
Figure 6: Mobile Penetration in Africa has a 30% Compounded Annual Growth Rate

Total African Mobile Connections and Penetration Rate (million, % penetration)¹



In addition, the same Euromonitor study showed that smartphones are expected to have a 78% market share of all cell phones by 2016.²⁵ Figure 7 shows the penetration of smartphones in different markets throughout the world, which is rapidly increasing each year.

Figure 7: Smartphone Penetration Trends by Regional Market²⁶



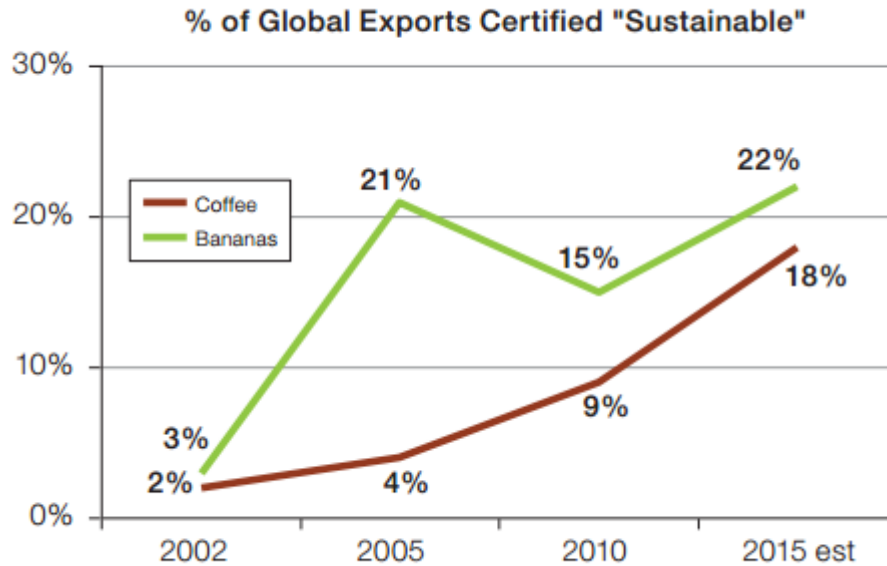
With the rapid growth of ICT, and particularly the adoption of smart phones, there is a significant opportunity to introduce mobile technology that connects and serves smallholder farmers, governments and large corporations throughout the world. Barriers to connectivity and adoption of technologies remain, but the infrastructure will be in place for the rollout of technologies that will help transform the agriculture industry in emerging markets.

Opportunity 2 – Shifting Consumer Preferences in Developed Markets are Driving Companies to Prioritize Sustainability in their Agricultural Value Chains throughout the World

Large agricultural companies require financial justification for almost any large investments they make in their supply chains. The same argument goes for driving sustainability among their producers in emerging markets. Fortunately, consumer preferences are rapidly shifting when it comes to how agricultural commodities are sourced from developing countries. A 2009 GMA/Deloitte survey of grocery consumers showed that “fifty-four percent of shoppers interviewed consider sustainability to be one of their decision making factors and are ‘Leaning Green’.”²⁷ At the same time, demand for agricultural commodities and products continues to increase on a global basis and “from Coca-Cola to Cargill, companies are tapping into smallholder value chains to secure a sustainable supply for their products.”²⁸

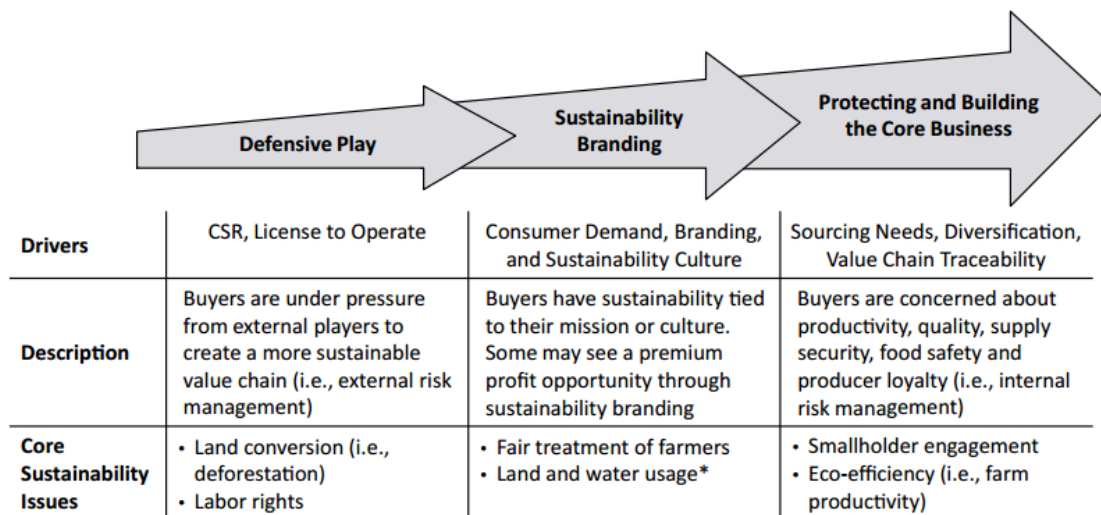
Due to shifting consumer preferences, many of the largest agriculture and consumer products goods (CPG) companies are rapidly shifting their sustainability strategies when sourcing from developing countries. Cargill, an agriculture company with over \$140B in annual revenue, has committed to source all of its palm oil sustainably by 2020.²⁹ Unilever, one of the world’s largest CPG companies, has “committed to sustainably source 100 percent of its tea by 2015—an amount that currently represents 12 percent of the world’s black tea supply.”³⁰ With the largest players in the market changing the way business is conducted, we are already able to see transformations in the market as a whole. Figure 8 shows how evolving sourcing strategies have led to a significant increase in the percentage of sustainable exports for coffee and bananas.

