Mobile Applications for Agriculture and Rural Development

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Abbreviations

2G		Second generation (mobile communications)
3G		Third generation (mobile communications)
4G		Fourth generation (mobile communications)
API		Application Programming Interface
B2B		Business to Business
CSR		Corporate Social Responsibility
DFID		Department for International Development
EDGE		Enhanced Data rates for GSM Evolution
FMCG		Fast Moving Consumer Goods
GGS		Govi Gnana Seva
ICT		Information and Communication Technology
ICTA		Information and Communication Technology Agency
IFC		International Finance Corporation
IKSL		IFFCO Kisan Sanchar Ltd
KACE		Kenya Agriculture Commodities Exchange
KTDA		Kenya Tea Production Authority
LTE		3GPP Long Term Evolution
m-apps		Mobile applications
m-ARD apps		Mobile Applications for Agriculture and Rural Development
m-money		Mobile Money
NGO		Nongovernmental Organization
NHS		National Healthcare System
OECD		Organisation for Economic Co-operation and Development
OLT		Ovi Life Tools
PE/VC		Private Equity/Venture Capital
PPP		Private-Public Partnership
PWC		PricewaterhouseCoopers
RFP		Request for Proposal
RML		Reuters Market Light
SME		Small and medium-size Enterprise
SMS		Short Message Service
SWORB		Strengths, Weakness, Opportunities, Risks, Benefits
TOR		Terms of Reference
USF		Universal Service Fund
USSD		Unstructured Supplementary Service Data

Executive Summary

Mobile communications technology has quickly become the world's most common way of transmitting voice, data, and services in the developing world. Given this dramatic change, mobile applications (m-apps) in general and mobile applications for agricultural and rural development (m-ARD apps) in particular hold significant potential for advancing development. They could provide the most affordable ways for millions of people to access information, markets, finance, and governance systems previously unavailable to them.

M-apps are software designed to take advantage of mobile technology and can be developed for technology besides mobile phones. But mobile phones have many key advantages: affordability, wide ownership, voice communications, and instant and convenient service delivery. As a result, there has been a global explosion in the number of m-apps, facilitated by the rapid evolution of mobile networks and by the increasing functions and falling prices of mobile handsets. M-apps are markedly different in developing countries because they typically run on second-generation (2G) phones rather than smartphones, which are far more common in developed countries.

Though there have been many studies on the mobile revolution, there is a lack of systematic trend analyses, in-depth case studies, and assessments of experiences with m-ARD apps in developing countries. Thus this report examines their development impact, ecosystems, and business models to provide an analytical framework for policymakers and development practitioners. The framework is designed to help them understand how these applications can be used to improve services for rural residents in these countries and support enabling environments for innovative m-ARD apps.

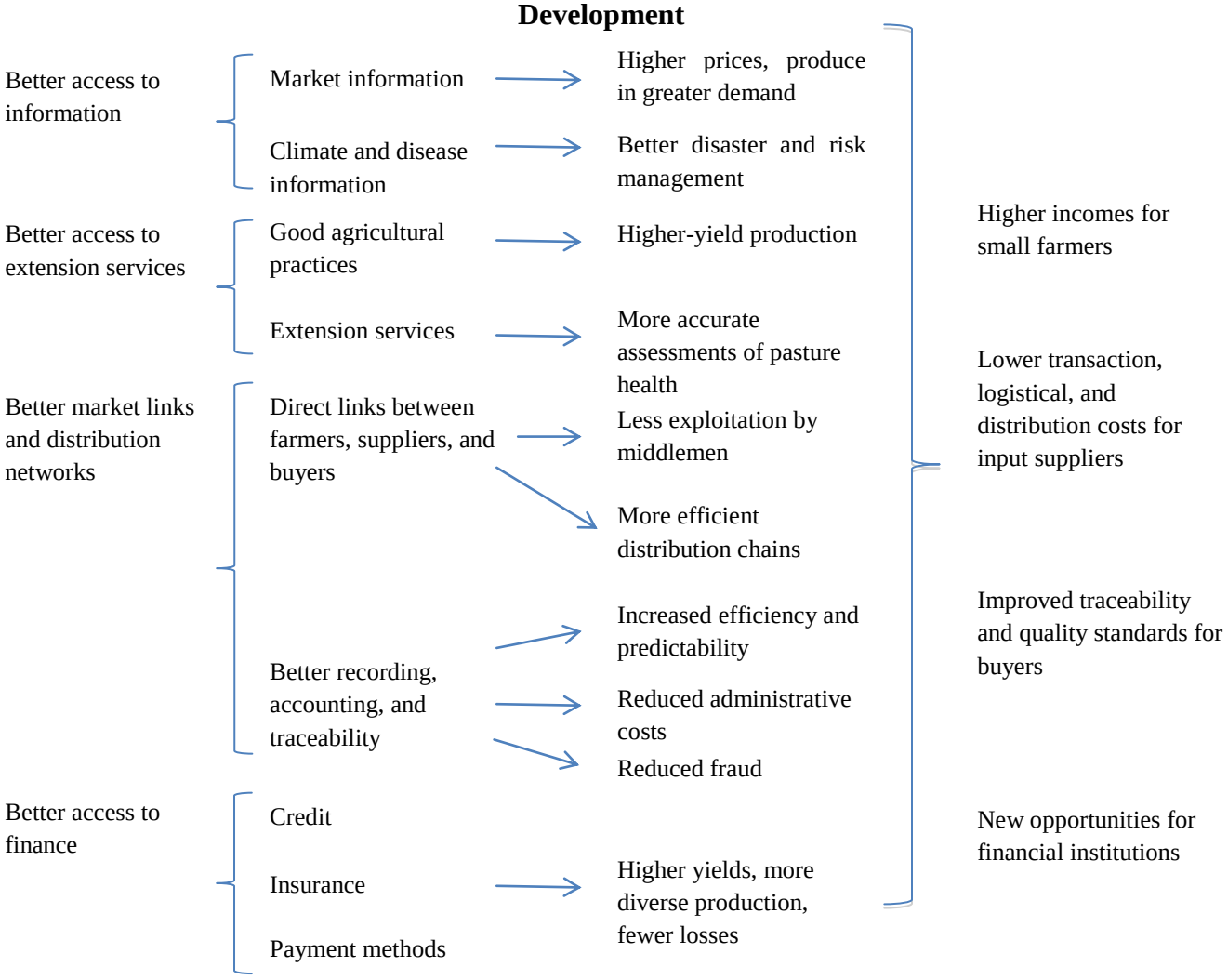
The report summarizes a study of 92 m-ARD apps in Africa, Asia, and Latin America and the Caribbean (Annex F; detailed information sheets for each app are available at http://www.worldbank.org/ict/m-ard). It also presents the findings of 15 detailed case studies of such apps in Kenya, the Philippines, and Sri Lanka (Annexes G, H, and I). This type of report faces several challenges. M-apps are evolving rapidly, with innovative new ones entering the market daily and several large institutional players—such as mobile network operators—competing for market share. Moreover, m-ARD apps are relatively new, and many have not been around long enough to properly assess their success.

Development Impact

Most m-ARD apps focus on improving agriculture supply chain integration and have a wide range of functions, such as providing market information, increasing access to extension services, and facilitating market links. Users are also diverse, including farmers, produce buyers, cooperatives, input suppliers, content providers, and other stakeholders who demand useful,

affordable services. These supply chain integration applications could provide significant economic and social benefits—among them, creating jobs, adding value, reducing product losses, and making developing countries more globally competitive. But the potential development impact of m-ARD apps mainly lies in their ability to provide access to useful, relevant information and services (Figure 1).

Figure 1. Results Generated by Mobile Applications for Agricultural and Rural Development



Quantitatively, the most widely used m-ARD apps provide access to valuable information—a crucial function because asymmetrical access to information is a weakness of rural markets in developing countries. Kenyan farmers who use the app DrumNet, for example, have seen their incomes rise by a third due to the service's comprehensive system of price negotiation, contracting, and other value chain support.

M-ARD apps also provide farmers and rural residents with timely access to extension services, such as advice on agricultural production, marketing, and technology, food security, and nutrition. Sri Lanka's e-Dairy helps farmers earn up to $262 more a year for each of their calves by providing veterinary and extension services delivered by mobile phones. Such applications also strengthen market links when used to improve production distribution and traceability. Tea growers in Kenya have reported average income growth of 9 percent—about $300 a year—by using Virtual City's production measuring, recording, and traceability functions.

In addition, m-ARD apps have expanded access to finance and insurance products in rural areas. Applications like M-PESA in Kenya and SMART Money and G-Cash in the Philippines have gained acceptance as safe, easy ways to receive payments and store money. Also in Kenya, users of Kilimo Salama's agricultural insurance products have seen their production increase by an average of more than 50 percent, or about $150 a year.

M-ARD apps also have significant qualitative impact, though such benefits are harder to assess objectively and largely depend on the local context. For example, Ushahidi—developed in Kenya and now used in other countries—uses a crowdsourcing approach to increase government transparency, provide information about domestic events (including social unrest), and support timely interventions in disaster-hit areas, such as in in Haiti after its disastrous 2010 earthquake.

Application Ecosystems

This report uses James Moore's (1996) revised definition of ecosystems: economic communities based on interacting organizations and individuals. The report identifies a wide range of players in the ecosystem for m-ARD apps, such as mobile network operators, m-app providers, content providers, and various types of users. Each player's assets, abilities, and incentives are described in Annex D.

M-ARD app ecosystems in developing countries are fragile and need support from policymakers and development practitioners. There are marked differences between the m-ARD app ecosystems of developed and developing countries, especially in terms of the differing influences of key players, existence and sophistication of m-ARD app platforms, and need for hyper-local services and support systems.

Roles and influence of key players

Mobile network operators dominate the m-ARD apps ecosystem in developing countries. They serve as gatekeepers, deciding which m-apps are allowed in their systems and dictating how revenues from the apps are shared. Kenya's Safaricom, for example, charges users up to 85 percent of the revenue from m-app transactions. In contrast, m-app providers in developed countries can choose whether to sell their apps through Apple's App Store or Google's Android

Market—or both—and receive much larger shares of the revenue. For example, m-app providers on Apple's App Store receive 70 percent on both app sales and transactions; final shares on the Android Market have not been established.
In developing countries, government departments are likely to be key content providers. Some governments, such as Kenya's, are following the lead of developed country governments by making data publicly available that can be used innovatively by m-ARD app providers.

In some developing countries, governments are the only viable source of data for m-ARD app providers due to a lack of commercial information providers. But such data can be unreliable or collected irregularly. Some m-ARD app providers have created market research units to provide users with valuable information. In India Reuters Market Light (RML) has established teams that monitor commodity prices in local markets.

Users of m-ARD apps include a wide variety of groups. Unlike in the developed world, users in the developing world demand hyper-local content. For example, agricultural prices must be sourced from local and regional markets so that farmers can compare prices and decide where to sell their produce.

There is also a burgeoning movement to collect information about users through innovative m-apps such as Kenya's Jana (formerly txteagle). This information can be used to provide users with better, more useful, and more relevant information. Content providers have also been innovative in their use of media and crowdsourcing to support their operations. Kenya's KACE provides information to commercial radio stations to complement its m-ARD app, and Ushahidi uses crowdsourcing to collect information of relevance to users.

Platforms
Platforms—that is, app stores—are the most important m-apps innovation in developed countries because they offer an operator-neutral platform that promotes innovation, encourage uniform application development standards, and provide a large pool of potential customers who are already connected. Platforms are even more important for m-apps in developing countries because they can offer a payment mechanism for users through mobile network operators (as with M-PESA). This mechanism removes a critical obstacle for m-app providers and users in the absence of other types of payment systems.

Platforms can also facilitate transactions between consumers and companies or institutions that see opportunities to market their products to rural consumers. Examples include banks, microinsurance companies, agricultural cooperatives, and suppliers and distributors of fast-moving consumer goods. All these platform features can generate faster and higher returns for m-app providers.

Nokia's Ovi Life Tools (OLT) is a highly promising platform for m-ARD app providers. For example, operator billing through OLT is available in 42 countries. In addition, the platform is geared toward narrowband, affordable m-apps. OLT has a large user base in many large developing countries, including China, India, and Indonesia.

An alternative platform, still in its beta phase, is BlueVia from Spain's Telefonica. Thus it was developed by a mobile network operator instead of an operator-neutral handset manufacturer or mobile operating system developer. BlueVia is similar to OLT in terms of platform functions, but m-app providers only have access to Telefonica subscribers because the platform is not integrated with competing mobile network operators.

Hyper-local services and support

Information provided by m-ARD apps must be highly localized to be of value to rural users in developing countries. For example, farmers attach much higher value to RML's services in India than those provided by IFFCO Kisan Sanchar because RML's information is much more relevant to their needs. But collecting hyper-local information is costly. Again, governments could support the development of m-ARD apps that provide such information by making government data public.

Because consumer education and literacy are usually low in rural areas, local support for m-apps is a critical driver of their adoption and an integral cost of marketing them. Uganda's Grameen Community Knowledge Worker Initiative used literate, village-based intermediaries to provide support and information to poor residents—an approach considered essential to its success.

Business Models

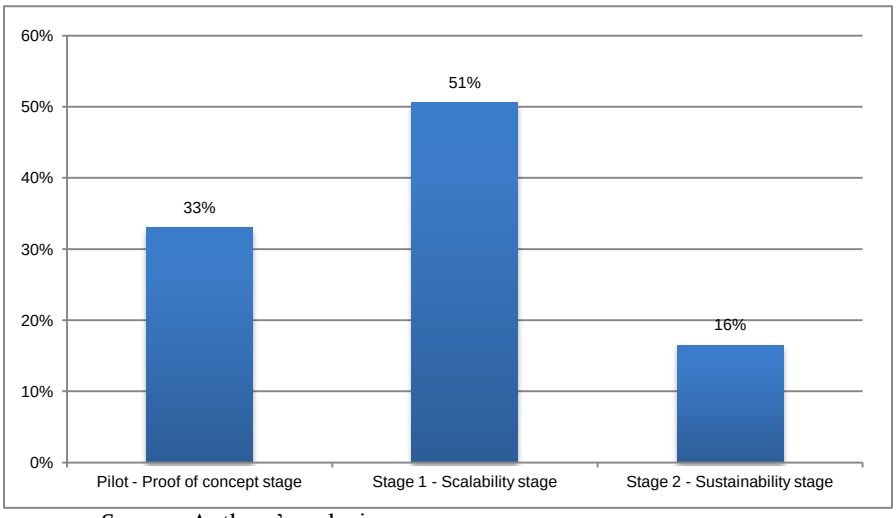
Business models are the systems that organizations use to create, deliver, and capture value. This report defines the concept of value for commercial m-ARD apps as their ability to earn enough profits to operate for at least the next two years. For noncommercial m-apps the concept is defined as providing nonmonetary benefits greater than the costs of providing them to targeted users.

In terms of services, commercial m-ARD apps typically deliver information or conduct transactions (or both), while noncommercial ones typically only provide information. It is difficult to assess business models for noncommercial m-apps due to the lack of a business approach by governments and donors. Specifically, the lack of a profit motive means that many noncommercial m-apps suffer from a lack of clear goals. Impact assessments and cost-benefit analyses can sharpen this lack of focus.

This report breaks down the 92 m-ARD apps studied into three stages of business development: the pilot stage, where concepts are being proven, usually with small target markets; stage 1, where m-ARD apps are being scaled up and trying to enter new markets; and stage 2, sustainability—defined as the requirement to be profitable or break even for commercial m-ARD apps, and continued donor or government funding for noncommercial ones.

Only 16 percent of the m-ARD apps studied have achieved sustainability (Figure 2). Most are facing challenges scaling up after successful pilots, with different challenges for commercial and noncommercial applications. Slightly more commercial than noncommercial applications fail between stages 1 and 2, even though sustainability is defined very differently for each type.

Figure 2. Stages of Business Development for the Applications Studied



Source: Authors' analysis.

Population size does not appear to be a major determinant of sustainability. More relevant factors include the size of the target market, customers' ability and willingness to pay, and the focus and usefulness of the services offered.

Willingness to pay and revenue

Willingness to pay reflects the demand for m-ARD apps because many commercial services are still not easily affordable because they have not achieved economies of scale. In addition, from a development perspective it might be nearsighted to focus on ability to pay because it ignores the poorer population who could benefit the most from such services.

Evidence on willingness to pay is mixed. Experiences in many countries suggest that farmers are willing to pay basic or even premium SMS charges. But that willingness heavily depends on the farmers' incomes, education levels, and the services provided. Poorly educated farmers are less willing to pay even basic charges—especially if the benefits of using a service take a long time

to appear. Users are more willing to pay for a mix of tools and relevant information, such as those offered by platforms like OLT.

Securing sufficient revenue is still a challenge for most providers of m-ARD apps. Only 29 percent of the applications studied receive enough revenue to cover operating expenses; the rest are partly or entirely dependent on government, donor or corporate social responsibility (CSR) funding. The most common revenue stream is a share of SMS revenue, though on average providers receive less than 18 percent of their revenue from this source. One strategy to overcome this obstacle is to use a freemium pricing model (see below). Charging for each transaction can also be successful, as with Kenya's Kazi560, which provides job information.

Providers must develop a creative mix of revenue streams while taking into account the affordability of services. The report describes various types of fees and the rationales for them. These include fees for user sign-up, information access, transactions, advertising, and data collection. Because disposable income is limited in rural areas of developing countries, an innovative alternative advertising model is being developed. This model takes advantage of information asymmetry and scale, as with Jana's use of crowdsourcing to collect data for companies interested in rural consumers, providing information about these customers not available from other sources.

Pricing models

The report identifies four main pricing models for m-ARD apps:

- The nonchargeable model generally does not charge users. These are typically noncommercial services that provide basic information, such as Sri Lanka's 1919 Government Information Center and Kenya's Ushahidi.
- The transaction-based model charges users based on the number of transactions they make. These m-ARD apps typically provide hyper-local, value added information, as with Virtual City (Kenya) and RML (India).
- The embedded services model provides a service for no charge, but it does so to generate demand or strengthen customer loyalty to the provider's main, chargeable product or service. This model often requires creating a new market and so has significant potential, as shown by Kilimo Salama.
- The freemium model offers basic services at no charge as a marketing or promotional tool but charges a premium for advanced and value added services. This model can help introduce applications, build trust, and facilitate upselling. Only a few of the applications studied use this model, including KACE (Kenya) and Manobi (Ghana and Senegal).

Some of these models might overlap, and some providers use them in combination.

Costs

The report analyzes a range of m-ARD apps for which cost data are available. For commercial applications, capital and operation costs are compared with user and transaction targets to assess affordability. Analysis of KACE, b2bpricenow.com (Philippines), and RML shows that providing useful information is costly. For example, RML's operating cost per user is $4. High costs result in a tradeoff between providing local information and achieving scalability because more local research units are required to collect data as an application's market expands. This means that costs rise at the same rate as new subscribers sign up. Accordingly, some providers use the freemium model to increase user volume so that they can build to scale.

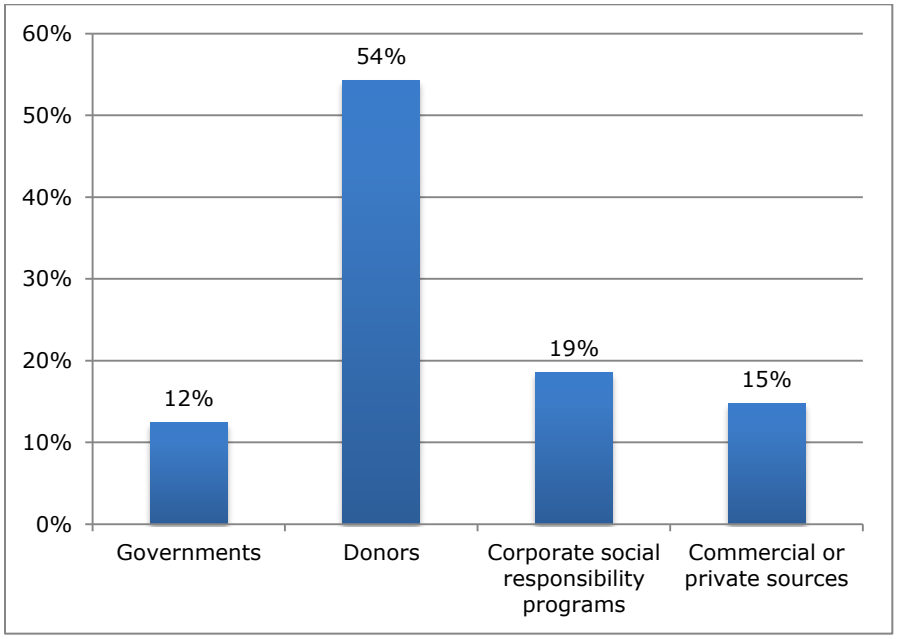
The analysis also shows that operating costs are much higher for some m-ARD apps, such as DrumNet and e-Dairy. For example, the DrumNet pilot's operating cost per user is $45. Costs are high because these applications cannot benefit from economies of scale in their pilot stages and because they lack a modular approach to system development. DrumNet, for example, provided full supply chain integration services from the outset instead of building a modular system like KACE and Virtual City.

Noncommercial providers have much lower operating costs per transaction. For example, the Philippines's TXT CSC has an operating cost of just $0.02 a user. This is largely due to the simple, information-only services provided by such applications.

Financing

Government, donor, or corporate social responsibility (CSR) funding covers the startup and operating costs of 85 percent of the m-ARD apps studied (figure 3), and there is a major financing gap between the pilot stage and stage 1 (scalability). This gap cuts across the case studies from Kenya, the Philippines, and Sri Lanka and is true for both successful and less successful applications. This gap occurs during the transition from public (donor or government) to private funding and poses a challenge for m-ARD apps because a lack of private funding implies that providers do not have access to the professional advice and skills needed for their next stage of growth.

Figure 3. Sources of Financing for the Applications Studied



Commercial applications in developing countries generally lack access to private equity and venture capital (PE/VC) funding because of a lack of firm clustering, limited PE/VC financing in these countries, and weak m-app ecosystems that do not support scalability. Noncommercial m-apps do not suffer as much from lack of finance because they are likely to continue operating as long as there is government, donor, or CSR funding. But here too growth can be limited by lack of sufficient financial support.

There are various ways to narrow the financing gap. Donors could create development funds for m-apps, providing financing based on their potential for advancing development. This could be supported by m-app labs, providing a single location for a suite of services including financing, expert advice, and skills development.

Another approach is to create apex funds, which pool investment capital from a range of sources, including donors and development-oriented investors. Such funds are operated by PE/VC groups willing to accept modest returns on the investments. While there are many large funds of this type, few offer relatively small loans ($100,000 to $500,000). Apex funds would also deliver business advisory services to help m-apps providers scale up or expand to other markets.

A third approach is to use universal service funds (USFs) to fund m-apps. USFs exist in many countries and typically have extensive resources due to low disbursements. But funding can be mobilized fairly quickly. Public-private partnerships (PPPs) can also help address the financing gap. PPPs provide a framework for governments to exploit the synergies between the private and

private sectors, provide access to funding and skills, and bring focus to the costs and benefits of m-ARD apps. This is an opportune time for PPPs because innovative models for service delivery are superseding their traditional use in infrastructure development. Text2Teach is an example of an m-ARD app using the PPP approach, with financing from the Philippine government, Nokia, and the Ayala Foundation.

Conclusion

M-ARD apps offer dynamic, interdisciplinary, and innovative services to rural residents in developing countries. This report offers only a snapshot of the field's evolution but provides policymakers and development practitioners with insight into its significant potential.

One of the main findings is that an enabling platform (or platforms) is probably the most important factor for the development of m-ARD apps. Platforms can facilitate interactions among ecosystem players, increase access to users, provide technical standards, and incorporate payment mechanisms.