Figure 8: Sustainability Trends in Banana and Coffee Exports from 2002-Present



Due to a shift in consumer preferences, large companies have evolved their sourcing strategies. Sustainability initiatives within a value chain, once solely a response to external pressure from NGOs and other related parties, have now become part of long-term value proposition for multinational corporations. Companies are adopting sustainability to drive their branding, and increasingly, to protect their assets and long term viability. Appendix I provides examples of how some companies are using sustainable sourcing to appeal to evolving consumer preferences.

Figure 9: The Transformation of Agricultural Sourcing Strategies³¹



With an increased focus on sourcing from smallholder farmers, agricultural value chains have also become more complex in nature. It is becoming more and more costly for large companies to ensure traceability and provide technical support throughout their supply chains.

Advancements in ICT and other technologies provide a great opportunity to help multi-national corporations address these challenges. In fact, investing in these technologies provide an opportunity to create financial gain in addition to driving sustainability throughout the value chain.

Overview of Existing and Emerging Mobile Technologies in Agriculture

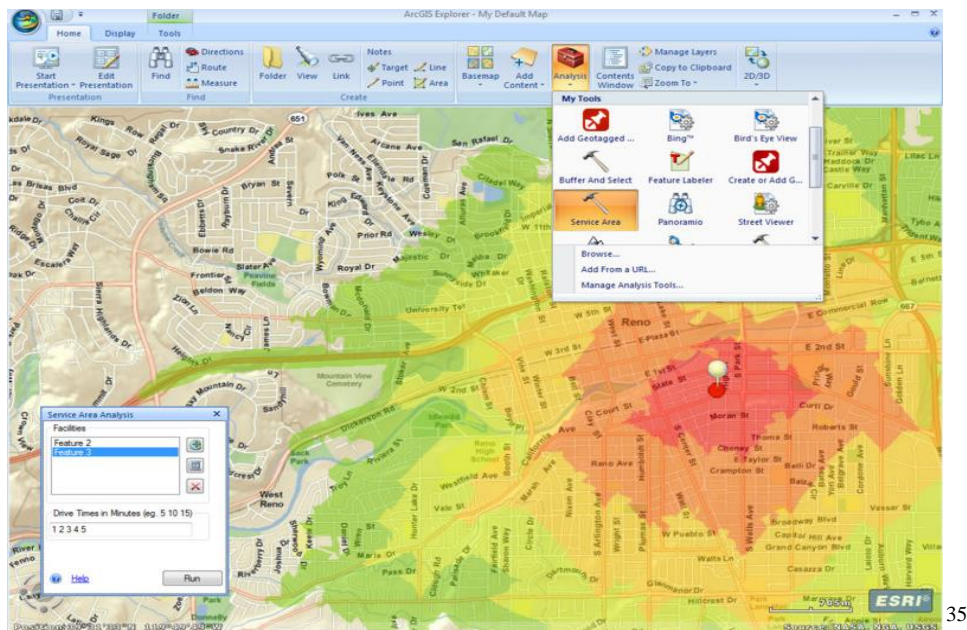
Cloud computing, integrated IT systems, online education, and the proliferation of mobile phones have made it easier to disseminate agricultural information to farmers in the poorest communities. All of these solutions provide farmers with access to education and information on a range of agricultural topics. The increased usage of smart phones and social media is an opportunity for farmers to engage with each other and with experts. Furthermore, aggregating news feeds on agricultural related topics can enhance access to information. Translation services on web browsers can help farmers access information in the language of their choosing.

Basic Agricultural Information

The increasing popularity of open source online education has boomed in agriculture. In fact, there is a task force, the Agricultural Learning Repositories Task Force (AgLR-TF), set up that aims to create a network of organizations that develop open source agricultural information. Some examples of universities that provide online education in agriculture are (NAIP) in India, Indira Gandhi National Open University (IGNOU), Yashwantrao Chavan Maharashtra Open University and in China. The biggest challenges to the proliferation of this information is the lack of interoperability between archives and databases. One of the largest efforts to distribute agricultural information, with 591 courses, is in China, and is on a website called Jing Pinke.³²

Monitoring Climate and Soil Data to Manage Risk

One of the benefits of the connectivity in agricultural is that the information allows farmers to make better land management decisions and decide whether to invest in insurance. GIS has been used to map out the topography of a particular agricultural area and is combined with statistical data in order to better analyze the soil. This information can be used when determining which plants would fare best with the particular soil conditions and where the plants should be grown.³³ The GIS data can be used in combination with historical data and sampling. With the advent of the cloud this information can be accessed from any computer, smart phone or tablet, which is helpful in poor agricultural community in which farmers may only have a mobile phone and may not own their own personal computers or tablets and rely on public or shared computing. One cloud based tool is ArcGIS Online, which is a “complete, cloud-based, collaborative content management system that allows organizations to manage their geographic information in a secure and configurable environment.”³⁴ According the FAO ArcGIS enables farmers to create web maps and are able to share this information with others and are able to overlay data onto these maps.



ArcGIS Systems Provide Metadata for Farmers and other Stakeholders

The cloud and connectivity also mean that soil conditions can be monitored in conjunction with weather information in order to better plan the planting season and harvest. Unusual weather

patterns, colder or warmer than average temperatures, or looming natural disasters can provide farmers with information that could help them make decisions on the types of crops they should grow, how long their growing season should be, and the risks they might encounter during the season.

Similarly, GIS has been used to provide pre-emptive information on pests and animal diseases so that farmers can respond according to the level of risk. Information on potential pests could enable farmers to prepare their crops with a particular pesticide or to harvest earlier than they had planned. The technology for pest information is still in its early stages but holds a lot of promise for prevention or risk mitigation planning. Furthermore, if farmers learn about animal diseases they have the opportunity to save the animals and reduce the financial impact of such disease.³⁶

Agricultural marketing information available to farmers would not only help farmers to sell their products at better prices, but also provide reliable food price information to policy makers to prevent price volatility and speculation.³⁷

Soil, Nutrient and Land Management Tools

Mobile technology and cloud computing can be leveraged to optimize the use of fertilizer, water and seeds, saving farmers money while reducing input consumption. One example of being able to leverage cloud computing and technology is precision farming in green houses. A company called Got Produce and Gandpa Domes in Japan leverage technology to deliver precise amounts of water, pesticides and herbicides to plants in greenhouses.



Gandpa Dome in Japan

These technologies are particularly useful in geographies that are prone to droughts because increases the efficiency of water usage to plants and it eliminates the effects of runoff in the water system. Got Produce, are internet connected greenhouses that “control all growing variables remotely, Got Produce growers have technical help that guarantees success.”³⁸ This also enables remote training of farmers on new techniques and technology solutions, allowing for more sustainable farming practices.

Market Information Sharing Systems

One of the most financially beneficial aspects of ICT in agriculture is real-time pricing information which allows farmers to decide whether to buy or hold and identify the best crops to grow and can help farmers reduce waste.



Mobile Systems can Provide Real Time Pricing Information

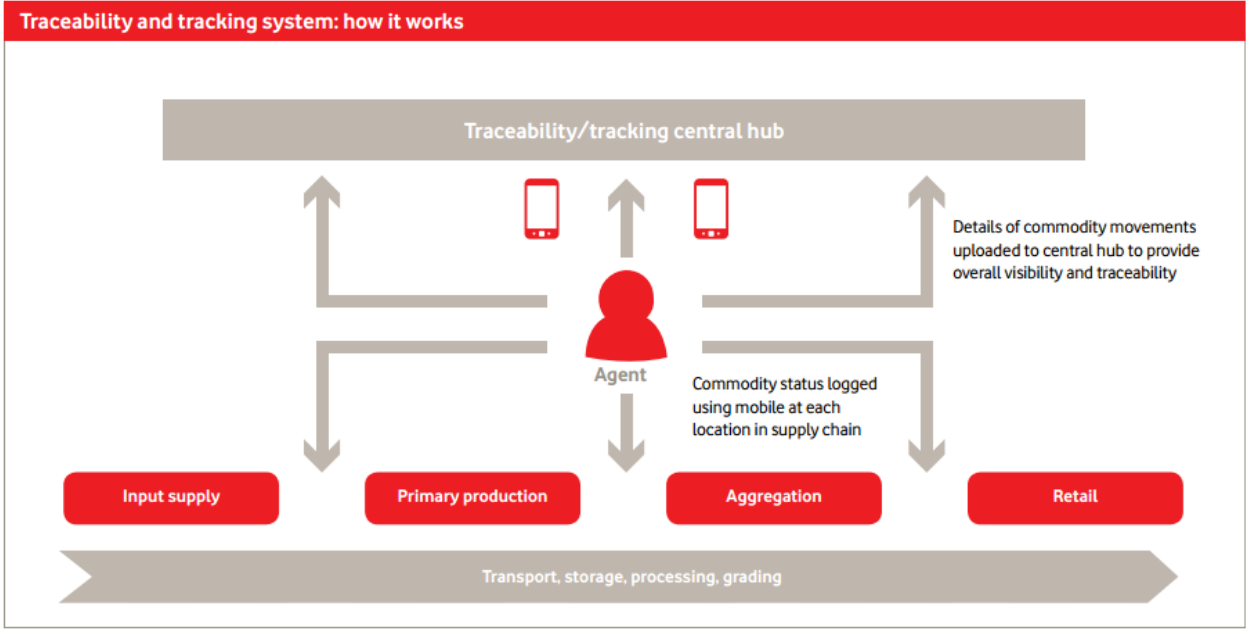
One example of such a system is the Reuters Market Light (RML), which is a subscription-based SMS service “provides localized and personalized information on commodity prices, crop cultivation (covering 17 crops), and the weather.”⁴⁰ Members of a different service, IFFCO Kisan Sanchar Limited (IKSL), a joint venture between the telecom network and the Farmer’s Fertilizer Cooperative Limited receive “five free voice messages a day with agricultural information and advice; they also have free access to a dedicated agricultural help line.”⁴¹