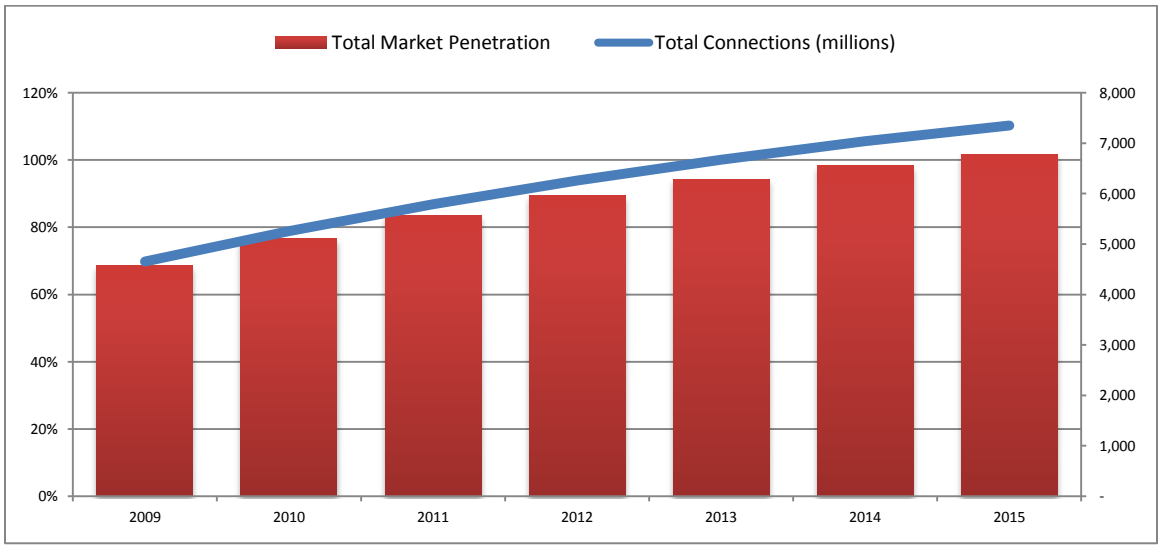
The hyper-local nature of m-ARD apps makes scaling up challenging for providers. It is crucial for providers to leverage existing information resources, and providers who can aggregate and customize content from different sources will have an advantage. Governments and donors can be immensely helpful by making data publicly available and ensuring that the data are as accurate and granular as possible.

Despite various challenges, some m-ARD apps are achieving scalability, replicability, and sustainability. Governments and donors play a critical role in helping m-ARD apps achieve sustainability by covering initial capital costs. M-ARD apps that can achieve low operating costs are also more likely to be sustainable.

1. Introduction

Mobile communications technology has become the world's most common way of transmitting voice, data, and services, and no technology has ever spread faster. At the end of 2010 there were 5.25 billion cellular telephone subscriptions worldwide (Figure 1.1). By 2015 the number of mobile phone connections is expected to exceed the global population.

Figure 1.1. Global Mobile Phone Market Penetration and Connections, 2009-15



Source: Portio Research 2011.
Note: Data for 2011-15 are projected.

The mobile phenomenon is especially important for developing countries because that is where it is growing fastest, and in the next few years nearly all new mobile customers will come from developing countries because penetration has reached saturation levels in developed countries. Mobile phone technology has also been key to leapfrogging fixed-line Internet in developing countries and providing mobile broadband to a growing share of people.

What Are Mobile Applications?

With mobile handsets being used in nearly every country and community, the development of applications for them offers uses that extend well beyond voice and text communications. Mobile applications for agricultural and rural development (m-ARD apps) could provide the most economic, practical, and accessible routes to information, markets, governance, and finance for millions of people who have been excluded from their use.

This section discusses m-apps generally; the report then switches to its focus on m-ARD apps. M-apps are software designed to take advantage of mobile technology, enabling the collection and transmission of data for economic and social activities—whether for commercial, administrative, or entertainment purposes (McNamara 2009). Moreover, m-apps are not necessarily associated with specific access devices but focus on providing information and facilitating activities.

M-apps can be developed for technology besides mobile phones. For example, in one of the case studies conducted for this report, e-Dairy—an agricultural extension service offering timely data on cow insemination in Sri Lanka—was designed for touchscreens, which are larger and less mobile than cell phones. The touchscreens are at fixed locations, and though their monitors can provide more information than the smaller screens on mobile phones, mobile phones have several advantages over less mobile (or fixed location) devices such as touchscreens. Mobile phones:

- Are owned by more people.
- Provide delivery in an instant, more convenient way.
- Can deliver personalized information to individual owners.
- Are cheaper to deploy.
- Provide other functions such as voice communication.

In addition, most m-apps can be replicated across different mobile interfaces and devices, such as SMS phones, mobile browsers, smartphones, and tablets. This is because the most challenging part of developing m-apps involves their common backend and infrastructure—especially if integration between databases is required.

In developed countries m-apps are considered software that operates on smartphones (such as iPhones, BlackBerries, and Android devices) rather than standard second generation (2G) mobile phones. But mobile phone operators—particularly in developing countries—have been developing m-apps, including for information on agriculture prices, for almost 10 years.

In recent years there has been a global explosion in the number of m-apps. Getting accurate information on the size of the m-apps market is challenging. Table 1.1 summarizes recent surveys and projections on the size of this market.

Table 1.1. Global Market for Mobile Apps, 2008-12
(billions of U.S. dollars)

Source	2008	2009	2010	2011[a]	2012[a]
Gartner		4	5.2	15	
Ellison			4.9		
GetJar / Chetan Sharma Consulting		4.1			17.5
MarketsandMarkets		4.5	6.8		

Source: Gartner 2011; Ellison 2010; GetJar 2010; MarketsandMarkets 2010; BBC Market Trust 2010.
a. Projected.

This explosion in the development of and market for m-apps has been driven by rapid growth in the use of smartphones and falling Internet access costs on mobile 3G networks. In 2002 Research in Motion transformed the smartphone market with its introduction of the BlackBerry. But Apple's iPhone, introduced in 2007, showed the real potential of smartphones, allowing multiple m-apps to be stored on one device and fully integrated with its operating system. Until then, smartphone users were limited to text messages, Internet and email use, and phone calls. Now m-apps can be tailored to a wide range of needs and purposes.

The advent of smartphones also brought with it operating systems (such as Apple's iOS and Google's Android) and application stores (such as Apple's App Store) that enabled third party providers to create m-apps for customers. These developments restructured the m-app market in developed countries from one where mobile network operators were gatekeepers to one that enables and encourages independent providers to build innovative m-apps and mobile network operators are primarily data conduits.

M-apps are expected to become increasingly pervasive. The convergence of mobile and computing devices and the growing use of mobile phones will increasingly make applications that started as computer-based functions—such as online banking—accessible by handheld devices.

The rapid speed at which mobile networks are evolving (from 2G to EDGE to 3G to 4G/LTE) is facilitating the changes in m-apps. For example, Kenya's M-PESA (which means "mobile" followed by the Swahili word for money) was originally designed to be a money transfer service, but additional services have quickly been added—including insurance, savings accounts, bill payments, bulk payments, and loan repayments. If m-apps mimic the evolution of mobile money services, change will occur quickly. Thus change and even obsolescence can occur quickly as one m-app is replaced by another with more features or technological flexibility.

In addition, handsets are changing quickly: standard mobile phones are offering more features and smartphones are becoming cheaper. For example, Research in Motion considers developing

countries a key area for potential growth and is lowering its prices in them. BlackBerry Messenger is already popular in developing countries where text messaging is widely used, and many carriers offer handsets with prepaid plans. Accordingly, BlackBerries and other smartphones will continue to penetrate these markets.

Still, from a development perspective there are constraints to the potential of m-apps. Smartphone penetration is low in the developing world. Even by 2015 standard mobile phones will outnumber smartphones in developing countries by nearly four to one (Figure 1.1). Few standard mobile phones have 3G functionality. For example, the most widely used phone in Indonesia, Nigeria, the Philippines, and South Africa is the Nokia 5130 XpressMusic, which is not 3G-enabled. The phone can download applications from Nokia's Ovi store, but the number of downloads is quite small—though growing quickly.

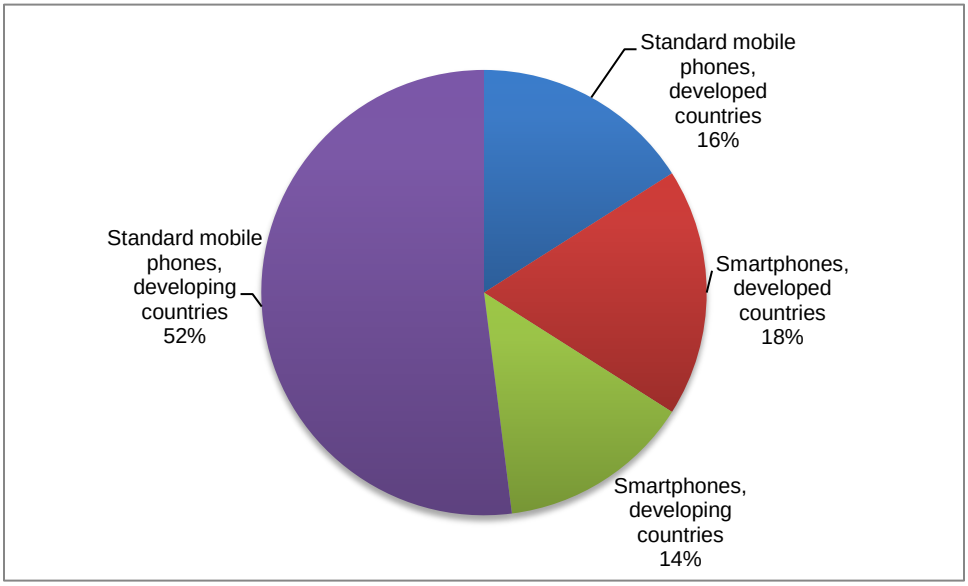
Standard mobile phones will continue to dominate in the developing world for at least the next five years, and probably longer in rural areas. Thus, over the short to medium term, the primary way of accessing m-ARD apps is going to be through these phones, limiting the types of services that these apps can offer.

The penetration of smartphones is premised on the availability of mobile broadband. But many developing countries have low or no 3G penetration. And costs—including of purchase and data downloads—are a major obstacle. Accordingly, m-apps in the developing world still primarily offer only SMS and other 2G services, especially in rural areas.

Moreover, most m-apps are for entertainment and lifestyle purposes, especially in the developed world. These consumer-oriented m-apps are typically offered on a mass-volume, low-cost basis. (Indeed, many m-apps lacking full functionality are free.) In contrast, it is far more complex and time-consuming to develop m-apps targeted at a specific challenge in a particular sector. M-apps for development purposes rarely generate sufficient revenues to be financially sustainable at a small scale or without significant revenue from bundling, advertising, cross-subsidies, and other sources.

Figure 1.1. Forecast of Global Mobile Phone Use by Type, 2015

Millions of units



Source: Strategy Analytics 2010.

This Report's Scope, Audience, and Focus

There are already many studies on the mobile revolution. But systematic trend analysis and in-depth case studies of mobile applications and services remain insufficient except for a few widely cited ones. More important, there is little analysis of experiences with business and operating models for developing innovative m-apps and m-services in key sectors. Yet m-ARD apps offer significant development potential due to some notable successes, the varied areas of possible applications, and their direct and pro-poor impacts.

Hence this report summarizes trends in and uses of m-apps (and m-services) for agricultural and rural development and provides examples and analyses of how they can be used to improve outcomes in the sector. It also analyzes the mobile ecosystem in developing countries and suggests how it could be optimized to develop viable m-apps for this sector. Innovative m-ARD apps, including candidates for scaling up and replication, are identified. The report applies analytical tools—including typology, results chain, ecosystem, and business model analyses—to case studies of m-ARD apps used worldwide.

The report provides an analytical framework that supports m-ARD app innovation for two main audiences:

- *Policymakers*. What policies could support m-ARD apps that offer the greatest potential benefits for development? What components of the ecosystem require support to provide an enabling environment for m-ARD apps?

- *Development practitioners*. Where could m-ARD apps have the largest development impacts? What kinds of business models have the best chances of success?

The report also provides a methodology for comparing business models for m-ARD app providers.

The report's analytical framework for development practitioners is designed to help them understand how m-ARD apps can improve services for rural residents. This framework pays particular attention to mechanisms that create an enabling environment for m-ARD app innovation, such as policies and education conditions, as well as appropriate areas of the agricultural economy.

The report focuses on access, which touches on every aspect of economic and social life—particularly in rural areas. Every need or activity that affects or governs living and well-being can be thought of as requiring access, whether to information, resources, markets, crop technology, finance, insurance, education, or many other areas. Access is also the first step in helping poor people receive the information and services needed to improve their lives. The importance of communications as an access enabler is widely accepted by development practitioners. Thus the emergence and use of affordable mobile communications and m-ARD apps could enable far more people to access things that they value and need to improve their lives.

Lessons drawn from the 92 m-ARD apps reviewed by this report are summarized in Annex E. These lessons should be highly relevant and practical to policymakers, development practitioners, and m-ARD app providers because they are based on actual experiences and provide much-needed insights on the m-ARD app phenomenon. The lessons distilled and the issues highlighted cut across various aspects of m-ARD app development and are discussed in more detail in the following chapters.

2. Methodology and Case Selection

This report developed a typology of agricultural and rural development and conducted desk research on 92 mobile applications for agricultural and rural development applications (m-ARD apps; information sheets for these case studies are available at http://www.worldbank.org/ict/m-ard) as well as detailed case studies of 15 m-ARD apps based on field visits to Kenya, the Philippines, and Sri Lanka. It applies various analytical perspectives to the case studies based on the development impacts of m-ARD apps (Chapter 3), mobile ecosystems (Chapter 4), and business models (Chapter 5). The findings are then used to offer recommendations for policymakers and development practitioners working on agricultural and rural development in developing countries (Chapter 6).

Typology

A structural typology of agricultural and rural development was developed to analyze how m-ARD apps can be used to address sector-specific issues. This typology identified the main economic subsectors in agricultural and rural development, various markets and activities in each subsector, and development challenges facing rural stakeholders. It was also used to classify the case studies of m-ARD apps, choose representative m-ARD apps for those studies, and map and analyze benefits for users.

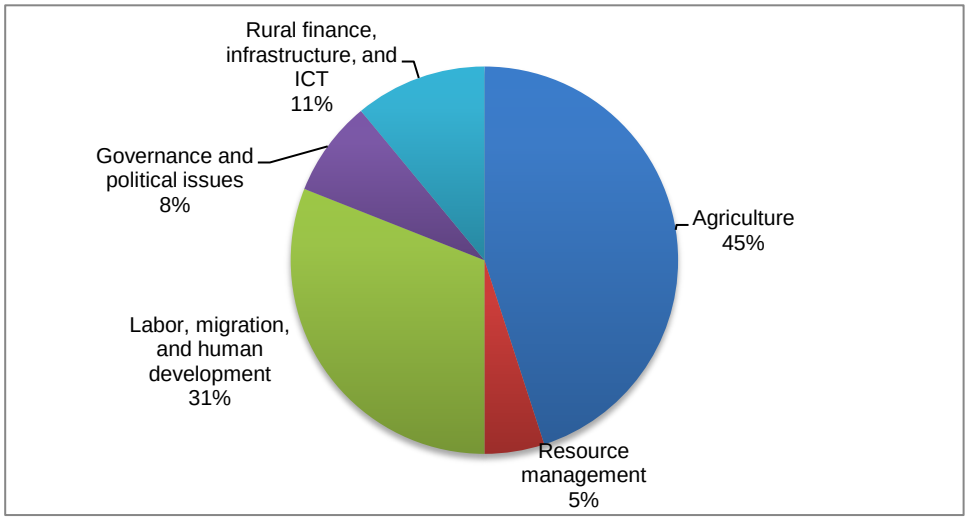
The typology of agricultural and rural development was split into five subsectors, with the most common m-ARD apps in the following order:

- Agriculture (including animal husbandry, fisheries, and forestry).
- Resource management.
- Labor, migration, and human development (including education).
- Governance and political issues.
- Rural finance, infrastructure, and information and communication technology (ICT).

(The complete typology is in Annex A.)

Figure 2.1 shows the subsector distribution of the 92 m-ARD apps studied worldwide, covering at least 20 countries. (Some apps cover more than one country.) Though governance and political m-apps only accounted for a small share of the total, e-government is becoming more important. The trend toward making government data publicly available (see, for example, www.data.gov.uk) means that there is likely to be high growth in this subsector.

Figure 2.1. Subsector Distribution of the Applications Studied

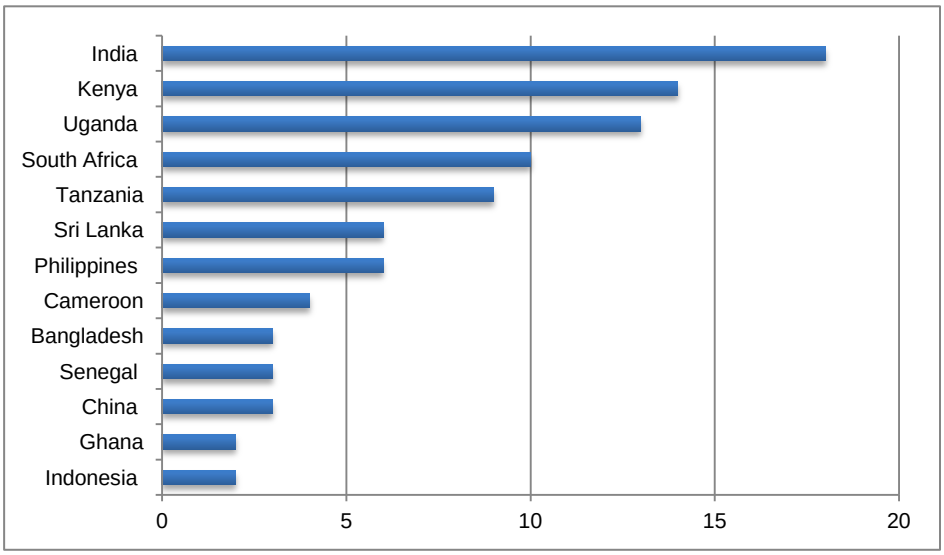


Case Studies

During the desk research an information sheet was used to record all pertinent information and initial analysis about relevant m-ARD apps identified (Annex B). It includes the subsector and segment, ecosystem players, business model, benefits, potential for growth, scaling up, and replication, hurdles to be overcome, and a SWORB (strengths, weakness, opportunities, risks, and benefits) analysis. This information was useful for identifying the best cases among the various m-ARD apps for the country case studies. Annex C summarizes the information gathered on all the cases researched, including descriptions, countries, and target users.

Based on the number of relevant m-ARD apps in the subsectors and market segments defined by the agricultural and rural development typology, a shortlist of countries was selected for detailed case studies. Figure 2.2 lists the number of m-ARD apps that could be studied in each of these countries.

Figure 2.2. Number of M-ARD Apps Identified by Country



Based on the typology, India and Kenya have the most m-ARD apps and the broadest spread of subsector and segment activities. Because Indian m-ARD apps have been extensively documented in other literature, they were excluded from this report. For Kenya the typology allowed for the study of at least five segments of agricultural and rural development. The country's global leadership in mobile payments through M-PESA appeared to offer the possibility of several innovative new applications and trends. Moreover, Kenya still seemed typical of the developing country experience, where m-ARD apps are largely at the pilot and commercialization phases.[1]

Though other countries in East Africa (Uganda and Tanzania) offered interesting areas for detailed study, the report team chose the Philippines and Sri Lanka because:

- The Philippines is home to m-ARD apps that provide text-based information on agriculture and extension services, the agriculture market, education, and government services.
- Sri Lanka has m-ARD apps on extension services, the agriculture market, and government services. In addition, a Sri Lankan researcher was able to add value by drawing comparisons with m-ARD apps developed in India for the same subsectors.
- Relative to Africa and Asia, Latin America and the Caribbean offered few opportunities to conduct a broad cross-sectional survey of m-ARD apps.

The final selection of Kenya, the Philippines, and Sri Lanka provided the broadest, most varied study opportunities. Case studies of 15 m-ARD apps in these countries included surveys and

[1] In addition, several Kenyan m-apps were discovered during the in-country research that had not been identified by the desk research.

interviews of key app sponsors and related ecosystem players. Much of the analysis in this report is based on these case studies, with trends and lessons also drawn from other m-ARD apps covered by the desk research.

Kenya, in particular, provided a window into perhaps the world's most dynamic environment for m-ARD app development, with constantly emerging possibilities for new apps and for scaling up and expanding existing ones. The strength of the country's software development system, its dynamic m-apps scene, and the general economic environment has led Nokia—a leading supplier of handsets in developing countries—to invest considerable resources in developing and diversifying this potential.

Table 2.1 summarizes how the 15 case studies, considered to best represent m-ARD apps in the three case study countries, are placed in the typology for agricultural and rural development. The table also provides a brief description of each app.

Table 2.1. Subsectors and Segments of the Mobile Applications Studied

Country	Application	Agriculture				Resource management	Labor migration & human dev.	Governance/ political issues	Rural finance, infra., & ICT	Description
		Price info	Market links	Extension and support	Distribution, logistics, & traceability					
Kenya [*Cases studied in detail]	*KACE	●	●							Provides daily market information on 20 commodity prices, facilitates offers and bids to match farm outputs with demand from wholesalers, and facilitates links between farmers and buyers (such as with contract negotiations and commodity transport).
	*DrumNet	●	●							Covers the horticultural and oilseed industry and provides information on market trends, weather, prospective partners, and the like. Includes finance, production, delivery, and payment functions to smooth supply chain processes among various actors, including producers, buyers and processing plants, transport providers, banks, and input retailers.
	*Virtual City		●		●					Provides automated systems to major buyers of tea, coffee, cotton, and dairy for collecting, recording, accounting, and traceability/distribution of agricultural products. Farmers receive faster and more accurate price, quality, and quantity information. Small and medium-size retailers can use phones to facilitate sales, deliveries, orders, and payments.
	*Kilimo Salama		●						●	Offers agricultural insurance to farmers who plant as little as one acre to shield them from financial losses when drought or excess rain is expected to affect their harvests. The insurance is weather-indexed and covers inputs such as seeds, fertilizers, and chemicals.
	KenCall Farmers' Information Service			●						Provides extension information and advice from experts. Information and answers to questions are available online or by returned phone calls within one day.
	Green Dreams—Mkulima FIS and iCow			●						Provides extension information and advice from a database using various technologies such as USSD, IVR, SMS, and the Web, including livestock management information and advice about cattle.

	*Grundfos Lifelink					●				Provides reliable, safe, convenient, and automatically pumped groundwater to villages. Users access water pumps using an electronic key paid for using M-PESA.
	Kazi560 /Mobile4Good						●			Links employers and job seekers using mobile phones. Employers can advertise and job seekers can subscribe to alerts for numerous types of jobs.
	Jana						●			Offers services to companies in developing countries such as collecting the opinions of mobile subscribers about consumer products. Rural inhabitants do such work and are paid in mobile phone minutes or other ways.
	*Ushahidi							●		Collects and reports information on crises, disturbances, and other events by mobile phone and updates the information on Google Maps. Has been used beneficially in Kenya and Haiti, and has been licensed to many other locations.
Philippines	b2bpricenow	●	●							Provides current market price information to farmers and cooperatives. Its online marketplace links these sellers to buyers and can process financial transactions using bank accounts (Web) or debit cards (mobile phones).
	Project Mind						●			Provides distance and informal education services by mobile phone. Students' performance is monitored through their answers—sent by SMS—to multiple-choice math and science questions. Exams are also administered this way.
	Farmers Texting Center		●	●						Innovative SMS-based service for answering agricultural queries—mainly about rice production—from farmers, extension workers, and others. Also provides technological updates on rice production and a virtual network where farmers and clients can interact.
	TXT CSC							●		Provides information to citizens on government services and enables citizens to provide feedback and complaints. Complaints are sent by SMS, voice, and other means, then routed to the appropriate agencies.
	text2teach						●			Provides fast and timely educational content using mobile and satellite technologies. Content includes more than 900 multimedia materials in video, picture, text, and audio formats. Also uses SMS to receive feedback and comments.