Value-Chain Monitoring and Distribution Systems

One of the many benefits of increased ICT usage in agriculture is in reducing transportation, transactional and corruption waste. ICT can also help increase product traceability, disease and pest tracking and storage. It also can protect public health by being able to pinpoint where a product came from and can easily communicate this information to consumers and others in the supply chain. Also, improving traceability for large corporations, whose consumers are demanding more ethical and socially friendly business practices, is important for agricultural producers to consider.

Figure 10 demonstrates how mobile systems can create a functional flow of information to improve traceability for large corporations.

Figure 10: Mobile Technology Provides Traceability and Tracking of Smallholder Farmers



With this type of system in place, food buyers, exporters and other stakeholders are able to collect information and using the mobile network. The system allows for more efficient and effective field audits, allowing companies to identify problems before they get out of hand. In addition, this allows for large amounts of records to be built so that agricultural stakeholders can better understand the large-scale conditions and challenges being faced by farmers in emerging markets.

Recommendations

Private Sector Companies should invest in Mobile Technologies that Drive Financial Gain and Increase Traceability in their Supply Chains

There are a number of mobile technologies that stand to drive significant financial value for both multi-national companies and smallholder farmers. Large companies are increasingly sourcing from smallholder farmers, and product quality is a significant issue when you are dealing with a large number of disaggregated suppliers. Perhaps an even greater challenge is traceability, which requires multi-nationals to keep track of the activities and outputs of their dispersed supplier base.

As described in the previous section, mobile technology provides a more cost efficient approach to managing information flows within a value chain. Until recently, however, most companies only invest in this type of technology “when government regulations force them to do so.”⁴² This is a reactive approach that shields companies from risk, but does very little to spur innovation and sustainability improvements in agricultural value chains.

What is needed is a proactive approach that allows companies to get ahead of regulations and evolving consumer preferences, better positioning them to take advantage of the potential gains while avoiding the associated risks. In fact, “the financial benefits far outweigh the implementation costs... various research studies and pilot projects have shown that the traceability data not only help manage food safety risks but also contribute to overall business performance.”⁴³ These gains are primarily realized through greater efficiencies throughout the supply chain, from sourcing from the right suppliers to improvements in warehousing and inventory management. One study showed that a Spanish frozen food processor who invested €1.8 million and recovered its investment in 18 months.”⁴⁴

Local Governments should Facilitate Partnerships between Mobile Network Operators and Private Sector Companies, NGOs, and Smallholder Farmers in the Agriculture Industry

A big factor that has led to the spread of ICT in emerging markets has been government, donor and private sector investment in mobile infrastructure within these countries. In fact, “emerging market government spending on ICT is expected to be \$138 billion in 2014” alone.⁴⁵ Unfortunately, many of these investments have failed to produce many of the expected social and economic benefits.

Going forward, the key is to integrate a wide range of stakeholders into the design of ICT systems and the implementation of newer technologies in emerging markets. These systems must be designed with profitability in mind for the mobile operators and their partners; they should also be designed to reach the greatest number of people and allow for a wide range of open source technology implementation. Mobile operators should also leverage their relationship with consumers and help them engage with agricultural stakeholders described in this report. Ideally, these operators will allow others to leverage their existing distribution

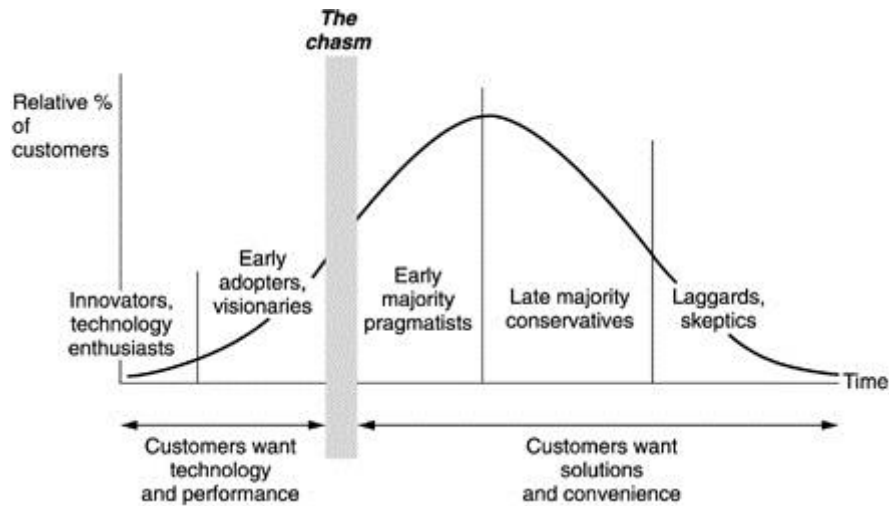
channels in order to provide greater access to the mobile customer and in turn better share information across agricultural value chains.

Local Governments should Facilitate Public-Private Partnerships to Incentivize the Adoption of Mobile Technologies among Smallholder Farmers

As described in this report, technology advancements and the rapid increase of ICT infrastructure in emerging markets provides a significant opportunity to both create value and drive sustainability in agricultural value chains. In addition, the environment appears to be shifting and soon large companies and investment firms should invest capital in technologies that will create a more connected network of farmers and other agricultural stakeholders. That said, the presence of the systems, technology and financing alone are not enough. Perhaps the greatest challenges is driving the adoption of new technologies in these emerging markets, where smallholder farmers lack trust in Western tools or ideologies (it should be noted that rural farmers in developed countries are also reluctant to change their behavior in the face of new technology).

In order for ICT and other technology advancements to drive sustainability in agriculture in emerging markets, a focused approach is needed by multi-nationals, NGOs and governments. Education will play an essential role, and those who are driving the adoption of new technology must conduct workshops and demonstrations of how value can be generated for the smallholder farmer. The goal should be to identify the “early adopters” within a community, who are those willing to take risks and test out new strategies and technologies in order to create a competitive advantage. Once the technology is proven among a small few, the next step is to gain the buy in of early adopters, who can help build critical mass needed to show measureable results among a group of farmers. The most difficult phase will be overcoming Moore’s Chasm, as shown in Figure 11 below. The key to overcoming this challenge is to identify the more influential members of a community, who can help convince other more conservative farmers that the new technology is the way of the future.

Figure 11: The Technology Adoption Curve



Most large multi-national corporations have little to no relationships among smallholder farmers and thus require an additional partner in order to implement new technologies in their value chains. Large companies must leverage the extensive networks and relationships built by NGOs among these communities. Governments must create favorable policies that allow for public-private partnerships and allow for foreign private companies to take part in industry associations and other local agriculture industry groups. Often, local governments are reluctant to allow large companies to conduct extensive amounts of business within their border with the fear that they will hurt local operators. This can happen in some circumstances. However, the best approaches will often bring local players into the value chain and incorporate their local expertise into driving technology adoption. Large donor governments and their agencies, such as USAID, can often help break these barriers between multi-nationals and local governments and should be included in initiatives where needed.

NGOs should ensure other Stakeholders stay Focused on and Accountable for Long-Term Sustainability Goals

NGOs have an in-depth understanding of the social and environmental issues on the ground that other stakeholders have yet to fully comprehend and incorporate into their strategies. These unique perspectives must be incorporated into any approach that aims to drive value for large companies, smallholder farmers and others in the agriculture industry in emerging markets.

Furthermore, it is important that NGOs help multi-nationals understand why prioritizing sustainable farming practices is in their long-term interests and how it can help them create a competitive advantage in the global marketplace.

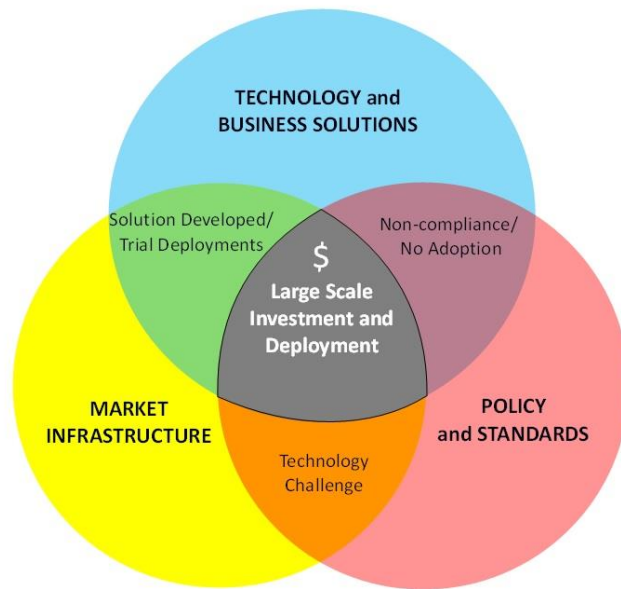
NGOs must also work with local governments to represent the interests of smallholder farmers when partnerships are created to address large-scale agricultural challenges. Large, publicly traded companies will often prioritize profits over other measures and it is important that there is protection for the other stakeholders involved. NGOs and local governments are uniquely positioned to establish norms and regulations that can protect the interests of the most vulnerable when new consortiums are formed and technology is introduced into emerging market economies.