Sri Lanka	1920 Agri Extension (also known as Govi Sahana Sarana)			●						Toll-free hotline service that provides crop advisory and technology advice to farmers in Sinhala and Tamil languages. The aim is to help farmers solve problems related to technology, inputs, and marketing matters. Users can call from anywhere in the country for immediate answers by call center operators. Agriculture experts are also available as a second line of support for more complicated questions.
	Dialog Tradenet	●	●							Forwards agricultural commodity price information by SMS and USSD, reducing information arbitrage. Subscribers receive up to five price alerts for five fruits and vegetables from each of the three markets covered. Also provides a trading platform for farmers to identify potential buyers.
	e-Dairy			●						Provides farmers with information and access to just-in-time veterinary services using SMS and touch-screen computers. Information covers animal health, milk prices, feed suppliers, drug suppliers, bank loans, techniques for stall construction, and other topics.
	1919 Gov't Info Center	●						●		Hotline that provides information on public services from 99 percent of government organizations, such as how to obtain passports, copies of birth certificates, marriage and death certificates, and national identity cards. Also provides information on train schedules and crop prices by SMS.

3. Development Impact

The largest number of mobile applications for agricultural and rural development (m-ARD apps) involve improving supply chain integration and likely have the greatest impact on agricultural and rural development. Agriculture is typically crucial to the economies of developing countries and employs many people (World Bank 2011). Thus improvements in agriculture are likely to have the greatest development impacts.[2]

Improvements in agriculture supply chains have impacts beyond the private sector, such as in the informal and public sectors. Such improvements can be assumed to generate spinoffs that provide economic and social benefits factors such as employment creation, added value, and reduced product losses (van Roekel, Willems, and Boselie 2002). For example, participation in modern supply chains can increase farmer incomes by 10-100 percent. Efficient supply chains also help make economies globally competitive (World Bank 2007).

Access to market information and extension services, facilitation of market links, and access to finance are all related to supply chain operations. The value of using m-ARD apps in the agriculture supply chain cannot be understated and—though they are not a panacea—there is evidence of their usefulness in these areas.

Key actors in the agriculture supply chain include:

- *Producers (farmers)*. Farmers integrated with a supply chain can gain access to timely, cost-effective, personalized information on markets, prices, inputs, weather, good practices, and impending natural disasters. They can also secure reliable, profitable links beyond local markets and expand under structured agreements (contract farming) with buyers.
- *Suppliers*. Providers of agricultural inputs through, for example, an SMS alert about a farmer's input requirements, can plan their stockholding requirements throughout the season and try to achieve economies of scale. This approach increases sales without adding credit burdens or risking default or the loss of working capital.
- *Buyers*. Buyers face numerous challenges in a supply chain that is poorly structured and requires cumbersome searches for produce and complex financial administration. Such a supply chain requires heavy reliance on brokers or trader networks that are not always able to deliver produce of predictable quantity, quality, or source. Unreliable quantities lead to supply shortfalls that increase production costs and can raise the costs of finished goods. With more efficient supply chains, buyers can benefit from cheaper, higher-quality produce.

[2] World Bank (2008). In particular, table 9.2 (p. 205) lists rural employment by sector of activity. For example, in Sub-Saharan Africa 61 percent of men in rural areas work in agriculture. Moreover, 60 percent of the region's population lives in rural areas; see UN Habitat and UNEP (2010).

- *Financial institutions and insurance companies*. Agriculture is considered a risky sector for financing. Financing small farmers involves high transaction costs, making the market undesirable for and underserved by financial institutions and products. With supply chain integration, financial institutions and insurance companies can lower transaction costs and avoid the complexity of managing large numbers of farming loans. In addition, producers can better manage risks and plant higher-yield produce thanks to better insurance coverage.
- *Rural development and agricultural extension organizations*. Extension workers play an important role in explaining the benefits of m-ARD apps and obtaining detailed information about the services required by communities . Extension workers are at the frontline in terms of collecting and disseminating information.

Virtual City's AgriManagr illustrates the benefits of automating the supply chain in Kenya's export market for tea (Box 3.1). In addition, this report found a number of cases where m-ARD apps improved access to information, finance, and rural extension and advisory services, and increased the efficiency of market links and distribution. Figure 3.1 shows a results chain of m-ARD apps addressing key challenges for agricultural and rural development and achieving development impacts.

Box 3.1. Virtual City's AgriManagr—Automating Tea Purchases in Kenya

Virtual City has introduced several applications, one sector at a time, in the form of turnkey automation paid for by a leading player in each sector or market segment (for example, a main industry buyer such as a tea factory or cotton or dairy cooperative). An m-app, AgriManagr, automates purchases and strengthens relationships between the leading chain of tea factories—the Kenya Tea Production Authority (KTDA)—and tea growers and transport companies. Based on positive initial results, AgriManagr will be more widely deployed in KTDA's territory.

Increased efficiency and reduced fraud at buying centers

AgriManagr cut the average transaction time at tea buying centers from 3 minutes under the manual system to 22 seconds. Weight data for tea is collected electronically at the buying centers and no adding, editing, or deleting of records is allowed without proper authority. Growers or clerks swipe growers' smartcards, automatically updating the day's transactions. Growers' receipts show the weight of produce delivered that day and the cumulative weight for the month. Fraud has been reduced as a result.

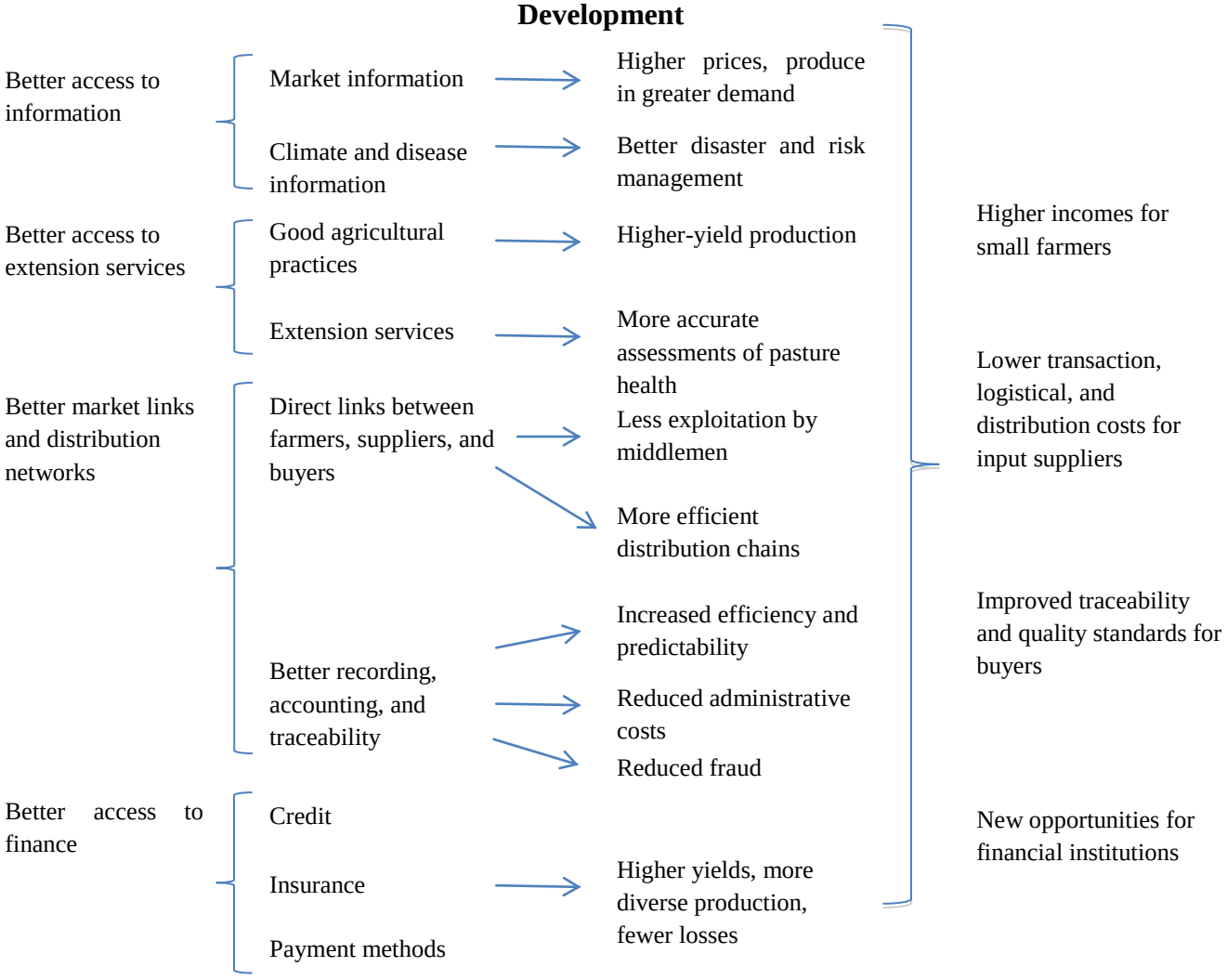
Higher incomes for farmers

AgriManagr has proven beneficial for small tea growers. The average weight per transaction has increased by about 9 percent. According to independent research, a typical tea farmer with a 3-acre farm earned about $3,300 in 2010, so the 9 percent additional income due to AgriManagr translated to about $300.

Lower administrative costs

Before AgriManagr, the average annual factory cost for paper, data entry reconciliation, communication, and fraud was approximately Kshs 60 million, or $600,000. This has been reduced by replacing paper documents with electronic data entry and reconciliation. In addition, the cost of collection has been cut by three-quarters.

Figure 3.1. The Results Generated by Mobile Applications for Agricultural and Rural Development



Quantitative Impact

Most m-ARD apps are in the pilot phase. But several have provided clear, quantifiable benefits (Table 3.2). These apps have increased income and access to finance for farmers and provided benefits to other players through supply chain efficiencies.

Increasing agricultural productivity, profitability, and sustainability in the developing world depends on the ability of rural populations to adopt changes and innovations in their use of technologies, management systems, organizational arrangements, institutions, and environmental resources. Expanding people's capacity depends on their access to knowledge and information. M-ARD apps such as KenCall Farmers' Info Service and GreenDreams in Kenya, Farmers

Texting Center in the Philippines, and 1920 Agri Extension and e-Dairy in Sri Lanka were developed to provide relevant information services to rural populations.

Table 3.2. Benefits of Various Mobile Applications

Application	Country	Increased income through better access to information and services	Higher-yield production	Improved efficiency in supply chain	Better access to finance
Virtual City AgriManagr	Kenya	• Typically, small farmers see their incomes increase 9% due to better measuring and recording of produce weights		• Transaction time reduced from 3 minutes to 22 seconds • Cost of delivery reduced by 75% • Fraud minimized through use of electronic data entry	
KACE	Kenya	• 75% of farmers and 60% of commodity traders report higher incomes		• Market integration (linkage efficiency) improved for two commodities—maize and beans	
Kilimo Salama	Kenya	• $150 average increase in income per small farmer	• 50% increase in production due to insurance on higher-yield inputs	• More efficient value chain leads to lower retail costs	• Farmers in first year insured 10-20% of their inputs and increased insurance to 50% of inputs the next year
DrumNet	Kenya	• Farmer incomes rose by an average of 32%		• Improved access to agricultural inputs • Input suppliers achieve economies of scale	• Bank creditworthiness increased due to secure produce supply contracts • Reduced transaction costs for financial institutions
b2bpricenow.com	Philippines	• Volume of trade since inception in 2000 is nearly $30 million		• Direct access to buyers improves sales	• More efficient and secure payments to members
Farmers Texting Center	Philippines	• Farmers are planting crops with higher yields	• Production increases of 20% reported		
Dialog Tradenet	Sri Lanka	• 23% premium on produce due to timely market price information		• Lower information asymmetry between farmers and brokers	
e-Dairy	Sri Lanka	• Additional income of $262 per additional calf due to more timely access to veterinary services	• Milk production can increase by 30%	• Accurate prices provided at delivery point instead of days after delivery, as in the past	

Providing access to information

The most widely used m-ARD apps provide users with access to useful, relevant information. An example is where a farmer can get commodity prices in various urban markets through a simple request made on a mobile phone. Asymmetrical access to pricing information is a weakness of rural markets. Middlemen can buy farmers' produce cheaply and sell it at high prices unless farmers have the same information about the prices for their produce in specific markets. Increasingly, because of mobile phone penetration and market information apps that require a low level of literacy to understand, m-ARD apps can provide farmers with direct, immediate benefits—such as higher incomes.

The case study on Kenya found many such examples. The DrumNet pilot reported that farmer incomes rose by a third due to a comprehensive system of price negotiation, contracting, and other value chain support. KACE reported that incomes increased for three-quarters of farmers and three-fifths of commodity traders—again, apparently due to a fairly complex support system for links in the value chain. Tea growers using Virtual City's AgriManagr reported an average 9 percent increase in their incomes (about $300 a year) because of more accurate recording of their production volumes (see Box 3.1).

Elsewhere, m-ARD apps focused on increasing access to information and providing support for transactions have improved bargaining power and lowered transaction risks and costs for small farmers. Examples include B2BPricenow.com in the Philippines and Manobi in Ghana and Senegal.

Tradenet is a service launched in 2009 by Dialog, Sri Lanka's leading provider of mobile services, to provide information on agricultural prices by mobile phone. This content is supported by Govi Gnana Seva (GGS), a nonprofit that specializes in agricultural marketing and collects and disseminates information on wholesale trade in produce. Tradenet enables farmers to access up-to-the-minute prices on agricultural commodities, reducing information arbitrage. As a result, farmers obtain better prices for their produce and, hence, higher incomes.

Farmers can receive up to five price alerts for up to five fruits and vegetables from each of the three markets covered by GGS, including the Dambulla Dedicated Economic Centre—Sri Lanka's largest wholesale market for fruits and vegetables, which handles nearly 80 percent of wholesale agricultural trade in the country. Tradenet is available free of charge to Dialog subscribers. Information on the Tradenet platform is disseminated using multiple technologies, including SMS, Unstructured Supplementary Service Data (USSD), and the Internet. The SMS service is offered in English, Sinhala, and Tamil.

Tradenet provides users with timely information on price movements in wholesale agricultural produce. In 2010 farmers 10-15 kilometers from the nearest market obtained an average premium of 23 percent on the price per kilogram of their produce by using Tradenet (Lokanathan 2010). Farmers also use the service to plan harvest and market entry times. They can do so

because most fruits and vegetables in Sri Lanka exhibit high intraday and interday price volatility due to mismatches between supply and demand. Accurate, real-time price information is allowing farmers to minimize the sunk costs associated with entering the market at nonoptimal times (since, due to transport costs, they cannot take their produce back to their farms even if prices are low in the market).

Information services such as Reuters Market Light in India, Manobi in Ghana and Senegal, and Ovi Life Tools in China, India, Indonesia, and Nigeria are designed to provide relevant information to rural residents. These m-ARD apps start by providing general market information about a specific region or village (such as weather information), but information can then be highly targeted.

Providing access to extension and advisory services

M-apps also play an important role in expanding timely access to rural extension and advisory services to meet the immediate needs of farmers and other rural residents as they change their production and livelihood systems. M-apps provide advice to farmers on problems and opportunities in agricultural production, marketing, conservation, and family livelihoods; transfer new technologies and good practices or lessons; facilitate the development of local skills, organizations, and links with other programs and institutions; and address public interest issues such as resource conservation, food security monitoring, agricultural production monitoring, food safety, nutrition, family education, and youth development.

The government-owned Information and Communication Technology Agency (ICTA) of Sri Lanka, for instance, discovered that between 2003 and 2008 more than half of the country's milking cows (over 560,000) were not pregnant at any given time (e-Dairy 2009). Low pregnancy rates were due to lack of timely access to artificial insemination and breeding services, resulting in a loss of 30-35 days' worth of milk (about 300 liters, worth $100). The e-Dairy service was introduced in 2009 to address this issue.[3]

E-Dairy enables farmers to request veterinary and extension services related to issues such as animal health, artificial insemination, milk prices, and construction of dairy stalls through a simple SMS interface or on touchscreen computers. Farmers type in personal identification codes and the code of the service they need. The request is then sent to all registered suppliers so that they can contact the farmers directly. Farmers usually obtain feedback within a few hours. So far, 300 farmers have registered for the service. E-Dairy also provides training on computer and Internet use.

[3] The pilot was launched by the Dambadeniya Development Foundation, a community-based organization, with financial backing from the ICTA. The foundation developed the technology used and supplies the information, while the ICTA funded half of the initial investment cost. Dialog, the country's leading mobile service provider, has provided a special SMS gateway for the service. The service received the Manthan Award South Asia, which recognizes best practices in electronic content and creativity in Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka. See http://www.manthanaward.org/other_full_story.asp?id=21.

According to Sri Lanka's Department of Dairy Foods, milk production could be increased by 30 percent if artificial insemination services were requested and supplied in a timely manner. Moreover, the ICTA estimates that farmers could earn an additional $262 a calf each year. Farmers could also benefit from access to optimal market prices. Dairy farmers are usually paid every 15 days. They used to deliver their milk to collection centers without knowing what price they would eventually be paid. By using e-Dairy, they can obtain prices before delivering their milk, ensuring that they receive the highest prices.

Extension services can also collect feedback for providers about the usefulness and needed features of their m-ARD apps. For example, the Grameen Community Knowledge Worker Initiative in Uganda collects data on the needs of rural farmers using mobile phones and feeds it into a database to better target extension services.

Establishing market links

M-apps are effective at strengthening market links. They are also being used to improve product distribution and traceability using more sophisticated and less expensive tools. Sensors that track spoilage, density, and light and that monitor storage facilities improve product traceability and food safety in rural areas (RFID News 2009).

Expanding access to finance and insurance

Rural farmers typically lack access to financial services that could increase their ability to upgrade or diversify their practices. This is mainly because financial institutions and insurance companies do not seek out rural customers because of the high costs of small transactions and of loan and claim management. Increasing attention is being paid to the potential to integrate financial institutions and mobile money (m-money) services in agricultural value chain applications.

M-apps such as M-PESA in Kenya and SMART Money and G-Cash in the Philippines have attained widespread trust and acceptance among rural populations as safe, easy ways of making and receiving payments and storing money. Banks and businesses also recognize these m-ARD apps as efficient means of administrating payments and money transfers. And, in these countries at least, m-money is increasingly accepted by banks as a legitimate platform to pay for agricultural inputs and outputs.

The implementation of an automated village well water supply system in Kenya (Grundfos Lifelink), for instance, depends entirely on M-PESA as a risk-free and cashless payment system. Villagers buy an electronic pump key to access safe pumped groundwater instead of having to walk long distances to collect water from a hand-pumped well or impure surface water source such as a lake or river. M-PESA is used to recharge the pump keys as needed. The minimum recharge is $1.25, which pays for at least 20 jerry cans of water. Payments flow directly to the system account, which then pays for maintenance and repays the community loan for the well.

Kenya's Kilimo Salama system is a more complex m-ARD app that provides weather-based microinsurance to small farmers using automated premium collections and payouts through M-PESA (Box 3.2). Farmers, agricultural input suppliers, and the insurance industry all benefit from this innovative product. In addition, it could protect rural residents against other unexpected life events if its use were extended to other insurance products such as funeral and accident coverage.

Box 3.2. Kenya's Kilimo Salama Microinsurance Product

Kilimo Salama is a weather-based insurance m-app distributed by farm input suppliers to insure farmers' investments in inputs—such as seeds, fertilizers, and chemicals—against weather risks such as drought or excess rainfall. It uses solar-powered weather stations to provide farmers with full climate data (rainfall, temperature, wind speed, sunlight) and mobile payment technology to collect premiums and distribute payouts. The m-app also provides an advice line for farmers and sends text messages to help farmers improve their techniques.

Benefits to small farmers

By insuring their farm inputs, farmers are more confident that they can plant the following season even after loss, due to the payout. The system's climate data also enable prediction of the incidence of disease and other potential risks. The information, combined with knowledge about farmers' locations and mobile numbers, enables farmers to receive timely text messages that help them improve their practices, productivity, and food security.

The initial pilot, where the indexed insurance made major payouts (80 percent of purchase value), gave farmers—who on average insured only 10-20 percent of their input purchases in the first season of the program—the confidence to increase their insurance to 50 percent of inputs the next year. In addition, more farmers bought seeds, fertilizers, and chemicals that have higher yields in normal years. Still, the complex interactions between weather, information flows, proper use of the information, and insurance arrangements underscore the critical importance of education and extension services alongside the sale of insurance and the adoption of new, more productive techniques.

Input suppliers

Distributing insurance also makes sense for suppliers: their revenue and turnover are closely related to climatic circumstances because their clients only buy inputs when it rains. When suppliers are the only ones providing credit to farmers, their businesses are quickly in danger of bankruptcy when droughts occur. Kilimo Salama provides more secure revenue for suppliers because farmers are willing to buy inputs even in seasons following adverse weather conditions. Moreover, Kilimo Salama is only offered by certified, trusted suppliers, potentially increasing the loyalty of their customers and boosting sales.

Insurance industry

The Kilimo Salama m-app made it feasible for the insurance company to provide a product in an otherwise untapped and practically unreachable market. Both the insurer and international reinsurers can be confident in the accuracy and timeliness of data provided.

Qualitative Impact

In addition to their quantifiable benefits, m-ARD apps have significant qualitative benefits. By nature, qualitative benefits are harder to assess objectively and largely depend on the local context. Determining success is made even more complex by the lack of clear project targets in many e-government m-apps. For example, how does a project assess the benefits of m-apps relative to the costs of providing them? This remains a key challenge for e-government m-apps.

For example, TXT CSC in the Philippines and the 1919 Government Information Center in Sri Lanka are e-government applications that provide government information to citizens though a mix of SMS, voice, and Internet channels. TXT CSC receives some of the heaviest traffic of the government's text-based services. Providing information about government services provides clear benefits at relatively low cost and in response to significant demand. But because both services mainly only provide information, quantifying their impact is challenging.

Ushahidi, developed in Kenya, is another example of an m-ARD app delivering qualitative benefits. It uses crowdsourcing to acquire information about events in an area and superimposes the results onto maps. It was initially used to monitor post-election violence, and its main benefit has been providing accurate information about what is happening on the ground and increasing government transparency. Ushahidi is also used to support timely interventions by and aid government agencies in disaster-hit areas, such as in Haiti after its disastrous 2010 earthquake. Ushahidi provides a platform for organizations to receive information, analyze it, and form a response. It is provided on an open source basis to a wide range of public and private agencies, including new ones—how the information is used and acted on is not Ushahidi's responsibility.

4. Mobile Ecosystems

The general definition of a mobile ecosystem is the same one used by James Moore when he applied biological concepts to the business world: an economic community supported by a foundation of interacting organizations and individuals—the organisms of the business world. This economic community produces goods and services of value to customers, who are also members of the ecosystem (Moore 1996). The ecosystem for mobile applications for agricultural and rural development (m-ARD apps) is the community of service providers, rural agencies, m-app providers, customers, and related participants such as government departments, financiers, and regulators.

All possible players in the ecosystem for m-ARD apps are listed in Annex D. The annex also describes the players' assets, abilities, and incentives, which are important parts of this report's analysis and were initially developed as an analytical information sheet.

This chapter analyzes elements of the m-ARD app ecosystem that differ in developing and developed countries. It is important to examine these differences because rural markets in developing countries are fundamentally different than in developed countries, and will remain so for quite some time. Lessons from the developed world are only valuable in drawing lessons relevant for developing country contexts and ecosystems. The main differences between the m-ARD app ecosystems of developing and developed countries are summarized in Table 4.1.

Table 4.1. M-app Ecosystems in Developing and Developed Countries

Participants/ features	Developing countries	Developed countries
Key players	• Mobile network operators are gatekeepers	• Platform providers dominant (such as Apple's App store) • Independent providers are key players
Platform	• Platform being developed (such as Ovi Store) • Often no mobile payment system • Mobile money available in some countries (such as Kenya's M-PESA) • Operator billing negotiated at the platform level	• Easy to put m-apps on the platform • Platform provides developer support, customer service, payment system (credit card, PayPal), and guarantees the functionality of apps
Content and services	• Hyper-local information • Highly local training • Content often not available in digitized form, so greater need for collaboration with local content providers	• Multiple ways of getting information and services in both rural and urban areas • Substantial information available in digitized form

As noted, in the developed world there are many ways of accessing information, including computers, newspapers, magazines, and blogs. By comparison, in rural parts of the developing world mobile phones are one of the main and often only ways of accessing information. For example, in the United States 94 percent of rural areas have at least one mobile broadband provider, television penetration is 98 percent, and radio penetration is 99 percent (U.S. Census Bureau 2011).