Conclusion

Emerging markets are well positioned to deliver a significant portion of the world's agriculture products, and especially export products that are in high demand by large multi-nationals. In addition, the smallholder farmer often plays an integral role in these value chains and must be targeted if sustainability advancements are to be made. Since large companies are being pressured by consumers to make sustainability improvements, they must leverage ICT and other types of mobile technology to improve traceability and provide greater value to their suppliers in emerging markets. In addition, NGOs, local governments and other stakeholders (e.g. mobile network operators) must align their incentives to help drive innovation on this front. Figure 12 below outlines the resources needed in order to drive investment in and the deployment of new mobile technologies that improve sustainability in agricultural value chains in emerging markets.

Figure 12: Technology Innovations Require the Alignment of Three Critical Resources⁴⁶

Enabling Conditions for Investment in Technology



Based on the research conducted by our team, we believe that mobile technology has the potential to drive sustainability in agricultural value chains in emerging markets in a large way. The figure above shows the need for an alignment of technology availability, market infrastructure and policies. The environment is favorable on all of these fronts. We expect challenges to remain, but are optimistic about the opportunity for emerging market countries to drive sustainability into their value chains and avoid many of the pitfalls experienced

Appendix I – Examples of Sustainability in CPG and Agriculture Branding/Marketing

Unilever⁴⁷



**What you buy
in the supermarket
can change
the world.**

More than one in three of the products in your weekly shop contain palm oil which, if not produced sustainably, can be a cause of rainforest destruction.

Last year Unilever funded the farming of 180,000 tonnes of RSPO* certified sustainable palm oil. That represented more than half of all the sustainable palm oil traded worldwide.

It was only 15% of what we used but this year we will more than double the volume and by 2015 all our palm oil will come from sustainable sources.

It is an important step. If everyone did the same we could transform the industry and help put a stop to deforestation.

Small actions, big difference.

* Roundtable on Sustainable Palm Oil

The Cargill Cocoa Promise

Working together for tomorrow's cocoa



We have experts in six cocoa producing countries around the world – contributing to initiatives that focus on farmer training, community support and farm development.

Take a look at just a few of our projects:

Farmer training

Cote d'Ivoire
60,000
farmers trained through
1,100
Farmer Field Schools

Cameroon
800
farmers have benefitted from newly established Farmer Field Schools

Community support

Ghana
49,000
people reached with the Cargill-CARE partnership
3,525
Farmers trained on child labour

Indonesia
60
children benefitting from our support for the Yayasan Panti Asuhan Rahmat orphanage

Farm development

Brazil
5 million
seedlings distributed to regenerate cocoa farms

Vietnam
100
development farms supported to showcase good agricultural practices



All of this helps us to supply customers around the world with sustainable cocoa - and consumers know they can trust our supply as our sustainable cocoa is verified by UTZ, FairTrade and Rainforest Alliance certification schemes.

Kellogg's GLOBAL SUSTAINABILITY COMMITMENTS

RESPONSIBLE SOURCING

- Ingredients / Materials**
Responsibly source top 10 ingredients/materials by 2020
- Sustainable Agriculture**
Continue enabling farmers and millers to implement more sustainable farming practices
- Smallholder Farmers**
Identify smallholder farmers and build programs to improve agronomist practices and business skills
- Women Farmers / Workers**
Identify women in the value chain & develop programs to help improve their livelihoods, families and communities

CONSERVING NATURAL RESOURCES

- Energy**
By 2020, expand low carbon energy use in plants by 50%*
Reduce energy GHG in plants by an additional 13%*
- packaging**
Continue adding value to foods and the planet via increased resource-efficient packaging
- Water**
By 2020, implement reuse projects in at least 25% of plants, reduce usage by additional 15% and continue watershed quality support*
- Waste**
By 2015, increase to 10% number of plants sending zero waste to landfill

* For metric, tonne food produced. Goals revised August 2014.
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By 2020, General Mills commits to sourcing 100% of its...



... **oats** from growing regions that demonstrate continuous improvement against industry-based environmental metrics.



... **cocoa** through origin-direct investment, which will improve the incomes of smallholder farmers and the quality of ingredients.



... **U.S. wheat** from growing regions that demonstrate continuous improvement against the Field-to-Market framework* or comparable environmental metrics.



... **vanilla** through origin direct investment, which will improve the incomes of smallholder farmers and the quality of ingredients.



... **dry milled corn** from growing regions that demonstrate continuous improvement against the Field-to-Market framework or comparable environmental metrics.



... **palm oil** from responsible and sustainable sources in 2015.



... **sugar cane** from responsible and sustainable sources.



... directly sourced **fluid milk** from producing regions that demonstrate continuous improvement as measured by the Dairy Sustainability Framework (U.S.) or other comparable environmental metrics (globally).



... **fiber packaging** from recycled material or from virgin wood fiber regions that are known to not contribute to deforestation. Any high-risk regions will be independently verified.



... **U.S. beet sugar** from growing regions that demonstrate continuous improvement against the Field-To-Market framework or comparable environmental metrics.

*The Field-to-Market framework studies the environmental impact of crop production in different regions.

SOURCE: GENERAL MILLS, INC. | FOODBUSINESSNEWS.NET

Works Cited

- ¹ “The Global Food Challenge Explained in 18 Graphics.” World Resources Institute. <<http://www.wri.org/blog/2013/12/global-food-challenge-explained-18-graphics>>
- ² “Connected Agriculture.” Accenture, Vodaphone. 2011. <<http://www.accenture.com/sitecollectiondocuments/pdf/accenture-connected-agriculture.pdf>>
- ³ “Farming: Wasteful water use.” World Wildlife Foundation. <http://wwf.panda.org/what_we_do/footprint/agriculture/impacts/water_use/>
- ⁴ Ibid
- ⁵ “The six countries that could change the future of food production.” Environmental Research Web. Jul, 2014. <<http://environmentalresearchweb.org/cws/article/news/57936>>
- ⁶ Ibid
- ⁷ “The six countries that could change the future of food production.” Environmental Research Web. Jul, 2014. <<http://environmentalresearchweb.org/cws/article/news/57936>>
- ⁸ “Sources of Greenhouse Gas Emissions.” Environmental Protection Agency. <<http://epa.gov/climatechange/ghgemissions/sources/agriculture.html>>
- ⁹ “Farming: Soil erosion and degradation.” World Wildlife Foundation. <http://wwf.panda.org/what_we_do/footprint/agriculture/impacts/soil_erosion/>
- ¹⁰ “Connected Agriculture.” Accenture, Vodaphone. 2011. <<http://www.accenture.com/sitecollectiondocuments/pdf/accenture-connected-agriculture.pdf>>
- ¹¹ “Shrinking Farm Numbers.” Wessels Living Farm. <http://www.livinghistoryfarm.org/farminginthe50s/life_11.html>
- ¹² “Africa’s path to growth: Sector by sector.” McKinsey. Jun, 2010. <http://www.mckinsey.com/insights/economic_studies/africas_path_to_growth_sector_by_sector>
- ¹³ “Connected Agriculture.” Accenture, Vodaphone. 2011. <<http://www.accenture.com/sitecollectiondocuments/pdf/accenture-connected-agriculture.pdf>>
- ¹⁴ “The Global Food Challenge Explained in 18 Graphics.” World Resources Institute. <<http://www.wri.org/blog/2013/12/global-food-challenge-explained-18-graphics>>
- ¹⁵ Thapa, G. “Smallholder Farming in Transforming Economies of Asia and the Pacific: Challenges and Opportunities.” IFAD. Feb, 2009. <http://www.ifad.org/events/gc/33/roundtables/pl/pi_bg_e.pdf>
- ¹⁶ Ibid.
- ¹⁷ Giovannucci, D. et. al. “Food and Agriculture: The future of sustainability.” United Nations – Sustainable Development in the 21st Century (SD21). <http://sustainabledevelopment.un.org/content/documents/agriculture_and_food_the_future_of_sustainability_web.pdf>
- ¹⁸ Schleifer, Philip. “The rise of south-south trade: a challenge for sustainable agriculture.” The Guardian. Sep, 2014. <<http://www.theguardian.com/sustainable-business/2014/sep/12/south-trade-sustainable-agriculture-palm-oil-commodities>>
- ¹⁹ Giovannucci, D. et. al. “Food and Agriculture: The future of sustainability.” United Nations – Sustainable Development in the 21st Century (SD21). <http://sustainabledevelopment.un.org/content/documents/agriculture_and_food_the_future_of_sustainability_web.pdf>
- ²⁰ Argawal, Sarah and Parag Khana. “Getting leapfrogging right: Adapting to the latest tech trends to developing nations.” The Next Web. May, 2014. <<http://thenextweb.com/entrepreneur/2014/05/31/getting-leapfrogging-right-adapting-latest-tech-trends-developing-nations/>>
- ²¹ Foster, Christopher. “ICT, Connectivity and Rwandan Agriculture.” Oxford Internet Institute. Oct, 2014. <<http://cii.oii.ox.ac.uk/ict-connectivity-and-rwandan-agriculture/>>
- ²² “Increasing Penetration of Mobile Phones, Smart Phones and Tablets Stimulate Mobile Gaming Growth.” Euromonitor International. May, 2013. <<http://blog.euromonitor.com/2013/05/increasing-penetration-of-mobile-phones-smart-phones-and-tablets-stimulate-mobile-gaming-growth.html>>
- ²³ Kemp, Simon. “Social Brands: Go Mobile or Stand Still.” Wearesocial.net. Apr, 2013. <<http://wearesocial.net/tag/mobile-stats/>>
- ²⁴ Evans, Jon. “In Five Years, Most Africans Will Have Smartphones.” Tech Crunch. Jun, 2012. <<http://techcrunch.com/2012/06/09/feature-phones-are-not-the-future/>>