In the developed world a considerable amount of Internet use involves social media. While social media is also widely used in the developing world, more attention is paid to the role of m-apps in solving problems where few alternatives exist. In the developed world the most popular types of m-apps are for games, weather, and social networking. M-apps that focus on agriculture are often extensions of services available from the Internet or desktop software. For example, Apple's App Store has 40 apps that can be found using agriculture as a keyword. Most involve utilities, productivity, or business issues. The reference category contains just 4 apps—and they all consist of basic agricultural glossaries that are of limited use, leaving just 36 agriculture-focused m-apps out of 425,000 (as of June 2011), or 0.008 percent of the total. In the Android market there are just 7 agriculture m-apps out of 200,000 (as of May 2011), or 0.004 percent of the total.

From an agricultural and rural development perspective, this means that outcomes in the developed world are the result of a particular context or development path. The introduction of the iPhone in 2007 and Apple's App Store in 2008 transformed the developed world's m-app ecosystem. The developing world—particularly because it has such information scarcity in areas such as B2B operations—will follow a different path of m-app evolution. Hence using the developed world's m-app ecosystem as a reference point for the potential evolution of m-apps in developing countries is not particularly useful.

The key challenge in developing countries is creating dynamic m-app ecosystems, including platforms, that mirror developed countries in some ways—most notably by making m-apps more accessible and viable. Several interventions can support progress toward a dynamic model in which a range of stakeholders feed a virtuous loop of m-app development. Numerous policy measures will be required to address deficiencies in the m-app ecosystem in developing countries. The needs and issues are discussed below, and recommendations are provided in Chapter 6.

Key Players

Mobile network operators

The mobile ecosystem in developing countries tends to be a loose association of companies not all pulling in the same direction. Mobile network operators generally dominate the ecosystem—providers are not seen as a core constituency. Instead of providing the tools needed to host and sell m-apps and letting the market determine which ones are desired, mobile network operators in developing countries decide which m-apps they want on their systems.

M-PESA, for example, has not released its application programming interface (API), so third party providers cannot develop innovative uses for it (Kemibaro 2011, Kimunyu 2009). Also in Kenya, Safaricom is the gatekeeper for any m-apps that want to link to its system and charges up to 85 percent of the revenue from m-app transactions. In India and Indonesia revenue shares are more favorable toward m-app providers, with even splits of revenue possible.

M-app providers

In developed countries mobile operators have become data carriers only and are of secondary importance to m-app hosting platforms. The best example is the end of AT&T and Apple's exclusivity agreement for iPhone coverage. As a result, iPhone sales have soared (Apple 2011). The Apple iOS and Google Android operating systems rely on third party providers for m-apps and charge about 30 percent of transaction revenue. Independent software developers are free to innovate and drive the development of m-apps.

Users

Depending on their goals, m-ARD apps target different types of users:

- *Farmers*. KACE in Kenya, Manobi in Ghana and Senegal, and several other m-ARD apps target farmers with pricing information as well as more sophisticated supply chain services.
- *Rural produce buyers and food processing plants (including warehouses).* Supply chain integration solutions provide a lower cost of supply and can increase the quality of supply. M-apps providing these kinds of solutions include KACE, Manobi, and Virtual City.
- *Cooperatives*. B2bpricenow.com in the Philippines initially targeted cooperatives that held accounts with the main agricultural bank. It has since expanded services to small farmers.
- *Input suppliers*. Kenya's Kilimo Salama, an agricultural insurance program, has formed a partnership with Syngenta, an agricultural input supplier with a network of additional suppliers.
- *Consumers.* Ovi Life Tools (OLT) in India, Indonesia, and Nigeria provides farmers with agricultural price information and consumers with health, entertainment, and education services. This approach could facilitate economies of scale, cross-subsidies, advertising, and other financial benefits.
- *Rural development organizations.* These include government health agencies, government ministry field workers, and donors active in the field. For example, the Grameen Community Knowledge Worker Initiative in Uganda collects data on the needs of rural farmers and uses it to improve the design of education programs.

Unlike in the developed world, m-ARD app users in the developing world demand relevant, hyper-local content. For example, agricultural prices must be sourced from local and regional markets so that farmers can compare prices and decide where to take their produce. (Several m-ARD apps provide this information, including Manobi, OLT, and Reuters Market Light). In addition, there is a burgeoning movement to collect information about users through innovative m-ARD apps such as Jana. This information can be used to provide users with better, more useful, and more relevant information.

Content providers

Several m-ARD apps provide hyper-local information as a key part of their services. Such content is useful because it can be acted on and relevant because it is user-specific. Several players in the mobile ecosystem can provide useful and relevant information:

Government departments. Government departments provide data to local m-ARD apps, following the lead of innovative developments in the United Kingdom and United States (www.data.gov.uk and www.data.gov respectively). Kenya's government has launched www.opendata.go.ke, which provides data on the national census, government spending, parliamentary proceedings, and public service locations as part of an experiment to see what innovative m-apps that providers can design using the data.

- *Extension workers*. Several initiatives provide extension services to farmers, such as the Grameen Community Knowledge Worker Initiative, developed and operated by the Grameen Foundation with funding from the Bill and Melinda Gates Foundation.
- *Civil society*. In Sri Lanka Govi Gnana Seva (GGS), a nonprofit, works with Dialog Tradenet to provide real-time market pricing information to farmers.
- *Specialized commercial units*. In Kenya, KACE has organized market research centers that collect and monitor local market data daily, report information to radio stations on bid/ask prices, and provide farmers with market links, pick-up and delivery transportation, and training in information and communication technology (ICT). The centers are a mix of wholly owned and franchised businesses, a model that appears attractive.[4]
- *Media*. KACE broadcasts local agricultural prices and trades using community radio.
- *Crowdsourcing*. Ushahidi in Kenya provides a platform for people to collect and plot information (ranging from disaster management to civil unrest) from officials or citizens sent by email, SMS, or Twitter.

[4] See Annex G, Kenya Case Study, section 4.3.

Platform

The most important m-apps innovation in the developed world has been the creation of a platform that allows independent software providers to create m-apps. For the purposes of this report, a platform is defined as software architecture that serves as a foundation or base for other programs or applications. A platform usually includes security features—procedural and software rules that m-apps must comply with to use the platform. Examples of platforms include Android, Apple's iOS, Ushahidi, and Telefonica's BlueVia.

Apple's App Store distinguishes itself from previous systems, such as those developed by mobile network operators, by providing an operator-neutral platform. Providers are free to be innovative, and getting an m-app into the Apple App Store is relatively easy. In July 2010 the platform had more than 43,000 app providers associated with iOS (AppStoreHQ 2010). Moreover, the App Store provides developer support, customer service, and a payment system, and guarantees m-app functionality. This creates consumer trust in the system and contributes to the massive number of m-app downloads.

Creating a similar platform for developing countries would face obstacles including low mobile broadband penetration, lack of an m-payment system, low smartphone penetration, and low advertising revenue. These factors, coupled with the importance of mobile network operators in driving mobile phone adoption, have created an alternative platform for developing countries.[5]

Nokia, drawing on its historical dominance in developing countries with standard phones and having lost significant market share to smartphones in developed countries, sees an opportunity in developing countries. Nokia launched the Ovi Store in 2009, incorporating a group of m-apps called Ovi Life Tools (OLT) targeted at users in developing countries. These tools are geared toward narrowband, affordable m-apps providing health, education, agriculture, and entertainment services. OLT has about 6.3 million users in China, India, and Indonesia (Nokia Conversations 2010b), and has been operational in Nigeria since November 2010. Several of Nokia's m-apps, such as Ovi Maps, use compression to reduce data usage, making them better suited to narrowband environments (ReadWriteWeb 2010).

Unlike the Apple and Android models, which use mobile network operators purely as data carriers, developing country platforms such as OLT must integrate with mobile network operators to use their operator billing systems. Credit cards are still uncommon in developing countries and so are not good mechanisms for consumers to pay for m-apps. Few institutions in developing countries are as trusted as mobile network operators and their associated mobile money (m-money) operations such as M-PESA, GCash, and Smart Money (the latter two both in the Philippines).

[5] Developing countries and emerging economies are defined according to the list in IMF (2010).

M-PESA has a long history of providing person-to-person transfers and other money services in areas with no prior access to financial services. Operator billing enables consumers to buy m-apps and have the cost deducted from their prepaid or postpaid balances. When the Ovi Store is introduced in an area, operator billing accounts for an average of 13 times more sales than credit cards (Nokia Conversations 2010a). As of November 2011, operator billing through the Ovi Store was available in 46 countries (Nokia Developer 2011).

Providers like using the Ovi Store because it negotiates on their behalf with mobile network operators—hence the rapid increase in the number of m-apps available through the store. But the Ovi Store has to negotiate with every mobile network operator in each country, slowing the process of providing m-app services relative to Apple and Android. Still, using operator billing as an alternative (though imperfect) replacement for m-money provides a foundation for m-apps to develop their own revenue streams. Without a payment mechanism, m-apps face significant challenges to becoming commercially sustainable. Hence, supporting m-money and other mobile payment systems is an important step toward promoting sustainable m-apps.

Mobile network operators have different models for m-app development platforms, of which BlueVia, created by Spain's Telefonica, is particularly interesting. Telefonica launched BlueVia in late 2010. BlueVia copies several features of the Apple and Android development platforms:

- Providers earn 70 percent of m-app sales and subscription payments.
- The application programming interface (API) is free.
- Providers earn a share of advertising revenue.
- Providers have access to all Telefonica subscribers (Telco 2.0 2010).

BlueVia differs from competing models such as T-Mobile's because it bring providers into the platform for free and does not charge for the API. Providers can also sell their products to third party m-app stores. Like Nokia's Ovi Life Tools model, BlueVia also allows providers to charge for their apps by mobile phone—in the Czech Republic, Germany, the Slovak Republic, and the United Kingdom using the O2 brand and in Latin America and Spain using the Movistar brand.

Still, the BlueVia model faces challenges. Though Telefonica has presented a plan for integration with other mobile network operators, it does not yet have any integration with competitors. As a result, the number of users is limited to Telefonica's 200 million subscribers, while the Android model's limit is potentially far higher. The Android model also has the advantage of not being associated with any mobile operator, while BlueVia is explicitly associated with Telefonica. BlueVia's stated intention is to be operator independent, but Vodafone, T-Mobile, and several other operators have launched their own app stores. It remains to be seen how the app store landscape will play out among mobile operators.

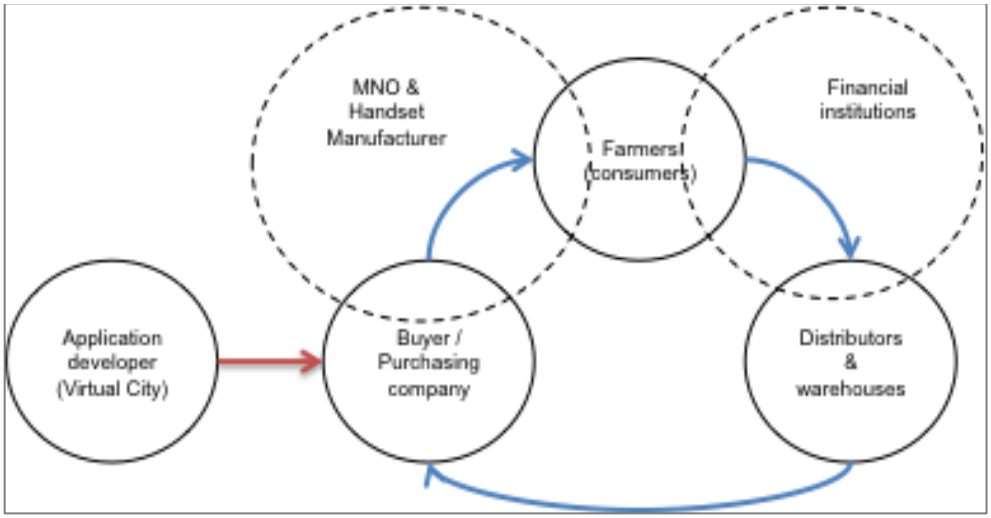
The challenges facing m-apps where there is no platform—and the potential benefits of getting one—are described in Box 4.1. In developing countries the ability to scale up depends on an m-

app ecosystem platform. A platform gives m-app providers access to a large number of consumers and well-known, trusted payment mechanisms (m-money companies such as M-PESA). A platform can also facilitate transactions between consumers and companies that see opportunities to market their products to rural consumers. These types of companies include suppliers and distributors of fast-moving consumer goods (FMCGs), banks, microinsurance companies, and agricultural cooperatives (see Figure 4.2 and Chapter 5).

Box 4.1. Virtual City: The Challenges of Working Without a Platform

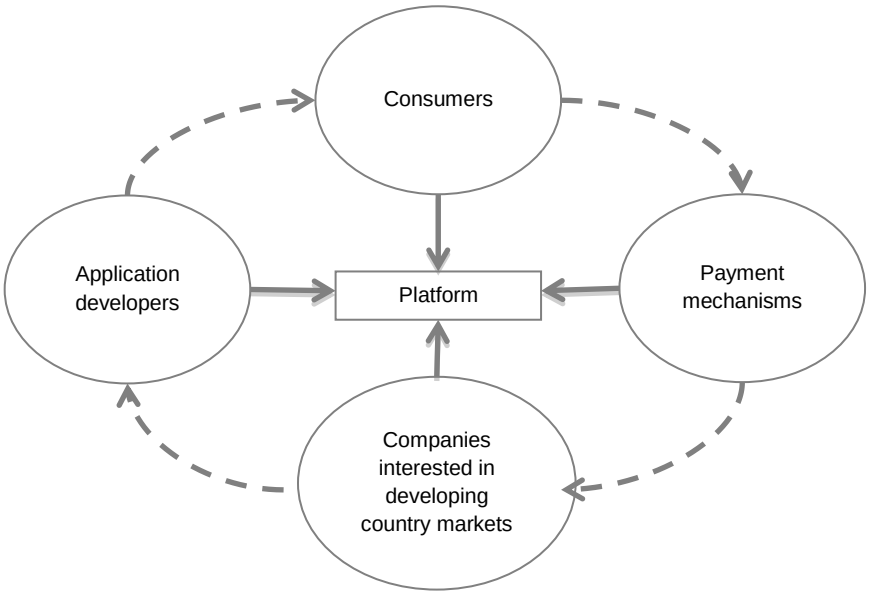
Virtual City is an m-apps developer in Kenya that has provided automation solutions in the tea, coffee, dairy, and cotton agricultural segments. Virtual City interacts only with the lead buyer in each sector to develop customized solutions (Box Figure 4.1). Virtual City might have some interaction with farmers and distributors, but this is intermediated by buyers. Virtual City does not have any influence on critical m-apps ecosystem players such as handset manufacturers, financial institutions, and mobile network operators. Virtual City's approach is self-sustaining because clients realize that its benefits justify its costs. But Virtual City is limited by the number of m-apps that it can develop.

Box Figure 4.1. Virtual City Ecosystem



In September 2010 Virtual City received $1 million from Nokia's Growth Economy Venture Challenge. This cash infusion provided financing as well as an opportunity for Virtual City to work with Nokia on integrating Virtual City's Mobile Distributor Solution with Nokia's Ovi Life Tools (OLT), creating potential for more clients and increased scalability. This is a promising route because the OLT platform serves 2G and 3G handsets that are far more commonly used than iPhone, Android, and Blackberry handsets in the developing world.

Figure 4.2. Ecosystem Platform



The Nokia Ovi Store and Ovi Life Tools (OLT) models suggest that a successful m-apps platform is possible for developing countries. Such a platform provides relatively uniform m-app approval procedures and processing times. The principle of streamlining the approval process through an intermediary such as the Ovi Store or OLT is important.

Highly Local Content and Services

Another fundamental difference between developed and developing country markets is that m-apps in developing countries must be hyper-local and tailored to user requirements—even down to the village level—in terms of the information and services that m-apps offer, necessary training, and the operating platform. Scaling up is difficult.

In developed markets there are many ways to access local information. Most local stores, for example, have a presence on the Internet. Finding the price for a good or service simply requires going online. In developing country markets information asymmetry is the norm. Disposable income is extremely low and people cannot afford to use several different methods to access information. To offer value to customers in developing countries, information provided by m-apps must be hyper-local.

A study of Indian services showed the relative value provided by specialized content providers (Mittal and Tripathi 2010). Farmers placed higher value on the information provided by Reuters Market Light (RML) than that provided by IFFCO Kisan Sanchar Ltd (IKSL). The information provided by RML was more specific, and RML had more experience with providing relevant information. IKSL was a partnership between a fertilizer cooperative and a mobile network operator. The information business was secondary to its primary business—gaining more mobile subscribers and increasing fertilizer sales (Lokanathan and De Silve 2010). Its learning curve, in terms of disseminating relevant content, was steep. Unlike RML, providing relevant content was IKSL's only way of generating revenue, so it spent more time trying to understand the needs of its target audience.

Moreover, levels of consumer education and literacy are usually low in rural areas of developing countries and so require onsite demonstrations or training in the use of m-ARD apps. Several m-ARD apps highlight the need for trainers to visit villages to explain the benefits and use of each app. Examples include:

- Govi Gnana Seva agriculture price collectors in Sri Lanka, who work in association with Dialog Tradenet.
- KACE's market resource centers, whose staff visit markets in Kenya to get data and work with farmers to help create links after they get information on market prices.
- Kilimo Salama, an insurance marketing application in Kenya that provides farmers with integrated financial training and educational extension services about insurance and high-yield seeds.
- Reuters Market Light in India, which provides local-level market information to farmers, using local teams to collect market data for submission to a central server.

Such support is costly. Some m-ARD apps are developed for literate village-based intermediaries such as phone operators, health workers, and entrepreneurs who then provide information to their village's poorest residents, who are illiterate or do not own phones. The Grameen Community Knowledge Worker Initiative in Uganda is an example.

For m-ARD app platforms, Nokia's requirement that OLT be hyper-local ensures that it can offer unique content in each country. In India, for example, OLT's agricultural information desk handles more than 10,000 data points a day, more than 275 different crops in more than 4,000 markets, and in 11 languages (Nokia World 2010). This is why services such as OLT are available in only 14 languages and 4 countries.

5. Business Models

Business models are the systems that organizations use to create, deliver, and capture value (Osterwalder and Pigneur 2009). Still, the definition of a business model is murky. It usually refers to a loose concept of how a company does business and generates revenue. Yet simply having a business model is a low bar to set for building a company. Generating revenue is a far cry from creating economic value, and no business model can be evaluated independently of industry structure (Porter 2001). Moreover, multiple business models may exist within an industry structure, and the concept of value has two meanings in the context of m-ARD apps in developing countries:

- For commercial mobile applications for agricultural and rural development (m-ARD apps), the concept of value is the ability to earn enough profit to continue operating in the medium term (more than the next two years).
- For noncommercial m-ARD apps (such as some e-government apps), value is defined as providing a nonmonetary benefit to a target group such as rural residents, patients, or any other defined group. For a noncommercial m-app to be sustainable, the social and economic value it delivers should be greater than the cost of providing it.

Commercial m-apps are either transactional or informational. Transactional m-apps have a built-in payment system—for example, integration with a mobile money (m-money) service provider (such as M-PESA) or operator billing service (such as Ovi Life Tools). Informational m-apps aim to be profitable or sustainable by generating an alternative revenue stream—say, by providing services (as with Jana). Noncommercial m-apps do not have any integration with payment systems or alternative revenue streams because they are funded by donors and governments.

The business model analysis in this report study was undertaken in accordance with the case study information sheet in Annex B. In addition, the business models for the 92 m-ARD apps studied were aggregated and the apps were placed into three stages of business development:

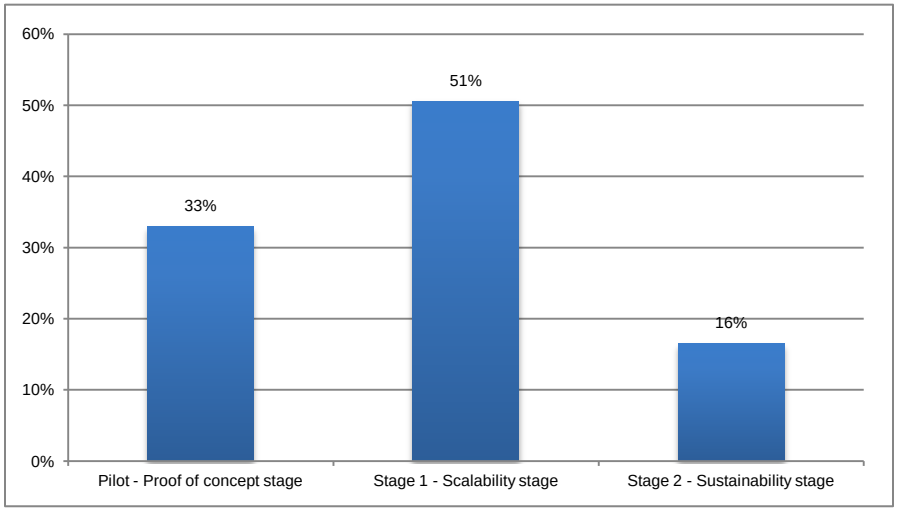
- *Pilot*. The proof of concept stage: m-ARD apps are testing their concepts, usually with small target markets, and often do not charge for their services. Donors and governments usually provide the funding for this stage.
- *Stage 1.* The scalability stage: based on a successful pilot stage, m-ARD apps begin scaling up and trying to enter markets. Commercial m-ARD apps move from being free to charging fees, such as for transactions or membership. In the noncommercial category, even if an app does not charge fees—as with a government information service such as TXT CSC in the Philippines—sponsors can make the transition from a limited to a larger scale and become more popular or feature-rich based on whether goals are being met and the costs of scaling up justify the outcomes.
- *Stage 2.* The sustainability stage: the point at which m-ARD apps are profitable or at least break even. Even if not profitable in stage 1—for example, an m-app may still be reliant on

donor support—an m-app's sponsors must demonstrate how sustainability can be achieved. Growth is still a major focal point, but medium-term sustainability has been achieved. This usually requires having a business plan that might call for more investment in marketing and enhancing software to reach the scale required for profitability.[6] For noncommercial m-apps, the funding cycle is not dependent on monthly cash flows, but rather the willingness of the donor or government to continue funding the application. Decision cycles for noncommercial m-apps might be much longer than for commercial ones.

Sustainability

Figure 5.1 shows where the 92 m-ARD apps reviewed by this report fall in terms of the three stages of business development. Figure 5.2 shows whether the apps are commercial or noncommercial and where they fall in the business development stages. Only 16 percent of the m-ARD apps have reached stage 2, the sustainability stage. This may be because many are still in early stages of development. With time, more of these apps will likely move from the pilot stage and stage 1 to stage 2. But the significant difference in the number of m-ARD apps at stage 1 and stage 2 indicates the major challenges involved in becoming commercially sustainable.

Figure 5.1. Mobile Applications by Business Development Stage



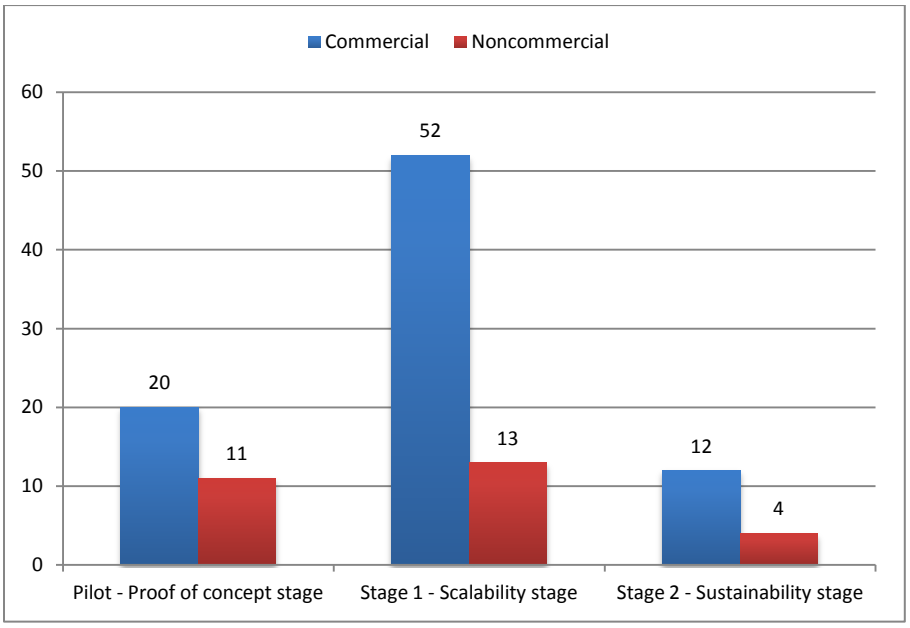
Most of the m-ARD apps studied—commercial and noncommercial—are facing challenges in scaling up after successful pilot stages. For commercial m-ARD apps this evolution requires balancing the demands of maintaining profitability and covering expansion costs. For

[6] In Kenya, KACE required 40 percent donor funding in stage 1 but has a clear business plan that will require spending much more on marketing and investing in the development of an enhanced platform, neither of which was possible under donor funding. With the promise of profitability within two years, the business plan is targeted at securing private debt and equity. DrumNet prepared such a plan for commercialization after its successful pilot, but its future is uncertain because it has tried to move from the pilot stage to stage 2 with a sophisticated, ambitious business plan that has yet to attract an investor.

noncommercial m-ARD apps the scalability stage involves a constant evaluation of the benefits that these apps provide to subscribers and whether they justify the costs of expansion.

A similar pattern emerges when comparing commercial and noncommercial m-ARD apps through the stages of business development. There are more m-ARD apps in stage 1 for both commercial and noncommercial apps. But there is a larger drop-off from stage 1 to stage 2 for commercial than noncommercial apps. There is little substantive evidence to explain this difference, though one possible reason is the different types of financing available to the two types of applications.

Figure 5.2. Mobile Applications by Type and Stage



Note: The number of enterprises sums to more than 92 because many applications have different versions in different countries or fall into a mix of categories.

The relationship between potential market size and the success of an m-ARD app adds complexity to the issue of sustainability. For example, Reuters Market Light (RML) is based in India, a country with a population of more than 1.1 billion (World Bank 2009), and has a subscriber base of 250,000—but is not yet profitable. B2bpricenow.com, based in the Philippines, where the population is 92 million (World Bank 2009), has a very different product offering focused on a niche market with far fewer subscriber than RML. Yet b2bpricenow.com is profitable. Though population size may be linked to sustainability, factors such as target market size, customers' ability and willingness to pay, and services offered may be more relevant.

Noncommercial e-government applications also face unique challenges to achieving sustainability, as they need continued support from various government agencies and ministries to deliver government information. This support ranges from simple responsiveness to

information requests to database integration. But the main challenge for most e-government m-apps is moving beyond providing information to providing responsive systems with tracking and feedback capabilities. Doing so adds significant value for users and helps ensure the sustainability of these services.

Willingness to Pay

Demand is one of the key sustainability issues for commercial m-ARD apps in developing countries, especially in terms of users' willingness to pay for goods and services. Willingness to pay is distinct from ability to pay, but they are related concepts from a demand perspective. For example, consumers who derive considerable benefits from the consumption of a good may be willing to pay for it, but their budgets are limited by their ability to pay.

Willingness to pay is more reflective of the demand for m-ARD app services because many commercial apps are not yet at their most affordable prices, as they are still unable to fully benefit from economies of scale. In addition, focusing on ability to pay is myopic from a development perspective because it ignores poorer population segments that are likely to benefit more from such services. Hence ability to pay does not provide as useful a perspective to development practitioners and policymakers, this report's main audience.

Evidence on willingness to pay from many countries—India, Kenya, the Philippines, Senegal, Sri Lanka, and elsewhere—indicates that farmers seem willing to pay for basic or premium SMS calls to secure information. But their willingness to pay for these calls, and possibly to pay an additional fee for the service, may depend significantly on their income and education levels and the scope of the information services provided. The experience of Manobi, a market pricing system in Senegal, suggests that small farmers earning just $1-2 a day might not be willing to pay for even a simple information service, such as market prices, even though they could double their income by receiving such information (Annerose 2010).

Experiences also indicate that poorly educated farmers are less willing to pay even basic phone charges for simple information services, and even less so if the benefits of the information emerge in the long term (such as learning about new farming techniques where the payoff is not immediate). But it is important to remember that almost all users have to pay for the voice call or SMS to access such services, and it is typical for m-app providers to receive a portion of this revenue from mobile network operators.

Hence the evidence is mixed on farmers' willingness to pay more than the basic telecommunications costs of SMS or premium calls for useful information or services. Some m-ARD app providers interviewed for this report are convinced that farmers are willing to pay for more value added apps that facilitate deals, have useful granular or local market information, and provide trading and linkage management services. In Kenya two case studies show that linkage

management can be priced at up to 5 percent of the value of the deal it facilitates. The combined benefits of higher commodity prices, more secure deals, elimination of middlemen, and other factors generate this demand (see below).

Willingness to pay can also be increased by offering a mix of tools and relevant information for users in developing countries. For example, Nokia combines several categories of services in its Ovi Life Tools (OLT) package:

- *Agriculture*: providing information on prices, weather, and availability of pesticides and seeds, for example. Information is customized by location.
- *Education*: tools to boost knowledge of the English language as well as general knowledge at the local, national, and international levels.
- *Health*: information, advice, and tips on health issues, particularly pregnancy and maternal health and childcare.
- *Entertainment*: games, email, and other entertainment.

Revenue

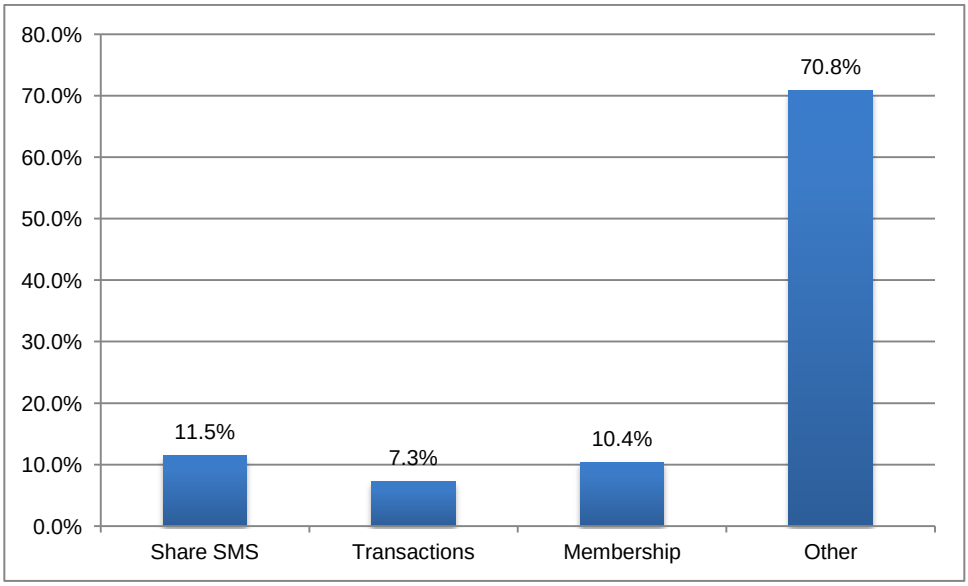
Typical revenue streams

Several revenue streams are available to m-apps. The costs of app development and support are often affordable, even on a consumption basis, and even more so because B2B prices are based on leveraging subscribers' willingness to pay. Thus m-app providers have reasonable options. The most common revenue stream for information services is a share of SMS revenue. But m-ARD app providers typically receive less than 18 percent of SMS revenues from mobile operators (just $0.016 a message in Kenya). This is part of the motivation for m-app providers to offer freemium pricing models that derive revenues from higher-value services based on transaction or membership fees.

A charge per transaction can also be quite successful. For example, Kazi560 in Kenya is a job information service that links job seekers to employers. There is a small fee for job seekers to receive an SMS message. This application has only been used in Nairobi but is expanding to other cities, though it is not yet targeting rural job seekers.

Still, securing such revenue is difficult. Only 29 percent of the m-ARD apps surveyed receive some form of operating revenues from normal business activities through shares of SMS, transaction fees, or membership fees (Figure 5.3). The other 71 percent are partly or entirely dependent on external financing (such as from donors or governments) because they do not earn enough revenues to sustain operations. But pricing for viability is possible if investment funding is secured.

Figure 5.3. Mobile Applications by Revenue Source



Commercial m-ARD apps must develop a creative combination of revenue streams that can yield a return on investment and cover operating costs while taking into account the app's affordability—a possible barrier for some consumers. But m-apps can be marketed with a range of strategies and pricing options, changing consumer perceptions of affordability. Table 5.1 summarizes a range of potentially feasible revenue streams for information and support services that benefit various players in the rural ecosystem and so could generate sufficient demand to ensure sustainability.

Table 5.1. Rationale for Fees and Revenue Streams for Mobile Applications

Revenue source	Fee	Customer	Rationale
User sign-up fees	One-time membership fee that gives farmers access to a network of partners and basic services	Farmers	Access to a network provides farmers with markets, credit, and information they would otherwise not receive
	One-time or recurring subscription fee for basic or premium services delivered through a Web-based portal, including reports, maps, and alerts	Buyers, banks, insurance companies, other commercial entities	A subscription to the portal featuring several basic services available to major customers payable on a scale for premium services such as individualized alerts and premium information
Information access fees	Nominal fee for an SMS message or package of messages	Farmers	Farmers benefit from pricing information if local or granular in nature, especially if m-apps use market information to offer linkage services that assist with tasks such as contracting and transport
Transaction fees	Nominal fee for SMS or USSD communications	Farmers	Offers to buyers or inquiries about credit could be made through the platform's SMS

			facility and involve a fee to buyers for each SMS, which is more cost-effective than other communications
	Fee on agricultural input or insurance transaction facilitated by the platform	Input retailers	Input retailers and agricultural input dealers can increase their sales by acting as certified network partners for input suppliers or distributers of microinsurance products on the system
	Fee on produce sales facilitated and expedited through the platform	Farmers and buyers	Farmers and buyers pay for services to expedite produce contracting collection and delivery, facilitate payment for produce, and track and report produce collection and payment (farmers have shown willingness to pay a fee of 5% in various cases)
Advertising and research	Fee for advertising products and services on platform to network partners either by SMS on a Web portal	Commercial companies	Companies (both users and nonusers of the m-app) will pay to advertise their products and services to farmers and others inside and outside the agricultural sector., and could target certain locations or demographics
	Fee for facilitating research in the form of simple questions (such as from farmers) about demand preferences	Commercial companies and others	Companies and agencies with economic or development interests in rural areas, such as suppliers and distributors of fast-moving consumer goods, banks, NGOs, and cooperatives, would pay for access to all farmers on the network. The research could be more successful if part of the fee were shared with targeted users such as farmers in the form of service credits or airtime.
	Fee for accessing valuable information available in growing database	Commercial companies and others	Many organizations, including research and community development organizations, would find valuable the data on farmers, buyers, and banks and the interactions contained in the service database.
Other service fees	Fee for alerting a bank to the loan needs of specific farmers and facilitating their interactions with banks	Banks	Some commercial banks want to lend to the agricultural sector and to small farmers but doing so is risky and expensive, so banks will pay to be introduced to farmers looking for loans—especially those with access to contracts or with known credit history
	Fee for process or platform customization	Buyers and banks	Major users such as buyers and banks may require customization of processes such as forms or of Web-based portals

Alternative revenue streams

The ability to find alternative or supplementary sources of income beyond government or donor support could significantly increase the sustainability of m-ARD apps. Revenue from advertisers

gives m-apps in the developed world a major advantage in reaching long-term sustainability. For example, providers in the Apple App Store and Android Market can earn $10 and $7 per subscriber, respectively, through advertising. (This is for apps with more than 500,000 downloads and/or more than 75,000 daily users.) Such amounts are unrealistic in developing countries because disposable incomes and the number of m-app users are much lower, and these countries have less of an advertising culture.

Instead of adopting the developed world's advertising revenue model, m-app providers in developing countries can take advantage of revenue opportunities available because of information asymmetry and scale. In such cases the lack of consumer information can be an advantage in encouraging companies interested in developing country markets to pay for information from m-apps.

Some innovative m-apps already operate along these lines. Instead of looking at consumers as their only source of income, these m-apps see the potential for facilitating and profiting from transactions between consumers and companies in developing countries. These companies typically have commercial interests in rural markets and may see an opportunity to market their products through m-ARD apps. They may also have an interest in nonagricultural m-apps where valuable market information could be extracted. Suppliers and distributors of fast-moving consumer goods (FMCGs), banks, microinsurance companies, and agricultural cooperatives are potential candidates for such market research and survey services.

For example, Jana, which started in Kenya and has since spread elsewhere, is a crowdsourcing m-ARD app that gathers small pieces of information from mobile customers in developing countries in exchange for airtime credits, and has automated algorithms to evaluate the quality of the data and compensate respondents. If a company selling FMCGs wants to understand consumer reactions to a brand of shampoo, a brief questionnaire can be texted to a Jana database of users. For answering the questionnaire, each respondent receives free airtime. Thus Jana is exploiting an alternative revenue stream that has been missing from developing country m-apps: FMCG companies are paying for access to a large number of consumers, getting information about consumers' wants, and promoting their products. Business models such as Jana's are highly scalable, low-cost, and focused on generating revenue.

The crowdsourcing or market intelligence approach can be combined with other m-ARD apps in rural areas to develop supplementary revenue streams, particularly as information about consumer habits is compiled over time. As indicated by Table 5.1, these databases can be mined to add value and benefit for nonrural organizations including governments that want to understand their citizens' behavior, motivations, and interests. This is relevant to the challenges facing m-app providers in developing countries, and should be an agenda item for m-app collaboration and networking initiatives.

Similar ideas, as well as related creative advertising, could be married with m-ARD apps to form partnerships with companies interested in rural markets. These companies could create supplementary revenue streams for m-ARD apps. Governments and donors could bring such companies into the evolution of m-ARD apps by including them in consultations, workshops, networking events, and other initiatives.

Pricing Models

This report identified four main pricing models for m-ARD apps: nonchargeable, transactional, embedded services, and freemium. These models are derived from the qualitative analyses of the 15 case studies in Kenya, Sri Lanka, and the Philippines, as well as a comparison with other well-developed cases elsewhere.

Table 5.2 categorizes 19 m-ARD apps based on these models. There are 11 nonchargeable, 3 transactional, 3 embedded, and 2 freemium models. But some of these models can overlap, and each has successful examples discussed in detail below.

Table 5.2 Mobile Applications by Pricing Model

Application	Nonchargeable	Transactional	Embedded services	Freemium
KACE				*
Lifelink			*	
DrumNet		*		
Kilimo Salama			*	
B2bpricenow.com		*		
Virtual City		*		
Dialog Tradenet		*		
e-Dairy	*			
1919	*			
1920	*			
Text2Teach	*			
Project Mind	*			
Farmers Texting Service	*			
Reuters Market Light		*		
Esoko		*		
Manobi				*
iCow		*		
Kazi560		*		
M-PESA			*	

Nonchargeable model
Under the nonchargeable model, subscribers generally do not pay to use m-ARD apps. These are typically noncommercial services such as Ushahidi, 1919, and 1920. These services typically aim to provide only basic market information and are likely to be developed and offered independently—not embedded in other product marketing or promotion strategies.

Transactional model
This model charges subscriber for using m-ARD apps based on the number of transactions conducted and shares some features with the freemium model. Examples of m-ARD apps using this model include Virtual City, KACE, and Reuters Market Light (RML). Under this model, m-ARD apps typically have to provide sufficient value to justify their use. Hence such services are typically highly effective and efficient.

For example, Virtual City's supply chain automation service enabled the Kenya Tea Development Authority (KTDA) to shorten transaction times from 3 minutes to 22 seconds, reduce fraud at collection points, and increase farmers' income by 9 percent. To justify their use and charges, these m-ARD apps may also provide hyper-local, niche, or value added information not available elsewhere. RML and Tradenet, for example, provide independently generated or collected niche information and value added services such as market trades and logistics support.

Embedded services model
Pricing for this model is indirect because m-ARD app services are provided free of charge. But the services are provided to generate demand and strengthen customer loyalty to the provider's primary, chargeable product or service. This model has potentially significant development impact because the m-ARD apps offered are typically new or used innovatively to help companies sell their primary product or service. In addition, the m-ARD apps are normally developed and provided by large companies, which bring have significantly more resources than other m-ARD app providers, and their benefits are relatively easy to assess because the service is new.

However, use of this model is limited by the scope of providers' primary products or services because the m-ARD apps must complement them to increase sales. In addition, this model could be used to entrench a company's market position to the exclusion of competitors. For example, M-PESA raised the market value of Safaricom, increased entry barriers for other operators, and has been an integral part of Safaricom's success in maintaining its market share over the past five years (Wireless Intelligene 2010). The potential for market failure as this model matures implies that regulatory intervention may be required to ensure that the development of m-ARD apps expands beyond the original players.

Freemium model
This model cross-subsidizes basic information or SMS services by charging for advanced, value added features, functionality, or related products and services. Value added services may include

access to market links for which providers charge membership fees or costs per transaction that can be fixed, graduated, or based on percentages of purchase or sale value. The freemium model can be seen as a variation of the nonchargeable model because it provides low-cost services at no charge mainly as a marketing and promotional tool to charge for more sophisticated services with higher costs.

The freemium model could offer significant advantages in developing m-ARD app markets because it introduces subscribers to providers' services, builds trust, and creates upselling opportunities. But only a few of the m-ARD apps analyzed by the research conducted for this report use the model. KACE offers market pricing information by radio or text messages to attract farmers to its market resource centers, which then provide assistance with market links such as transactions, delivery coordination, competitive pricing on inputs, and other supply chain services. Users pay for this assistance as a percentage of the transactions, and most of KACE's revenues come from these fees. Manobi follows a similar strategy, offering free market price information that is subsidized by higher-value services.

Costs

Commercial applications

Where cost data could be obtained, a range of m-ARD apps was selected that are illustrative of the pricing models. To have as complete a dataset as possible, capital and operating expenditures were measured against available user and transaction target levels to compare development and support costs with affordability (measured as a percentage of rural household income in countries where the apps are active). Though, as noted, willingness to pay is a more relevant measure for measuring demand for most m-ARD apps. The analysis first compares KACE, b2bpricenow.com, and Reuters Market Light (RML). These three m-ARD apps have adopted different models to address their costs. Table 5.3 summarizes the estimated capital and operating expenditures per transaction for each of these apps.[7]

Table 5.3. Sample Commercial Mobile Applications with Low Costs

Application	Current or target market (number)	Incremental cost per user or transaction (U.S. dollars)		Cost per user as % of household income	
		Capital expenditure	Operating expenditure	Capital expenditure	Operating expenditure
KACE—SMS and radio broadcast trade platform, as well as market resource centers	1,000,000	0.40	0.50	0.07	0.8
b2bpricenow	26,000	31	2	2.51	0.15 per transaction
Reuters Market Light	250,000	8	4	0.94	0.47

[7] These estimates are based on publicly available information and are not necessarily accurate.

- *KACE*. In its forward-looking expansion plan seeking to move from stage 1 to stage 2 of business development, KACE is targeting about 1 million farmers and, in addition to its one-time incremental capital expense of approximately $400,000 ($0.40 per targeted user), would have an annual operating cost of $0.50 per user. It provides a range of services, starting with simple market price information (which could contribute significantly to the business revenues if the user target is reached), progressing toward fees or commissions based on matching buyers and sellers, and finally commissions based on successful delivery of agricultural goods (supply chain integration). The progression from simple market information to supply chain integration is needed to achieve its target market. If the target market of 1 million is missed by 50 percent, the operating cost per user doubles to $1, which could require higher pricing for simple market information. But the total package of services, with reasonable assumptions for the number of accesses a year by each farmer, can be operated for less than 1 percent of the typical rural farmer's household income (well below what consumers normally spend even on private ICT services). This promises good potential for marketing the services profitably. KACE's higher-value services contribute the most to its commercial viability, though missed targets could delay commercial payback and profitability.
- *B2bpricenow.com*. This site targets a much smaller group—mainly agricultural cooperatives. Its m-ARD app is based on providing a payment platform to facilitate transactions between cooperatives and buyers, thus its cost related to household affordability is less relevant compared with the other two examples in this set. Because its target audience is so much smaller, its operating costs per user are higher than KACE's. But it shares one feature with KACE: using one income stream to cross-subsidize another. B2bpricenow.com is expanding beyond cooperatives to individual farmers and hopes to develop a mobile trade platform. This progression would not be possible without its primary income from matching cooperatives and buyers.
- *Reuters Market Light*. RML has the highest operating cost of these three m-ARD apps: $4 per customer based on current customer levels. This includes some startup sunk costs, but is also believed to reflect the capital cost of starting up, expanding to another country, or building and staffing new granular, hyper-local information collection and support services. Its operating cost is still less than 1 percent of rural household income, even if only half of its declared users are active at any given time. It has adopted a different approach from KACE and b2bpricenow.com because it is not cross-subsidizing different products. Instead, it is focused on providing agriculture-related price, weather, and other information targeted at users based on their locations. To do this, RML builds teams that monitor agricultural prices and other data in each location. Because of this expense, RML's market remains relatively small, especially relative to India's population.

Providing useful, relevant information is costly. There is a tradeoff between the provision of local information and scalability: local teams are needed to collect data, which means that

expansion into new areas involves the same content provision costs. Costs climb at the same rate as new subscribers sign up. RML, for example, is not yet profitable even though it has 250,000 subscribers in 12 Indian states.

Some m-ARD app providers have found ways to overcome this problem. Local data also need to be collated at the national level to take advantage of the best price offers. KACE's model collects information locally but provides farmers with national information and linkage support. Manobi also provides different levels of local information, starting with free local pricing information and moving toward more sophisticated information that costs subscribers more. This freemium model allows m-ARD apps to provide hyper-local information while benefiting from economies of scale.

In contrast to the relatively low operating costs of KACE, b2bpricenow.com, and RML, operating costs are much higher for the three m-ARD apps—DrumNet, Dialog Tradenet, and e-Dairy—in Table 5.4.

Table 5.4. Sample Commercial Mobile Applications with High Costs

Application	Current or target market (number)	Incremental cost per user or transaction (U.S. dollars)		Cost per user as % of household income	
		Capital expenditure	Operating expenditure	Capital expenditure	Operating expenditure
DrumNet	5,000	57	45	8.7	6.8
Dialog Tradenet	1,500	107	11	7.7	0.9
e-Dairy	300	333	20	23.9	1.4

There are two explanations for the higher cost base:

- *Different stages of the business cycle*. DrumNet, for example, did not progress beyond the pilot phase and was unable to take advantage of a larger market to defray costs. In attempting to become fully operational, its high incremental costs were likely partly responsible for its failure to secure financing. But it was expected that nonfarmers—such as buyers, input suppliers, and banks—would provide at least half of its revenues, so relating costs to affordability for farmers was not particularly relevant. E-Dairy is still in the pilot phase, with a small market of about 300 farmers.
- *No modular system development*. DrumNet tried to provide a full supply chain integration service from the outset and did not build a modular system like KACE or Virtual City (an agricultural supply chain m-ARD app). But it still could have had potential if it had been successful in refinancing and attracting high-value players such as major buyers and banks. Tradenet initially provided only agricultural market price information. Since its purchase by Dialog, a mobile network operator in Sri Lanka, it has become a marketplace for various goods to broaden its target market. But this approach is not segmented by target market; it is trying to appeal to a large single market. So opportunities for cross-

subsidies are limited. The higher operating costs for DrumNet, Tradenet, and e-Dairy highlight the tension between low-margin SMS market information services such as Tradenet and higher-margin linkage assistance services (such as delivery confirmation and other supply chain integration functions) such as DrumNet. The model used by KACE and Manobi has more potential in this regard because it can shift from low-margin fees to high-margin fees based on more sophisticated services.