-
- ²⁵ “Increasing Penetration of Mobile Phones, Smart Phones and Tablets Stimulate Mobile Gaming Growth.” Euromonitor International. May, 2013. <<http://blog.euromonitor.com/2013/05/increasing-penetration-of-mobile-phones-smart-phones-and-tablets-stimulate-mobile-gaming-growth.html>>
- ²⁶ “China, emerging markets drives worldwide smartphone adoption.” Venture Outsource. <<https://www.ventureoutsource.com/contract-manufacturing/china-emerging-markets-drives-worldwide-smartphone-adoption/>>
- ²⁷ “Finding the green in today’s shoppers: Sustainability trends and new shopper insights.” GMA and Deloitte. 2009. <<http://www.gmaonline.org/downloads/research-and-reports/greenshopper09.pdf>>
- ²⁸ “Catalyzing Smallholder Agricultural Finance.” Dahlberg. Sep, 2012. <http://dalberg.com/documents/Catalyzing_Smallholder_Ag_Finance.pdf>
- ²⁹ Ibid.
- ³⁰ Ibid.
- ³¹ Ibid.
- ³² <http://jingpinke.com> (National Top Level Courses in Google translation)
- ³³ “Information and communication technologies for sustainable growth.” FAO. 2013. <<http://www.fao.org/docrep/019/i3557e/i3557e00.pdf>>
- ³⁴ Ibid
- ³⁵ “New Release of Esri ArcGIS Explorer Provides Improved Access to Geoprocessing Services.” ESRI.com. Mar, 2010. <http://www.esri.com/news/releases/10_1qtr/new-explorer.html>
- ³⁶ “Information and communication technologies for sustainable growth.” FAO. 2013. <<http://www.fao.org/docrep/019/i3557e/i3557e00.pdf>>
- ³⁷ Ibid.
- ³⁸ Got Produce. <<http://www.gotproduce.us/>>
- ³⁹ Connecting Smallholders to Knowledge, Networks, and Institutions. REPORT NUMBER 64605. November 2011 World Bank
- ⁴⁰ Ibid
- ⁴¹ Ibid
- ⁴² Smith, Ian and Anthony Furness. Improving Traceability in Food Processing and Distribution. Woodhead Publishing, Ltd., Abington Hall, Abington, 2006.
- ⁴³ Alfaro, J. A., & Rábade, L. A. (2009). Traceability as a strategic tool to improve inventory management: A case study in the food industry. *International Journal of Production Economics*.118 (1), 104-110.
- ⁴⁴ Ibid.
- ⁴⁵ Argawal, Sarah and Parag Khana. “Getting leapfrogging right: Adapting to the latest tech trends to developing nations.” *The Next Web*. May, 2014. <<http://thenextweb.com/entrepreneur/2014/05/31/getting-leapfrogging-right-adapting-latest-tech-trends-developing-nations/>>
- ⁴⁶ Jain, Monica. “Investing in Seafood Traceability: Why Aren’t Investors in Seafood Businesses Doing More?” *National Geographic – Voices*. May, 2014. <<http://voices.nationalgeographic.com/2014/05/12/investing-in-seafood-traceability/>>
- ⁴⁷ Hance, Jeremy. “Unilever backtracks: may purchase palm oil from Sinar Mars.” *Mongo Bay*. Apr, 2010. <http://news.mongabay.com/2010/0407-hance_unilever.html#sthash.V6yaBVAM.dpbs>
- ⁴⁸ Image sourced from <http://www.cargillcocoachocolate.com/wcm/groups/internal/@ccc/documents/image/na3074649.jpg>
- ⁴⁹ Image sourced from <http://photos.prnewswire.com/prnvar/20140812/135667>
- ⁵⁰ Image sourced from <http://www.foodbusinessnews.net/~media/ImagesNew/FoodBusinessNews/Features%202013/9/General-Mills-Sustainability-Goals.ashx>