Noncommercial applications

Relative to commercial m-ARD apps, noncommercial ones are generally information-based and use relatively simple service models. Unlike KACE, which has a sophisticated supply chain integration model, m-ARD apps such as TXT CSC (the Philippines) and 1919 (Sri Lanka) provide information to users at no charge. Because users are not being asked to pay for these services, affordability is less relevant, though costs are still very low.

The three examples in Table 5.5—Farmers Texting Center (the Philippines), TXT CSC, and 1919—target markets of different sizes and each has a relatively low operating cost per transaction. For example, TXT CSC is an e-government program that provides government information to citizens. It has a simple service model: text messages are received by staff, then either forwarded to the relevant government department or, if the information is readily available, responded to directly. The backend consists of a mobile phone, computer, and several staff members. The cost per user is about $0.02. The challenge of the TXT CSC model is that the information it provides to citizens is limited and expanding beyond basic information provision is difficult. Still, basic information provision can be implemented at a low cost. The challenge of this model is its limited lifespan and restricted future expansion.

Table 5.5. Sample Costs for Noncommercial Mobile Applications

Application	Current or target market (number)	Incremental cost per user or transaction (U.S. dollars)	
		Capital expenditure	Operating expenditure
Farmers Texting Center	36,000	0.06	0.93
TXT CSC	12,000	0.17	0.02
1919	1,277,500	0.05	0.12

Financing

Lack of financing for m-ARD apps was one of the main findings from the case studies in Kenya, the Philippines, and Sri Lanka. This includes some of the relatively successful cases such as KACE, Grundfos Lifelink, Kilimo Salama, Farmers Texting Center, 1920, and DrumNet (which was a successful pilot, although it did not advance to stage 1). The finding also reflects a

common financing gap issue that affects technology entrepreneurs in both developed and developing countries, and is often called the "Valley of Death."[8]

This report splits financing into private and public. In the private sector the main measure of success is whether an m-app is profitable. A private investor such as a venture capitalist wants to earn a strong rate of return on risky ventures. Public measures of success are more complex, involving social as well as financial benefits.

Several m-ARD apps have been partly financed through commercial corporate social responsibility (CSR) programs, a form of private financing that shares some features with public and donor financing. Examples include Kilimo Salama in Kenya (Syngenta CSR) and Text2Teach in the Philippines (Nokia CSR). In addition, development challenge awards such as those received by Virtual City from Nokia can be considered CSR. This form of finance is usually tied to a company's commercial interests, but the mechanism for measuring success or evaluating outcomes may be complex, and is certainly longer-term than purely private investment.

The challenges of measuring success outside the traditional metric of profit and introducing a readiness to accept lower or even no financial return for a developmentally beneficial goal is also one of the drivers of philanthrocapitalism and social entrepreneur investment. With varying levels of profit expectations, these investors aim to bring the traditional strengths of the private sector to developmental, social, and public sector challenges. Philanthrocapitalists and social entrepreneurs have pushed measures such as the double bottom line (financial and social performance combined) and the triple bottom line (financial, social, and environmental performance). These measures are not without difficulties, are prone to manipulation, and are sometimes only meaningful within the socioeconomic context of a particular project and environment.

This trend blurs the line between private and public money. In the past, private funding was motivated entirely by profit. In the world of philanthrocapitalists and social entrepreneurs profit is not the only measure of success. This is a relatively new phenomenon.[9] For m-ARD apps, most financing still comes from private or public sources. Drivers of the new approach—such as working closely with projects, providing networking skills and business knowledge, and pushing for clearly measurable outcomes—have yet to be implemented on a large scale. But there is a

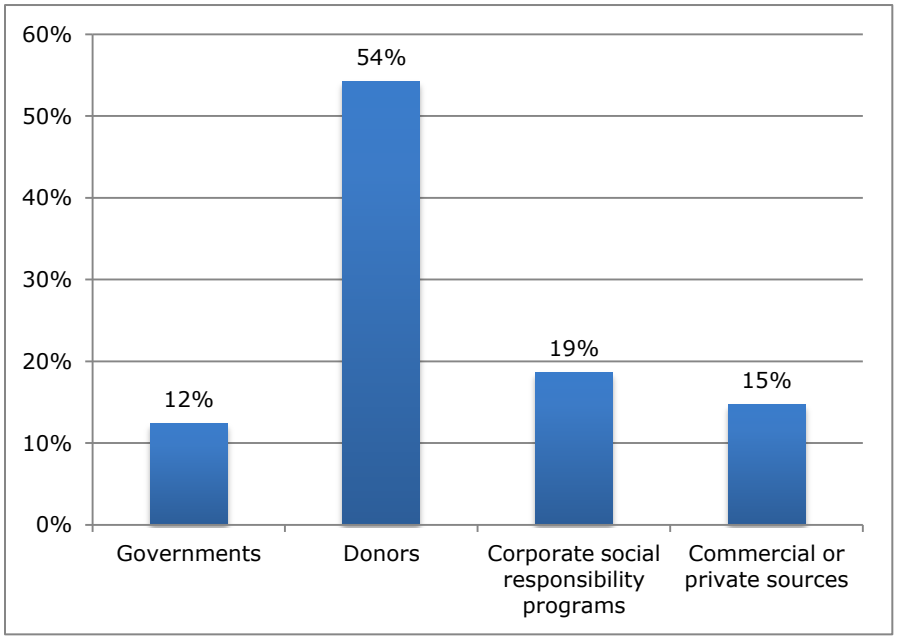
[8] The "Valley of Death" is estimated to be the range of financing between $50,000 and $1,000,000. This is because even in most developing countries, small and medium-size enterprises can usually borrow from family and friends for startup capital under $50,000. For needs above $1 million, innovative enterprises can gain traction with venture capitalists, private equity firms, and banks. See Infodev (2008) and Jaffe (2011).

[9] Concepts of philanthrocapitalism are advanced in recent books such as Morino (2010), Tierney and Fleishman (2011), and Crutchfield, Kania, and Kramer (2011). All conclude that the concepts of philanthrocapitalism are used by a minority of nonprofits, foundations, and donors.

good reason to seek financing for m-ARD apps from philanthrocapitalists and social entrepreneurs.

For example, this report found that 85 percent of m-ARD apps rely on government, donor, or CSR funding (some of the latter could possibly be classified as philanthrocapitalism) for startup and operating costs (Figure 5.4). The financing gap is particularly wide between the pilot stage and stage 1 (scalability) and during the transition from donor funding (usually limited to the pilot stage) to commercial or government funding. And while there is sufficient funding at the pilot stage, donors who provide the most funding at this stage are not operationally suited to provide long-term funding—particularly as m-ARD app providers try to scale up. Moreover, donors are usually not able or inclined to finance a large-scale marketing effort, often one of the key elements needed to raise funding.

Figure 5.4. Sources of Financing for Mobile Applications



In addition, in developed countries the support infrastructure for startups is substantial and highly liquid. In developing countries the lack of multiple sources of financing also means a lack of liquidity, so finding sufficient financing is a major challenge.

Different funding issues for commercial and noncommercial mobile applications

Providers of commercial m-apps in the developing world face very specific financing challenges. There is a need for financing primarily to close the gap between the pilot stage and stage 1 of the funding cycle. An analysis by the Kenyan Capital Markets Foundation found that only two information and communication technology (ICT) firms—both telecom companies—are listed on the Nairobi Stock Exchange, and that small and medium-size enterprises (SMEs) face an equity gap (Capital Markets Authority 2011). These findings echo those from this report's case

studies. There are three main reasons for the lack of private equity and venture capital (PE/VC) funding in Kenya and other developing countries:

- *Lack of firm clustering.* M-app providers are geographically dispersed. Fostering collaboration between firms and accessing capital are challenging when firms are located far apart, especially when broadband networks are underdeveloped. Recent initiatives such as iHub in Nairobi are trying to address this problem, in addition to providing PE/VC firms with a single point of contact (iHub 2011).
- *Lack of access to financing.* There are limited funds available for a PE/VC fund. Though there are several angel investors in Kenya, these are wealthy individuals, not PE/VC firms.
- *Lack of a healthy ecosystem.* As this report has emphasized, the most significant obstacle to addressing the challenges of scalability for m-ARD apps is the lack of a platform that links stakeholders to build a healthy m-apps ecosystem.

Funding for noncommercial m-ARD apps faces the same challenges as commercial ones but with one basic difference: government-supported m-ARD apps such as Sri Lanka's 1919 and 1920 rarely face the pressures of finding funding and of scaling up. Such m-apps will likely continue to operate for as long as governments have sufficient budgets for the initiatives.

As a result, noncommercial m-ARD apps often lack clear goals and assessments of their costs and benefits, creating a major obstacle to increasing value for citizens and accessing commercial funding. For example, 1919 provides access to government information by SMS. One measure of success is the number of SMS messages that it receives each month. On this measure, 1919 could be considered a success. But this measure does not take into account the costs of setting up the service or its value to citizens and the sponsoring government department. Another major challenge for 1919 is compelling other government departments to respond to citizen requests. The 1919 m-app is not integrated with other departments' databases, and there is no way for citizens to check the status of specific information or service requests.[10]

Financing forms, types, and cycles

To better understand the challenges of financing m-ARD apps, Table 5.6 summarizes financing forms and types and financing cycles at the pilot stage, stage 1, and stage 2 of business development. Various combinations of financing may be appropriate at different times in the financing cycles.

[10] SMSONE, in Maharastra, India, is an example of an m-app that integrates government services. It allows residents of the state to register for SMS alerts on information relevant to their daily lives, such as water and electricity supplies, traffic congestion, and bill payment reminders.

Table 5.5. Forms, Types, and Sources of Financing for the Applications Studied

Forms of financing	Types of financing (examples)	Typical sources
Grants and sub-grants (mainly pilot stage and stage 1)	Direct grants Grant matching Public-private partnerships Corporate social responsibility funds	Governments Donors Private companies Foundations Trust funds
Equity (pilot stage and stage 1)	Seed / startup Stages 1 and 2 Syndicate Crowdsourcing / social networking	Angel financing Venture capitalists Institutional investors Friends and family
Others, including business relationship-based and asset-backed (stages 1 and 2)	Franchises Joint ventures Licensing Leasing Factoring	Business partners Commercial banks Factors
Loans and debt (mostly stage 2)	Mezzanine Commercial loans Loan guarantees	Commercial banks Governments Donors

Different forms of financing are relevant at different stages in the m-ARD app business cycle. For example, during the pilot stage the Grameen Foundation uses donor funding to conduct ethnographic research and needs assessments, develop prototypes, establish partnerships with key m-app ecosystem players, generate and package content, pilot solutions and business models, and achieve limited or moderate scale. If the pilot proves successful and operations mature, social investment funding is pursued or the operation is spun out into locally owned social businesses with lower cost bases. In this model, donor funding is critical at the early stage to investigate market failures and innovate where the private sector sees excessive risk. Once a model can be proven effective, patient commercial capital can be obtained.

Possible financing solutions

There are various possible ways to address the financing gaps facing m-ARD apps. Each comes toward the same solution from a different direction—public, private, or a combination.

*M-apps development funds***.** Donor funds have supported many m-ARD app startups. The challenge is moving from startup funding to longer-term sustainable financing. Donors could set up m-app development funds to provide financing for m-apps based on their potential for advancing development. The International Finance Corporation (IFC) and U.K. Department for International Development (DFID), for example, are interested in accelerating viable m-app models and possibly continuing to support them in stage 1 (scalability).

The preceding analysis on m-app ecosystems has established that funding of individual m-apps does not address the systemic challenges facing providers. Thus donors have begun focusing on some of these challenges. For example, the Mobile Application Labs—supported by Nokia, the government of Finland, and the World Bank Group-based infoDev, with locations in Kenya and South Africa—is one approach to supporting clusters of m-app developers (infoDev 2008). As a result of such interventions, Kenya has become the fastest-growing m-app economy in the developing world, with the number of Kenyan m-apps jumping from 2 in April 2010 to more than 40 in January 2011 (Nokia 2011).

Apex funds. Limited financing for m-ARD apps could be addressed by creating apex funds. Such funds would also provide critical business skills to m-app providers for their next stages of growth. The funds would be operated by private equity or venture capital (PE/VC) groups and would provide investment capital from donors or development-oriented investment agencies such as IFC. The PE/VC groups would reallocate the financing to commercial m-ARD app providers as seed or matching funds, as these providers are typically unable to access funding provided by markets and agencies such as IFC.

The PE/VC groups might have to accept lower returns from m-ARD apps than other investments would generate. But that might be feasible as part of the groups' philanthrocapitalism initiatives and lower expectations for returns. Unlike other funding mechanisms described in this report, apex fund would allow m-ARD app providers to access skills for scaling up and replication through professional funding arrangements. Apex funds would:

- Focus on providing a high volume of small loans—usually between about $100,000 and $500,000—compared with the larger thresholds from sources such as IFC, which has a minimum funding amount of $5 million.
- Assess projects and make loans in a much faster, more responsive, and agile manner, with fewer hands-on controls, than is typically required by donors.
- Warn investors to expect lower returns than traditional venture capital investments, at least as institutions and procedures are being built up.

The apex fund approach could include more than one phase of financing. But as this chapter has noted, different vehicles are used at different stages, and it is important to have a complete financial ecosystem in place.

Universal service funds (USFs). USFs and similar bodies are administered by government departments (the least desirable approach), regulators, or public-private corporate entities created to deliver ICT-related applications to previously unreached rural areas. Though the skills to manage and allocate such resources have been developed over many years, most USFs would require sensitization and capacity development to move into the m-app field. The USF approach has several advantages for commercial m-apps and could aid the development of

the m-apps ecosystem. More than 70 countries have active USFs and up to half of these would be able to provide financing with little delay. The advantages of using USFs are:

- USFs leverage private investment because they are usually commercial market-based and offer only smart-subsidy investments (which can still be a substantial portion of startup capital). In other words, the subsidies are given competitively to commercial entities committed to rolling out self-sustaining service while also recognizing that some areas and projects need a kick-start to encourage investment. Awards are made based on commercial proposals to meet specific targets developed by USFs.
- A USF could be viewed as representing a significant country commitment to m-apps development by the government and ICT industry, using resources collected from the private sector.
- USFs often have extensive financial resources that they have been building up for several years through levies on revenues of telecommunications operators. Most USFs have distributed less than the funds they have received and are looking for good projects.
- USFs have started developing the skills to form public-private partnerships (PPPs), including through other forms of financing such as tender competitions seeking the lowest subsidies to deliver ICT services in rural areas.
- USFs promote fully privatized commercial market development through the competitive smart-subsidy approach, which can create focused interest and leverage private investment.
- Some USFs have already made commitments to supporting ICT applications. This can be directed toward m-apps as universal access targets are met.
- Significant resources have already been spent providing the human capital skills needed to support both infrastructure and services rollout in rural areas. Thus these skills may only require a strategic reorientation.
- In many developing countries the amount of money required to bring change to m-app development and use could be small relative to the funds held by USFs. Thus enough funds would be available to support m-app ecosystem development—assuming that the administrative capacity of USFs can be retargeted.

USFs are not without controversy even though most have been dispersing funds for several years. Many USFs in developing countries have dispersed relatively small percentages—33 percent, on average—of the funds they hold, and utilities tend to see USFs as additional taxes with few benefits. Still, the principle of USF funding is clear because unfettered free markets are unlikely to deliver goods to all citizens. There is a collaborative role for government and the private sector to play in providing services to areas where they are not profitable. Many USFs are starting to do better at disbursing funds and providing services to areas that had not had access to them. This institutional learning can be used to deliver m-apps. Aid agency activities such as the U.S. Agency's for International Development's Global Broadband and Innovations initiative are providing support to USFs to encourage increased disbursement of funds.

As with PPPs (see below), donors could have considerable leverage in helping USFs adapt their procurement strategies into the m-apps field by demonstrating and promoting the potential of m-apps to fulfill universal access goals in rural areas, helping tailor terms of reference (TOR) and request for proposal (RFP) documentation to m-app development, and redirecting the focus of USFs into the m-apps market.

Public-private partnerships. PPPs provide a framework for governments to exploit the synergies between the public and private spheres and to access the funds and skills needed for noncommercial m-apps in particular. A major strength of the private sector is its evaluation of costs relative to benefits. This is usually driven by the profit motive and the personal investments of project developers. Hence a synergy exists between the public sector's ability to finance m-apps that provide public goods such as access to government information and the private sector's ability to assess a strategy's costs and benefits.

PPPs were first developed for infrastructure projects that the private sector had insufficient resources to fund and the public sector had insufficient skills to manage. PPPs have since been successful in delivering public health outcomes. For example, in OECD countries and Brazil, China, India, and the Russian Federation it is projected that 5 percent of healthcare spending will go to infrastructure and 95 percent to services between 2010 and 2020 (PWC 2010).

Some of the most successful PPPs have involved telecommunications, energy, transportation, and healthcare. One of the largest PPPs has been in U.K. healthcare starting in the 1990s, when the U.K. government realized that the only way to overcome decades of underinvestment in the National Healthcare System (NHS) was through infrastructure partnerships with the private sector.

This is a particularly opportune time to use PPPs for service delivery because they have grown tremendously over the past two decades and perceptions have changed on how they deliver services. Since the 1990s PPPs have expanded across the globe and have been particularly successful in developing countries. The perception that PPPs are valid only for infrastructure is based on the number of successful infrastructure projects supported by PPPs. But this is quickly changing as governments realize that PPPs can also be used to deliver services. For example, the NHS began to experiment with PPPs in 2003 to shorten waiting times for medical services (PWC 2010). The pressure to use PPPs in areas besides infrastructure will only increase as governments face mounting deficits stemming from the global financial crisis of recent years. Governments' ability to leverage private investment is going to be a critical tool in delivering services.

But various issues must be taken into account to use PPPs for m-app development. One key issue is measuring the results of PPPs. The traditional value for money metric used for infrastructure PPPs cannot be easily modified for service delivery because the latter involves far more players. For example, an assessment must include all the major service delivery players and so would have to include all m-app ecosystem stakeholders—such as mobile network operators, financial

institutions, agents, content providers, providers, and handset manufacturers and distributors. Hence the system for assessing PPPs must be modified to include metrics for each of these players, and these metrics must be included in PPP contracts. The downside of this approach is that a uniform set of metrics is not available because the context, goals, and m-app ecosystem players will differ for each service delivery PPP.

Governments should also establish clear TOR, RFP, and associated procurement mechanisms based on clear business and development goals for m-apps. In addition, governments will need to be creative but cautious in terms of defining goals for m-apps because they tend to be more complex for service delivery PPPs. E-Dairy and Text2Teach provide examples of such service delivery goals and the structuring of PPPs:

- *E-Dairy* in Sri Lanka is illustrative of a modified PPP approach to m-app development where the focus is on outcomes instead of infrastructure. E-Dairy is an m-ARD app that aims to increase milk production through increased pregnancy rates in cows. The increase in pregnancy rates can be achieved through timely access to veterinary services. Dairy farmers access a database that provides information on timing and can request services directly through the app. The ICT Agency of Sri Lanka provided half of the startup funding for e-Dairy. A grassroots community development organization called the Dambadeniya Development Foundation provides the m-app's technology and operational management.
- *Text2Teach* is a program in the Philippines that seeks to enable teachers and students to access more than 900 multimedia educational materials using SMS. The program's goal is to narrow the digital divide by improving teaching of basic education and making learning more fun for students. It has improved science, math, and English results by 11-19 percent for 120,000 fifth and sixth graders in more than 200 schools. The innovative m-ARD app highlights the potential for collaboration between NGOs, the private sector, and government. It is financed by a grant from Nokia that covers project management, implementation, mobile phone costs, and most operational costs. The program is managed by the Ayala Foundation, which is tasked with raising matching funds from the public sector to ensure the program's sustainability and impact.

  Collaboration between the public and private sectors enables the program to address education needs not just in specific areas but for the entire public elementary school system. The central government provides 23 percent of the funding, schools and local branches of the Department of Education provide 3 percent, and the Text2Teach Alliance provides 74 percent. Though not a true PPP in that goals and measurements are not defined in a PPP contract, it reflects the kind of methodology that could be used for m-app PPPs.

The use of PPPs in developing countries has often suffered from poor planning, design, and measurement as well as unclear goals. Hence donors and other development practitioners may need to provide sufficient capacity building for both public and private entities interested in PPPs.

6. Conclusion

Mobile applications for agricultural and rural development (m-ARD apps) offer innovative, dynamic, interdisciplinary services. These new services could raise incomes and create more opportunities for people in rural and underserved communities in developing countries as well as stakeholders throughout the ecosystem for m-ARD apps.

Because m-ARD apps are developing rapidly, the observations in this report provide only a snapshot of this field's evolution. Still, the lessons summarized here and in the case studies should show policymakers and development practitioners how great a potential role that m-ARD apps could play in development. The report's main findings are:

1. **Enabling platforms are likely the most important factor for m-ARD apps** to move from the pilot stage to the scalability and sustainability stages—beyond donor and government funding. Such platforms are based on the links between handsets, software applications, and payment mechanisms that facilitate interactions among stakeholders in the m-app ecosystem. Platforms can provide access to more users, offer effective technical standards, and incorporate payment mechanisms. These outcomes can facilitate both demand and supply and faster recovery of investments.

   A developing country platform faces two main obstacles: the lack of commonly accepted payment mechanisms and of uniform approval procedures for m-apps. Whatever the payment mechanism—operator billing, mobile money (m-money), or, in the future, credit cards—it is crucial to the success of m-apps. Countries without a payment mechanism risk falling behind on the development of m-ARD apps. And a simple, uniform m-app approval procedure can link m-app providers with potentially millions of mobile subscribers, encouraging innovation and facilitating competition so that the m-ARD apps with the highest value are scaled up quickly.

2. **Several other mechanisms, such as incubators and central hubs, could support the development of ecosystems for m-ARD apps**. For example, a geographic cluster that enables m-ARD app providers to work together, such as Nairobi's iHub, can spur innovation. These locations provide an environment conducive to m-app development by offering high-speed Internet and other communications facilities. They may also attract commercial funders looking for an easy way to invest in m-apps.

   Accordingly, efforts to develop enabling environments for m-ARD apps should initially focus on supporting the creation of a common platform or platforms that provide uniform standards and payment mechanisms, and helping develop innovative m-app ecosystems by supporting providers, financiers, third party distributors, and other stakeholders.

3. **The hyper-local nature of many m-ARD apps makes scaling up challenging**:
    - Many m-ARD apps start small and focus on meeting specific customer needs, often with donor support. They tend to grow at a rate that matches capabilities, with little thought given to scaling up beyond a certain threshold.
    - Rural users of m-ARD apps value highly customized information and services. For example, farmers often need market pricing information for towns close enough for easy transport of goods. This imposes costs on content development and supply, which are then localized, and could hinder the achievement of scale economies because customers will be clustered in areas that each need their own content development.
    - Consumers in rural areas of developing countries usually have low education and literacy levels and so require onsite demonstration or training in the use and benefits of m-ARD apps. Such support is costly.

    In environments where information is scarce, leveraging existing resources will be crucial for success. Governments and donors could support the development of m-ARD apps by making publicly available accurate, granular data such as weather forecasts with integrated flood and drought information at the village or community levels. Providers of m-ARD apps are unlikely to be able to collect such data as part of their business operations, and its provision will encourage providers to innovate. In addition, m-ARD apps that can aggregate and customize content from different sources will have an advantage.

4. **Some m-ARD apps are achieving scalability, replicability, and sustainability.** Despite various challenges, a number of m-ARD apps are doing well, with a good balance of cost, marketing, and pricing strategies. Scalability is premised on several factors, including affordability, demand, and effectiveness in reaching target markets. Some m-ARD apps appear to be highly replicable. But operational issues must be taken into account, such as local languages and the ability of public service providers to compel other agencies to answer inquiries.

    Sustainability is easier to achieve when initial capital costs are covered by governments or donors and subsequent operating costs are relatively low. Commercial m-ARD apps need to improve or expand their services in response to user needs and ensure that they provide enough value to generate sustainable demand and revenues—increasing users' willingness to pay and overcoming ability to pay issues even at low economies of scale. Commercial m-ARD apps should also pursue innovative alternative revenue streams, such as advertising, and consider various pricing models to attract subscribers and build customer loyalty.

    Noncommercial m-ARD apps should have clear and measurable goals, outputs, and outcomes.

5. **About 85 percent of m-ARD apps rely on government, donor, or corporate social responsibility (CSR) funding for startup and operating costs**. Yet there is a funding gap for m-ARD apps moving from the pilot stage to the scalability and sustainability stages—indicating that m-ARD app providers need to have realistic, multistage financing plans from the start of business planning, to prepare for likely shortfalls later in the financing cycle.

   In addition, seed funders for m-ARD apps should be aware that they are unlikely to be suitable financiers at later stages. Instead, they should encourage and facilitate development-oriented professional financiers who can address gaps in the funding cycle and provide private sector business skills—such as for management, marketing, and networking—that will be critical after the pilot stage.

   Providers of m-ARD apps should consider a variety of financing methods, including apex funds, universal service funds (USFs) restructured to support m-ARD apps, public-private partnerships (especially to support noncommerical m-ARD apps), and special purpose donor funds. M-ARD apps could also attract investment from social entrepreneurs and philanthrocapitalists. Providers should carefully assess the benefits and drawbacks of all these financing vehicles.

6. **Enabling regulations and policies are crucial**. M-apps have a relatively long history in the developing world. Mobile money was the first innovation, providing clear benefits in countries such as Kenya and the Philippines, and regulatory forbearance was one of the key reasons for its success.

   Adopting regulatory forbearance during the creation of a new service means that firms experimenting with a new service are given space to be innovative and rewarded for taking risks, with the leading firm gaining first-mover advantage. The need for regulatory intervention can then be reassessed based on the maturity of the market, with a focus on ensuring a dynamic regulatory perspective to encourage development and innovation of m-ARD apps and possible intervention in cases of market failure.

   Another helpful step is introducing technical education policies that support m-app operating systems. Finally, rigorous impact assessments should be conducted to quantify the economic and social benefits of m-ARD apps. The findings of such assessments would support evidence-based policymaking and direct financing to interventions with the greatest benefits.

Annex A: Typology of Agricultural and Rural Development

Sub-Sector	Segment	Development Challenges
Agriculture, Animal husbandry, Fisheries & Forestry	• Livelihood	• Transition from subsistence to income generation (Risk raking & scale up is difficult without external support) • Small-scale farmers face relatively high transaction costs
	• Agro- support (e.g., weather, advertising, emergency)	• Detrimental / catastrophic impact of storms or draught (see rural finance/insurance) • Disaster management
	• Agro-marketing / trade (e.g., advertising, pricing, strategic link-ups)	• Lack of contact with local / regional markets • Lack of access or effective contact between the various players (producer, buyer, credit/ bank) in agric. markets • Control of information & resources by middlemen • Geographic/transportation challenges to trade
	• Distribution, Logistics & Traceability	• Inefficiencies, delays & costs in collection, transportation & record keeping • Fraud at produce collection points affecting farmer incomes • Cost of implementing solutions (e.g., cost of placing RFID tags on fruit)
	• Other rural SME & micro-businesses	• Financing for start-ups
	• Extension services	• Access to fundamental knowledge re farm & crop management, etc., timely assistance • Literacy & capacity building challenges
	• Research & Innovation (e.g. new supply chain / business models)	• Access to information & finance (see rural finance) • Access to most recent information on crops, pests, etc.
Resource Management	• Water	• Lack of wells & irrigation • Water contamination • Cost of water • Challenges in scaling up solutions
	• Land	• Land ownership • Soil erosion • Appropriate fertilizer use
	• Environment & Climate	• Impact of climate change

Labor, Migration and Human Development	• Employment	• Lack of information, especially geog. specific info – i.e. jobs available in a specific region • Lack of jobs
	• Education, learning & training	• Low literacy, especially among women • Costs of schooling
	• Rural Youth	• Opportunities, mentoring, skills, finance
	• Rural Women opportunities	• Opportunities for business & self-betterment
	• SMEs and micro-businesses / private sector development	• Training & mentoring
	• Migration	• Urbanization • Cost of Remittances, especially small scale
Governance / Political	• E-Government and administration relevant to rural development, including: o Census & social status related data collection or enquiry o Election & opinion management	• Corruption • Opportunity to consult political leaders • Empowerment & participation • Information about issues
	• Awareness raising	• Availability of programs to rural people
	• Other m-government services	• Registrations of all personal data, companies, land ownership, etc. • Taxation & other levies
Rural Finance, Infrastructure & ICT	• Mobile Money, m-Banking and micro-finance related services	• Access to appropriate finance • Regulatory, technological, literacy challenges
	• Agricultural insurance services	• Detrimental / catastrophic impact of storms or draught • Access to insurance for small farmers, as well as understanding & trust
	• Transport	• Infrastructure (roads, vehicles...) • Cost of transportation in rural areas
	• Broadcasting & program related	• Potential for local & regional participation & voice
	• Printed media	• Distribution, choice of printed media

Annex B: Information Sheet Used for Desk Research on Mobile Applications

Segment *i.e., Which of Typology Segments*	**Name of Application**	**Country(s) / Region**
Segment / Activity *i.e., which segment in the Rural Development Typology*		
Description of Application *E.g., Sale of crop insurance to farmers with seed purchase via M-PESA. Note whether it is purely information or transaction based*		
Technology *E.g., voice, video, SMS, email, GPS, multi-media*	**Technical development path** *Note any past or expected changes and what impact technological change could have on the application and its viability*	
Leading Ecosystem Player *E.g., mobile network operator, Bank, ISP, Farmers' Union, Commercial Agent*	**Lead role(s)**	
Business Model / Rationale *E.g., Market differentiation, clear revenue/profit potential (describe)*		
Other key players 1	**Roles**	**Incentives / Business model**
2		
3, etc.		
Year of commencement	**Maturation Cycle Position** *Emerging / Expanding / Mature*	**Status** *E.g., Pilot / Rolling out / Established*
Comment on maturation / status of development		
Costs of the application & evidence of cost recovery & profit/sustainability, *E.g., Development of the technical systems & content; maintenance & skills*		
Description of benefit & impact for beneficiaries *Identify the target users, describe the benefits they receive & the impacts, direct &/or indirect.*		
Quantifiable benefits *Identify any evident quantifiable measures of benefit & summarize any economic or social analysis contained in the source material.*		
SWORB *[May be summary of other sections]*	**Strengths**	**Weakness**
	Opportunities	**Risks & Barriers**
Market potential assessment *E.g., Will the application grow? Is it valuable? Focus on user demand & service provider sustainability for the service*		
Replicability / hurdles / issues *Can it grow elsewhere? Will it grow naturally, or are there hurdles? E.g., Needs dominant player, needs regulatory change, investment too high*		
Further study / research questions		**Select for case study** *Yes / No*
Contact	**Comments on contacts made, arrangements, etc.**	

Annex C: Types of Mobile Applications by Subsector

This annex contains a listing of all m-apps for rural development identified worldwide, arranged by Subsector and Segment following the classification of Annex A: Rural Development Typology. It also provides a basic description of each application, the target users, country or countries of implementation, and status (whether active, planning, pilot or no longer active).

All applications listed here have their own individual entry using the structured case study information sheets in Annex B. However the structured data is not presented in this report in the interest of length.

To assist with cross-referencing from this annex to Annex E entries, the Annex E Index is included here on the next page. The 79 applications which have a fairly substantial or comprehensive entry in Annex E are shaded in this document. The number of shaded entries may increase as more information becomes available through further research.

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Agriculture, Animal husbandry, Fisheries & Forestry • Livelihood	n/a				
Agriculture, Animal husbandry, Fisheries & Forestry • Agro-support	Nokia Life Tools	Nokia Life Tools is a software suite embedded in certain Nokia phones to provide agricultural, educational and entertainment services to developing country markets	General public, farmers	China, India, Indonesia	Active
	Reuters Market Light	It provides localized and personalized information via SMS text messages on weather, market prices, local and international agriculture and commodity news, and crop advisory tips enabling farmers to make informed decisions, reduce waste and maximize their profits.	Farmers, agricultural businesses or associations	India	Active
	DatAgro	The DatAgro project is taking advantage of the high penetration rate of cellphones in Latin America to allow rural farming cooperatives to define the types of information most critical to their lives and livelihoods and receive it via text messages.	Farming cooperatives	Chile, Latin America	Active
	SoukTel	SoukTel is a cellphone-based service that uses SMS technology to link people with jobs and connect aid agencies with people who need help.	Job seekers, employers	Palestinian Territories	Active
	LifeLines	The system's database which stores the Frequently Asked Questions (FAQs) received in the service, comprises a list of more than 350,000 questions and answers currently. Education service was introduced to provide value added and critical academic support to teachers in remote rural areas for their day to day academic transactions.	Farmers, rural teachers	India	Active
	e-Dairy	Created awareness among small dairy farmers in sending SMS utilizing their mobiles / CDMA / Touch button screen and the internet to obtain their Animal Health, veterinary and other related	Small dairy farmers	Sri Lanka	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		just in time dairy extension services. Further provided training & development activities in Computer usage for the youth of farmer's families / Livestock development officers / Veterinary surgeons. Developed database backed, SMS enabled dairy farmer / service provider tracking / messaging software and touch screen software.			
	mKRISHI	The mKRISHI application enables farmers to send queries, comprising of text, voice and pictures, specific to their land and crop to agricultural experts, using their mobile phones. The mKRISHI ecosystem provides an integrated view of the farmers profile, farming history, and the required farm parameters on a console at a remote location to an expert. Farmers can also send pictures of their crops and pests captured with mobile phone cameras; sensors provide farm specific soil and crop data, weather stations provide microclimate details and voice based querying system gives freedom to the farmers to ask any query in their local (natural) language. After analysis of the available information, the expert's advice on the farmer's query is provided on the farmer's mobile phone.	Farmers	India	Active
	FADECO Telecenter & Community Radio	FRC 100.8 FM has signed a contract with a SMS management company in Dar es Salaam and has been allocated two short code numbers. The question is delivered directly to our computer via a Web managed system. We are therefore able to print it off, respond directly or email the question to our experts. The farmer receives a received note on his/ her mobile phone immediately to confirm the message is received at FADECO. After the question/ request is processed, we make a radio program with the response.	Farmers	Tanzania	Active
	Weather	The application allows anyone	General	Uganda	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
	Application (Grameen)	with a mobile phone to send and receive text messages to find out the local weather forecast by city or district.	population		
	LIRNEasia / HJS Traceability App	Gherkin farmers in Sri Lanka were given mobile phones with a Sinhala menu-based application that allows farmers to send and receive information related their crops.	Gherkin farmers	Sri Lanka	No longer active
	Behtar Zindagi	Behtar Zindagi is a mobile and IVR based information service comprised of information services for Agriculture (information on life cycle of crops), Weather Alerts and Advisories, Commodity Prices, Coastal and Inland Fisheries (fishing zones, wind speed, wave height), Livestock, Health, Rural Finance and Education.	Rural residents	India	Active
Agriculture, Animal husbandry, Fisheries & Forestry • Agro-marketing / trade	Esoko	The platform provides automatic and personalized price alerts, buy and sell offers, bulk SMS messaging, stock counts and SMS polling. Markets, commodities, languages and currencies are easily configured. Esoko also offers strategy, support and trainings to projects rolling out MIS.	Agri-business, NGOs, government, farmers, traders	N. Sudan, Burkina Faso, Cote d'Ivoire, Ghana, Nigeria, Mali, Rwanda, Tanzania, Zambia, Kenya, Mozambique, Uganda, Malawi, Mozambique, Madagascar	Active
	Google Trader (Grameen)	Google Trader helps buyers and sellers to find each other. Users can broadcast a message by sending an SMS, allowing them, for example, to list the products that they are selling or to find space on a truck to take their goods to market.	Rural producers, consumers	Uganda	Active
	DrumNet	At the core of DrumNet's service provision is an IT platform that is compatible with the Internet, mobile phone networks, and other wireless devices. The platform allows DrumNet to offer unique products like SMS scouting, data mapping and tailored reporting – be it on market trends, weather, prospective partners, or related	Agricultural suppliers	Kenya	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		requests.			
	Manobi	With Xam Marsé, the latest market information system on SMS and the Internet developed by Manobi, Senegalese farmers, traders, hoteliers, and housewives can now receive free daily text messages containing information on the product of their choice on any selected market.	Farmers, traders, hoteliers	Senegal, South Africa	Active
	WAMIS-NET	WAMIS-NET is a Network of Market Information Systems from Benin, Burkina Faso, Côte d'Ivoire, Guinea, Niger, Mali, Senegal, Togo, and Nigeria. Together they provide to all stakeholders up to date and accurate information on 400 rural and urban agricultural commodity markets via different media. The network monitors the development of the agricultural sector through the collection and publication of related statistics and analytical reports.	Farmers	West Africa	Active
	Soko Hewani	Offers and bids are announced on the Soko Hewani program. Listeners, mostly smallholder farmers and agro SMEs, are given an opportunity to phone, send SMS, IVR or e-mail messages into the radio program and bid on the offers, or offer on the bids. The radio program staff on standby during the Soko Hewani broadcast then match the offers and bids, using mobile phone calls and SMS, or reference back to the specific MRC which submitted the offer or bid for further negotiation and conclusion of deals.	Farmers, agro-SMEs	Kenya	Active
	CELAC	The project has a database of phone numbers to whom local agro-related information is sent every Monday.	Farmers, Community Development Workers, Agricultural Extension Workers	Uganda	Active
	First Mile Project	The project encourages people in isolated rural communities to use mobile phones, e-mail and the Internet to share their local experiences and good practices, learning from one another. While	Small farmers, traders, processors	Tanzania	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		communication technology is important, real success depends on building trust and collaboration along the market chain. Ultimately farmers and others involved develop relevant local knowledge and experience and share it – even with people in distant communities – to come up with new ideas.			
	China Mobile Rural Information Network	The Information Network is a service platform built to provide information regarding the needs of rural residents, rural businesses and rural authorities. In 2009, to better serve rural residents, agricultural enterprises and rural governments, we completed the third full-scale upgrade of our Rural Information Network, enhancing operational capabilities and allowing for needs and services for new product development, production, and distribution as well as a centrally-shared information database to be accessed and utilized across the country.	Rural residents, rural businesses and rural authorities	China	Active
	b2bpricenow	b2bpricenow.com is an integrated e-commerce m-commerce program that has an agriculture e-marketplace that provides up-to-the-minute price updates and other market information as well as money movements through the integrated solution.	Farmers, agri-business	Philippines	Active
	Farmers Information Communication Management (FICOM)	Important tips on growing crops are relayed from the Uganda National Farmers Federation headquarters to district level offices, and then to 24 'village phone centers', in which each farmer's group owns a mobile phone. The farmers also send and receive SMS messages with updates on market prices, saving at times a whole day's travel to market.	Farmers	Uganda	No longer active
	Agricultural Market Information Systems (AMIS)	Market investigators collect up-to-date agricultural commodities prices information from a grower's – level market on market days and send price information using text messaging over cell phones into a	Farmers	Bangladesh	No longer active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		database managed on a SMS Server, which in turn would be accessible to clients requesting price information for agricultural products through a text message request.			
	GL-CRSP Livestock Information Network and Knowledge System (LINKS)	LINKS is a Livestock Information Network and Knowledge System which provides regular livestock prices and volume information on most of the major livestock markets in Ethiopia, Kenya and Tanzania along with information on forage conditions, disease outbreak, conflict and water supply to support decision making at multiple scales.	Farmers, traders	Ethiopia, Kenya, Tanzania	Active
	Infotrade	Infotrade provides critically analyzed information collected from 20 district markets in Uganda covering a total of 46 commodities. Data is collected thrice weekly, verified and posted on a Website. Information can be accessed by email, or directly on a mobile phone.	Farmers, traders	Uganda	Active
	Ratin SMS	To assist the stakeholders in the grain industry that cannot access commodity prices through internet, EAGC initiated an SMS facility which has been tested and it's now operational. SMS codes for Kenya, Tanzania and Uganda were set up and tested by CELLNET-Kenya Ltd. RATIN SMS is a low-cost, highly implementable cell phone based platform that seeks to redress lack of market information.	Farmers	Kenya, Tanzania, Uganda	Active
	Foodnet and Farmgain	Data on prices, traded volumes, market flow, growing conditions and other relevant information is collected from villages and market centers and, together with relevant national and regional information is disseminated in local languages by local FM radio stations. The project receives and disseminates instant reports through SMS on changing market prices. Both the national and localized market information projects are fully integrated, utilizing one central information processing facility,	Farmers, traders	Uganda	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		thus reducing cost and augmenting local information with national and regional market information of relevance to the local target area.			
	Dialog Tradenet	Dialog Telekom, together with Govi Gnana Seva (GGS) launched a service to deliver spot and forward agricultural commodity price information via mobile phones. The service is based on Dialog's Tradenet platform – and derives on-line agri-produce price information from three Dedicated Economic Centers at Dambulla, Meegoda and Narahenpita. Dialog Tradenet is a repository for national-level market information built on a suite of digital technologies. Tradenet encompasses the collation, comparison, qualification and subsequent dissemination of trade enablement information to large numbers of stakeholders minimizing information arbitrage.	Farmers	Sri Lanka	Active
	Mandi Bhav	Tata Teleservices (TTSL) partnered with Impetus Technologies to launch a Mandi Bhav as a VAS targeting rural farmers. Via this service, subscribers on the Tata Indicom network can get real-time spot market prices on 500 commodities from over 3,000 large markets (mandis) across India. The service is targeted toward farmers and agricultural commodity traders who need updated information on current prices of various commodities across the country.	Farmers	India	Active
	KRIBHCO Reliance Kisan Limited	Reliance Telecommunications and Krishak Bharati Cooperative Limited (KRIBHCO), a fertilizer producing cooperative, formed a joint venture in June 2009, called KRIBHCO Reliance Kisan Ltd. This JV was again primarily a rural distribution model for telecom and nontelecom products. Reliance, in late 2009, announced a full suite of upcoming VAS targeting mGov services in Maharashtra and Kerala which would include market price	Agricultural value-chain	India	In pilot

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		information as well.			
	Compañía Argentina de Granos (CAGSA)	CAGSA is a major food broker in Argentina; they simplify the logistics of transporting harvested grain and corn to their distribution centers, deliver supplies such as fertilizer, and provide various agri-business services to their members. Syncrologix Mobile Solutions' SmartTasks application is an application for the BlackBerry Enterprise Solution. It offers a way to build BlackBerry-specific reporting and data capturing forms that process requests for various CAGSA services.	Agricultural value-chain	Argentina	Active
	Portal CONAPROLE	Access to information through Internet connection and providing SMS services to cooperative partners with information on their referrals, quality of milk delivered, receivable balances, detail of liquidations and purchases, as well as general information about the Cooperative's activities, information and connections.	Dairy producers	Uruguay	Active
	Virtual City AgriManagr	AgriManagr automates produce purchasing transactions and reduce your costs while improving relationships with your customers and suppliers. Virtual City's AgriManagr solution has been used in the Dairy, Tea, Coffee and Cotton industries.	Workers in dairy, tea, coffee and cotton sectors	Kenya	Active
	Mkulima Farmer Information Service	Mkulima FIS is a farmer information resource and helpline available over mobile phones and the Web. It is a mobile IVR (Interactive Voice Response), service that uses USSD (Unstructured Supplementary Services Data) to lead a farmer through a set of options as they seek information for a particular issue.	Farmers	Kenya	Not yet active
	iCow – Green Dreams	iCow is a voice based mobile app developed for the dairy industry. iCow uses voice prompts to help farmers monitor their dairy cow fertility cycle from the time the cow is inseminated until she delivers.	Dairy farmers	Kenya	Not yet active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Agriculture, Animal husbandry, Fisheries & Forestry • Other rural SME & micro-businesses					
Agriculture, Animal husbandry, Fisheries & Forestry • Extension services	DigitalICS	To improve the efficiency of their certification and inspection processes, CEPCO introduced a new system that uses software called DigitalICS. The m-app is used by internal inspectors who visit each plot of land and fill out a survey regarding the farmer's growing practices, the status of the land plot and the farmer's equipment. Inspectors can record audio and take pictures to augment the survey with visual evidence, questions and comments from farmers and other kinds of qualitative data. The survey data is uploaded to a Web-based application that helps evaluators review the inspections and take appropriate action.	Agricultural associations	Mexico	Active
	Farmer's Friend (Grameen)	Farmer's Friend (Powered by Google SMS) offers farmers an affordable and targeted way to search for agricultural tips through a SMS-based database. Keywords in the query are matched against the database and the farmer receives a reply with a tip related to his or her query terms.	Farmers	Uganda	Active
	mAgri (IKSL, IFFCO, GSMA)	A voice message service which provides agricultural advice in the form of minute-long voice messages in local languages. Farmers receive five messages, each one minute long every day, except on Sundays. There is also a helpline service, which gives farmers access to experts on farming and veterinary medicine.	Farmers	India	Active
	National Farmers Information Service (NAFIS)	NAFIS (the National Farmers Information Service) is a voice service that offers agricultural extension information which farmers can access through mobile	Farmers	Kenya	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		phones. NAFIS is updated through the Web , and the IVR is created automatically through a Text-to-Speech engine in both Kiswahili and Kenyan English.			
	Avaaj Otalo (Voikiosk)	Avaaj Otalo is a voice-based community forum that connects farmers in Gujarat, India to relevant and timely agricultural information over the phone. Farmers call up a phone number, and then navigate through audio prompted menus to ask questions, listen to answers to similar questions, and listen to archives of a popular radio program for Gujarati farmers. The number farmers can call is toll-free.	Farmers	India	Active
	Nutrient Manager	The Nutrient Manager decision tool for rice has already been released and used with CD and Web-based applications in the Philippines. To reach more farmers, especially those without computers, the Philippines has been selected as the country to develop and provide, through a partnership with the public and private sector, a mobile phone–based IVR application that sends farmers a text message with a field-specific fertilizer guideline based on information they provide about their rice field. This tool is set to be released in mid-2010.	Farmers	Philippines	planning only
	Kenya Farmer's Helpline (KenCall)	The service which primarily targets individual farmers will also be accessible to agriculture extension facilities, so as to complement existing efforts to support and engage the SHFs with detailed and varied agricultural information on how to improve production (growing, harvesting and rearing), planning (agricultural inputs and planting), negotiating and selling.	Farmers	Kenya	Active
	Distance Diagnostics through Digital Imaging (DDDI)	The Distance Diagnostics through Digital Imaging system allows textural information and descriptive images to be submitted directly from Extension offices, for rapid diagnosis by resource professionals. The system utilizes	Farmers, livestock workers, field workers	Honduras, Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras,	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		conventional software and hardware which has proven to be effective and reliable.		Nicaragua, Panama, Dominican Republic	
	1920 (Govi Sahana Sarana)	The Sri Lankan Ministry of Agriculture's agricultural advisory services have been expanded with the creation of a hot line, 1920, which can be used to obtain information from the Advisory Council. Callers can ask advisors questions from any phone, the first three minutes of the call are free. The service helps farmers in solving their various problems such as agriculture related technical matters, inputs and marketing problems.	Farmers	Sri Lanka	Active
	Farmers' Text Center (FTC)	An SMS based service for answering agriculture related queries.	Farmers	Philippines	Active
	eExtension Service	The Philippine eExtension Service is an addition to Techno Gabay, a national extension system that has the goal of providing farmers with access to best practices and latest science and technology to improve agricultural methods and increase agricultural productivity.	Farmers	Philippines	Active
	Información Mensajeria Móvil	Información Mensajeria Móvil is a series of text message-based subscription services. Subscribers can choose services such as training, best practices, advisory and agriculture news, science and technology, fishing and aquaculture, rural opportunities and credit instruments.	Farmers	Colombia	Active
Agriculture, Animal husbandry, Fisheries & Forestry • Innovation	Nano Ganesh	Nano Ganesh is a GSM Mobile based remote control system exclusively for the use with water pump sets in agriculture areas. The need of Nano Ganesh arose from the routine problems faced by the farmers in operating the pumps. These problems include fluctuations in power supply, difficult terrain, fear of animals on the way to pumps, hazardous pump locations along rivers or water storage beds, shock hazards and	Farmers	India	In pilot

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		rains.			
Agriculture, Animal husbandry, Fisheries & Forestry • Research	EpiCollect – A PLATFORM FOR CREATING APPS, NOT AN APP ITSELF	We provide a generic framework, consisting of mobile phone software, EpiCollect, and a Web application. Data collected by multiple field workers can be submitted by phone, together with GPS data, to a common Web database and can be displayed and analyzed, along with previously collected data, using Google Maps (or Google Earth). Similarly, data from the Web database can be requested and displayed on the mobile phone, again using Google Maps.	Field workers	None yet	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Resource Management • Water	1. WaterReporter	The solution uses open source software, Web-based GIS and relatively simple software on mobile phones, allowing water-quality test data from field kits to be sent in and centrally monitored and analyzed.	Field workers, labs, rural people in areas lacking potable water	South Africa	In pilot
	Grundfos Lifelink	A Lifelink system is a single-point water supply with a submersible borehole pump that is powered by energy from solar panels. Water is pumped to an elevated storage tank, whereupon it is led by gravity to a tap unit in a small house. The tap unit also serves as a payment facility.	People getting water from a community pump	Kenya	Active
	SMSONE	SMSONE is basically a very-local newsletter. A local youth buys the franchise rights for a village for $20 to be the local reporter, then signs up 1,000 names. The info is entered in a database and the subscribers get a text introducing the kid as their village's reporter. The subscribers don't pay anything. SMSONE's service can give farmers instant updates about crop pricing or news of a seed or fertilizer delivery a town away. SMSONE subscribers get a text when the pipes are about to be turned on at local water taps.	Villagers	India	Active
Resource Management • Land	n/a				
Resource Management • Environment & Climate	Greenpeace India – SMS Lead Generation	The SMS lead generation campaign is a filter mechanism designed to source 'warm prospects'. An SMS text message was sent to 56,137 people, all qualified as potential warm prospects with an interest in environmental issues.	Campaigners, NGOs	India	No longer active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Labor, Migration and Human Development • Employment	2. Mobenzi	Mobenzi is a new software service designed to create work in impoverished communities in South Africa. Even among the unemployed, mobile phones are common, and Mobenzi pays them to perform simple tasks, via SMS on their phones.	Job seekers	South Africa	In pilot
	Jana	Jana is a service that enables mobile phone subscribers to earn money and accumulate savings by completing simple micro-tasks for large corporate clients.	Job seekers	Africa	Active
	Babajob	Babajob.com is a job Website and mobile portal dedicated to connecting informal sector workers – cooks, maids, drivers, guards, etc.- and employers to India and eventually worldwide.	Job seekers	India	Active
	KerjaLokal (Grameen) – NOT TARGETED AT RURAL	KerjaLokal is a blue collar job search service that can be accessed via the mobile phone. The KerjaLokal.com microsite can be accessed from a mobile device through a WAP browser.	Job seekers	Indonesia	Active
	Mobile for Good (M4G) – NOT TARGETED AT RURAL	M4G delivers vital health, employment and community content via SMS on mobile phones in order to inform and empower disadvantaged individuals and help bridge the digital divide, the widening technology gulf which exists between rich and poor countries.	Job seekers	Kenya, Cameroon, Tanzania, Uganda, Nigeria, Nepal	Active
	Kazi560	Subscription service to receive SMS alerts of new jobs available in Kazi560's database.	Job seekers	Kenya	Active
	Freedom Fone – A PLATFORM, NOT AN APP IN ITSELF	Freedom Fone is an information and communication tool, which marries the mobile phone with Interactive Voice Response (IVR), for citizen benefit. It provides information activists, service organizations and NGO's with widely usable telephony applications, to deliver vital information to communities who need it most.	Job seekers	Zimbabwe	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Labor, Migration and Human Development • Education, learning & training	BridgeIT and Text2Teach	BridgeIT is a program that uses mobile phones to bring educational videos to rural classrooms in Tanzania. Text2Teach is an educational program which aims to enable teachers and students to access over 900 multimedia educational materials like video, pictures, text or audio files via Short Message Service (SMS) in the Philippines and was initiated by BridgeIT.	Teachers, students	Philippines, Tanzania	Active
	Project MIND COMPLETED PROJECT	The objectives of this project are to test the feasibility and acceptability of using short message system (SMS) technologies for delivering nonformal distance learning (DL) to different socio-economic, cultural and gender groups; and to determine the motivation of users for distance learning purposes.	Teachers, students	Mongolia, Philippines	Active
	MILLEE	With a donation of 450 cellphones from Nokia, they deployed MILLEE games with 400 rural children in 20 villages in India. They compared their learning gains against 400 children in another 20 villages. They deployed MILLEE games with another group of children from the urban slums. The MILLEE games target an entire academic year of the local, official English curriculum.	Teachers, students	India	Active
	Question Box / Open Question	Question Box is Open Mind's initiative that helps people find answers to everyday questions like health, agriculture, business, education and entertainment. It provides easy access to information in hard-to-reach areas and breaks through technology, language and literacy barriers. We do this through hotlines connected to live operators or SMS. Open Question is a simple software to start your own Question Box project.	Rural people	India, Uganda	Active
	Project ABC	The purpose of the pilot program is to use information technology	Students, low-literacy	Niger	In pilot

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		(mobile phones) as a complement to traditional literacy training, providing households with the opportunity to practice their literacy skills via SMS.	people		
	Multimedia Word and Drumming Strokes games – NOT TARGETED AT RURAL PEOPLE	Based on an analysis of 25 traditional Chinese games currently played by children in China, we present the design and implementation of two culturally inspired mobile group learning games, Multimedia Word and Drumming Strokes. These two mobile games are designed to match Chinese children's understanding of everyday games.	Students	China	Active
	BBC Janala – NOT TARGETED AT RURAL PEOPLE	BBC Janala ('Window'), launched in November 2009 is a unique multi-platform (including mobile, internet and TV) project that harnesses multimedia technology to provide affordable education to potentially millions of people in the Bangladeshi-speaking community. By dialing 3000 users can access hundreds of English language audio lessons and quizzes.	Bangladeshi-speakers	Bangladesh	Active
	M4Lit – NOT TARGETED AT RURAL PEOPLE	The m4Lit project set out to explore the viability of using mobile phones to support reading and writing by youth in South Africa. In the pilot phase of the project a mobile novel (m-novel) was written and published in September 2009 on a mobisite and on MXit.	Students	South Africa	Active
	M4Girls	The M4girls project is a partnership between Nokia, Mindset Network, and the Department of Education (North West Province/South Africa) to test the provision of educational content on a mobile phone platform to girl learners.	Teachers, students	South Africa	No longer active
	Voices of Africa Mobile Reporting – A	The training program combines several face to face workshops with practical assignments for an optimum learning experience.	Trainee reporters	Ghana, Cameroon, Kenya, Tanzania,	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
	PLATFORM, NOT AN APP ITSELF	During the initial workshop trainees are introduced to the basics of mobile reporting. When they are familiar with the mobile phone, trainees go back to their communities and practice their newly acquired skills by making short video reports about diverse topics in their communities. They publish each report on the training Website and receive individual feedback by email or Skype from our professional coaches.		South Africa	
	ICT Bites	The project was set up to deal with the shortage of qualified teachers. There is a special focus in the project on in-service education of Licensed Teachers, teachers with only a few weeks of formal teacher education. The project will use available infrastructure and media to Develop models for communication and distribution of learning material for different technical environments (broadband, VSAT, mobile phones, CD/DVD, memory cards etc).	Teachers	Tanzania	In pilot
	Dr Math	Dr Math provides tutors to help with mathematics homework. Pupils use Mxit on their mobile phones. Tutors are from University of Pretoria. The service runs from 14:00 – 22:00 Sunday – Thursday. Tutoring is mostly in English, but some in Afrikaans.	Students	South Africa	Active
Labor, Migration and Human Development • Rural Youth	Jokko Initiative	Tostan is adding a new component to its community empowerment program (currently reaching over 800 communities in eight African countries), to teach the practical uses of standard cell phone capabilities and SMS texting. Mobile phones will increasingly serve as the platform for services provided by governments, health clinics, schools, and banks. The Jokko Initiative will provide a new generation of girls with access to	Rural youth, rural women	Senegal	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		the valuable tools of communication technology, and training in its applications for community engagement and positive social change.			
Labor, Migration and Human Development • Rural Women opportunities	n/a				
Labor, Migration and Human Development • SMEs and micro businesses / private sector development	Trade at Hand	Trade at Hand is an ITC service which objective is to make innovative use of mobile phones by business exporters from developing economies. There are four solutions: Market Prices, consists in sending, via SMS, product prices on international markets; Market Alerts is a Web-to-SMS tool that enables Business Support Organizations to transmit business opportunities, contacts and market news to targeted business people; mCollect allows national market price collecting and food security institutions to use the SMS channel to gather price information from their networks of rural market price collectors; Mobile Marketplace, offers a virtual marketplace to small-scale producers who have access to a mobile phone, enabling them to advertise their products to big buyers.	Farmers, exporters, food security institutions, buyers	Burkina Faso, Mali, Mozambique, Senegal, Liberia	Active
	TiendatekWeb – NOT TARGETED AT RURAL	The first product is a point-of-sale software application that allows micro-retailers to record all store expenses and revenues directly on a mobile phone; the camera even serves as a bar code reader which allows them to record sales and inventory at the product level. All applications run on smart phones that have touch-screens and synchronize wirelessly with Web servers.	Micro-retailers	Latin America	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Labor, Migration and Human Development • Migration	n/a				
Labor, Migration and Human Development • Miscellaneous	JavaRosa – A PLATFORM, NOT AN APPLICATION IN ITSELF – NOT TARGETED AT RURAL	JavaRosa is an open-source platform for data collection on mobile devices. It is a project of Open Rosa, a member of the Open Mobile Consortium. JavaRosa has been designed for a wide and ever increasing variety of applications including taking survey data, following disease management, guiding health workers through treatment protocols at point of care, and collection of medical records.	All people	Uganda, various	Active
	FrontlineSMS – NOT TARGETED AT RURAL	FrontlineSMS is award-winning free, open source software that turns a laptop and a mobile phone into a central communications hub. Once installed, the program enables users to send and receive text messages with groups of people through mobile phones. What you communicate is up to you, making FrontlineSMS useful in many different ways.	All people	Over 50 countries	Active
	CellBazaar – NOT TARGETED AT RURAL	CellBazaar leverages the simple, widespread power of SMS to bring the market to your phone. By sending simple text messages to 3838, you can post items for sale, look for items to buy, and obtain current market prices of products or services. Alternatively, WAP provides an even faster experience as you browse a simple graphic menu to access the entire marketplace.	Buyers and sellers	Bangladesh	Active
	GeoChat – A PLATFORM, NOT AN APP ITSELF	GeoChat is a flexible open source group communications technology that lets team members interact to maintain shared geospatial awareness of who is doing what where -- over any device, on any platform, over any network. GeoChat allows teams to stay in	Teams	Various	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		touch one another in a variety of ways: over SMS, over email, and on the surface of a map in a Web browser. GeoChat allows networks of organizations and individuals to form cross-organizational virtual teams on the fly, linking field to headquarters -- keeping everyone on your team connected, in sync, and aware of who is doing what, and where.			
	Mesh4X – A PLATFORM, NOT AN APP ITSELF	Mesh4x allows organizations to create seamless cross-organizational information sharing between different databases, desktop applications, Websites, and devices. It allows you to create or join a shared data mesh that links together disparate software and servers and synchronizes data between them automatically. You choose the data you wish to share and others do the same, enabling dispersed groups within or across organizations to see and synchronize data. Using Mesh4X, changes to data in any one location in the mesh are automatically synchronized to every other location. For cases where no Internet access is available at all, there is no longer any need for the slow transport of files physically between locations. Mesh4X gives you the option to synchronize all data via a series of SMS text messages.	Organizations	Various	Active
	Mobilisr – A PLATFORM, NOT AN APP ITSELF	Mobilisr is an open source enterprise class mobile messaging platform for NGOs around the world. The Praekelt Foundation and Cell Life, South-African based organization, are collaboratively developing an open source enterprise-level messaging platform.	NGOs	South Africa	In pilot
	Open Data Kit – A	Open Data Kit (ODK) is an open source mobile data collection	Various	Sub-Saharan Africa	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
	PLATFORM, NOT AN APP ITSELF	system designed so that components can reconfigured as needed. The system harnesses rapidly evolving functionality on mobiles and on the internet into an easy to use package. The mobile client, ODK Collect, is built on the Android platform and can collect a variety of data types: text, location, photos, video, audio, and barcodes. ODK Aggregate is a Web server built on Google's App Engine infrastructure. It provides a free and scalable repository where collected data can be stored, exported into a number of formats or visualized on a Google Map. Instead of closed solutions with limited lifetimes, ODK builds on open technologies and open standards that guarantee interoperability and enable future capabilities. By using the XForms standard, ODK can share complex forms and data with systems such as OpenMRS, EpiSurveyor, and the OMC's JavaRosa.			
	Rapid Android – A PLATFORM, NOT AN APP ITSELF	Rapid Android is a unique platform where, for the first time ever, a phone can now be used not only as a data entry tool but a data aggregation platform. Rapid Android allows users to use the Android phone as a mini-server, in addition to using it as an SMS client, allowing users in the field to enter data, to create surveys, and rapidly analyze data in the field. Rapid Android is a complete two-way SMS solutions that unlike other tools on the market, allows for analysis and processing on the actual phone.	Anyone entering data in the field	Various (UNICEF)	Active
	RapidSMS – A PLATFORM, NOT AN APP ITSELF	RapidSMS is a platform created from the same underlying pieces of computer code. Each one was crafted to solve a specific problem of a field office. The underlying code-base is open-source, so anyone can use it and build upon	Anyone entering data in the field	Various (UNICEF)	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		the platform. RapidSMS is designed to be customized for the varied needs and constraints of UNICEF and the developing world. Each RapidSMS product is an SMS-based tool that enables mobile data collection and messaging.			
	Mobile Researcher – A PLATFORM, NOT AN APP ITSELF	Mobile Researcher is a SaaS platform which transforms the ubiquitous mobile phone into a cutting-edge research tool. Leverage Web and mobile technologies to design and deploy surveys to fieldworkers in minutes, monitor, manage and communicate with your team and analyze responses in real-time. Using Mobile Researcher, the process of data collection, capture, storage and analysis takes place instantly with data available immediately from anywhere in the world. Manage surveys, people and data from your Web-based console.	Field researchers	Multiple	Active
	InSTEDD GeoChat – A PLATFORM, NOT AN APP ITSELF	InSTEDD GeoChat is a unified mobile communications service designed specifically to enable self-organizing group communications in the developing world. The service lets mobile phone users broadcast location-based alerts, report on their situation, and coordinate around events as they unfold, linking field, headquarters, and the local community in a real-time, interactive conversation visualized on the surface of a map. Once you create a GeoChat group, you may use it as the text equivalent of a push-to-talk radio: send the group a message on the Web , by email, or by SMS, and the rest of the group receives it.	Groups	Cambodia, Thailand	Active
	Text to Change – A PLATFORM, NOT AN APP ITSELF	With the Text to Change concept we offer an interactive Mobile SMS Quiz with knowledge questions linked with a rewarding system (incentive). By means of	Various	Uganda, Cameroon, Tanzania, Namibia, Madagascar	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		this edutainment and this interactive way of communicating, we tend to reach out to millions of people in Africa and around the world in order to spread the message of our partners and make it a subject of discussion. The SMS Quiz is designed to raise and help resolve key issues around local development programs.			
	Sembuse and MXit – A PLATFORM, NOT AN APP ITSELF	Sembuse allows users, for 15% of the cost of a normal 160 character SMS message in Kenya, to send one with 1000 characters in it. Sembuse is a mobile social network. It's a way for East Africans to connect with each other via short messaging, cheaper than normal SMS messages. MXit is a free instant messaging software application developed by MXit Lifestyle in South Africa that runs on GPRS/3G mobile phones and on PCs. It allows the user to send and receive one-on-one text and multimedia messages to and from other users, as well as in general chat rooms.	Various	East Africa, South Africa	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Governance / Political • E-Government and administration relevant to rural development	3. eSMS – NOT TARGETED AT RURAL	eSMS is an exclusive SMS Gateway established by the Kerala State IT Mission for use by various government departments for providing departmental services over mobile phones.	Citizens	India	Active
	1919 / GovSMS – NOT TARGETED AT RURAL	Now in Sri Lanka by dialing 1919 using any phone you have the access to all the services offered by the government. The beauty of that is service is available in Sinhala Tamil and English. This makes accessing the government services a much better experience and makes the life really easy when it comes to deal with government agencies or departments.	Citizens	Sri Lanka	Active
	Mamamayan Muna – TXT CSC	TXT CSC is a support mechanism of the Mamamayan Muna flagship program of the Civil Service Commission (CSC) under the Public Assistance and Information Office (PAIO). It seeks to provide improvement on government frontline services, act on requests, recommendations, complaints and other concerns of the citizen in an upfront, courteous, and efficient manner.	Citizens	Philippines	Active
Governance / Political • Awareness raising					
Governance / Political • Other m-government services	Disaster and Emergency Warning Network (DEWN) – NOT TARGETED AT RURAL	The DEWN is an innovation based on widely available mobile communications technologies such as short messages (SMS) and cell broadcast (CB), aimed at rendering a cost effective and reliable mass alert system. The network connects mobile subscribers, police stations, identified religious/social community centers and even the general public to a national emergency alarming center.	Citizens, first responders	Sri Lanka	Active
	Ushahidi	The Ushahidi Platform was built for information collection,	Citizens, NGO, media,	Kenya, India, Mexico,	Active

		visualization and interactive mapping. Ushahidi, which means testimony in Swahili, is a Website that was initially developed to map reports of violence in Kenya after the post-election fallout at the beginning of 2008. The volunteer team behind Ushahidi rapidly developed a tool for Kenyans to use SMS, email, or the Web to report and map incidents of violence.	election monitors	Lebanon, Afghanistan, DR Congo, Zambia, Philippines	
	SMS e-Service	The e-Service is a communication and information sharing forum between citizens, Ministry of State and Registration of Persons, Public Sector Reform and Performance Contracting (PSR&PC) and the Directorate of e-Government. The project will enable citizens to access government services through mobile phones and to query the manner services are delivered and to obtain real time feedback regarding requirements, costs and status of the most commonly demanded public services.	Citizens	Kenya	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
Rural Finance, Infrastructure & ICT • Mobile Money, m-banking and micro-finance related services	4. Ekgaon CAM, and, Self-Help MIS	CAM is a mobile information services framework for rural areas in the developing world. CAM is a three-tier document-based architecture for providing remote rural information services for SHGs in Microfinance. The CAM framework consists of the CAMBrowser, a single mobile phone application, CAMForm paper forms, equipped with embedded processing instructions and the CAMServer, an on-line service that links CAM with Web-based services.	Microfinance institutions	India	In pilot
	Zero (ZMF)	The ZERO platform converts new generation low cost NFC mobiles with large storage capacities as a secure, self-sufficient bank branch, with biometrics based customer ID, for customer enrolment for no-frills accounts and all types of transactions in the village with the local Customer Service Point operator acting as a Teller. mZERO (mobile version of ZERO) is available as a self-service payment option for customers on the mobile phone SIM to enable both over-the-counter and remote payments.	Rural people	India	Active
	MAP – NOT TARGETED AT RURAL	Once an individual has been through the simple biometric identification process – via one of our Data Capture Stations based in bank branches, or one of our mobile stations available in rural areas – they are issued a smartcard and PIN tied to a bank account. Individuals can access a wide range of services, using this card in conjunction with point-of-sale terminals (deployed to agent networks, petrol stations, grocery stores, Savings and Credit Co-operatives, bank locations and high traffic retail locations), ATMs at bank branches, mobile phones or via the internet.	All people	Uganda	Active
Rural Finance, Infrastructure &	Kilimo Salama	Kilimo Salama (Safe Agriculture) is an insurance designed for Kenyan	Farmers	Kenya	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
ICT • Agricultural insurance services		farmers so they may insure their farm inputs against drought and excess rain. The project, which is a partnership between Syngenta Foundation for Sustainable Agriculture, UAP Insurance, and telecoms operator Safaricom, will offer farmers who plant on as little as one acre insurance policies to shield them from significant financial losses when drought or excess rain are expected to wreak havoc on their harvests.			
Rural Finance, Infrastructure & ICT • Transport	Starbus (*bus)	The system is a proof-of-concept engineered to create a bottom-up, transportation information infrastructure using only GPS and SMS. The system, *bus, involved the development of a hardware device (a *box) containing a GSM modem and a GPS unit, that can be installed on a vehicle and used to track its location. The *box communicates via SMS with a server connected to a basic GSM phone. The server runs route a prediction algorithm and users can send SMS messages to the server to find when a bus will arrive at their location.	Bus users	Kyrgyzstan	In pilot
Rural Finance, Infrastructure & ICT • Broadcasting & program related	Gaon Ki Awaaz	Gaon Ki Awaaz, which means Village Voice in the Avhadi language, sends out twice-daily news calls to subscribers directly over their mobile phones. Launched in December 2009, the project recently expanded to 250 subscribers spread over 20 villages.	Villagers	India	In pilot
	4400 Initiative – NOT TARGETED AT RURAL	UNICEF Nepal has a Website with a special meta-site just for young people called the Voices of Youth. Now, every week on a popular youth-oriented radio program, the radio team frames a topic or a question and invites the listeners to respond via a free text message to an established short code, 4400. The responses are then posted on a forum on the UNICEF Voices of	Youth	Nepal	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		Youth (VOY) meta-site, or the Freedom Express debate platform.			
	CGNet Swara – NOT TARGETED AT RURAL	CGNet Swara is a new audio-based citizen journalism service in Chhattisgarh, India. Citizen journalists can call a phone number to record news, and listeners can call in to hear news recorded by citizens around them CGNet Swara moderators use a Google SMS channel (a free SMS group service in India) to send out an SMS after a news report is published. The SMS includes the number recipients can call to hear this report..	Citizens	India	Active
	Managing News – A PLATFORM, NOT AN APP ITSELF	Managing News originated as a news aggregation and republishing platform heavily integrated with RSS/Atom. Users can track a diverse set of RSS/Atom feeds, visualize them, and republish selected reports on a platform that allows for mapping and pluggable visualizations. Managing News has subsequently added SMS functionality to the system. The system is based on Drupal, and integrates several open source projects including OpenLayers, SimplePie, and many Drupal plug-ins.	Citizens	Afghanistan	Active
Rural Finance, Infrastructure & ICT • Printed media					
Rural Finance, Infrastructure & ICT • Miscellaneous	SocialTxt	SocialTxt is a mobile messaging platform that uses the available advertising space on 'please call me' (PCM) messages, to communicate selected information to a specific target audience. Through use of the PCM advertising space, SocialTxt's objective is to give nonprofit organizations the ability to reach a potential 900,000 individuals in South Africa per day with essential information aligned toward the Millennium	All people	South Africa	Active

Subsector / Segment	Name of Service/ Product	Description/Summary	Target Users	Country	Status
		Development Goals.			

Annex D: Mobile Applications Ecosystem for Agricultural and Rural Development

Players	Assets & Capabilities	Roles	Incentives & Business Model	Limitations , Constraints & Threats
Technology & ICT service providers				
mobile network operators	• Mobile infrastructure • Extensive retail outlets / agent networks • Large customer bases that include low-income segments • Strong branding • Customer trust • Customer service structures • Ability to make good margins on low ARPUs	• Provide infrastructure and communications service • Host applications, databases and/or take app development on board • Provide incentives to app providers & hosts in the form of bulk data discounts, etc.	• Acquire customers • Manage churn • Increase ARPUs • Capture additional revenue opportunities • Meet service obligations and CSR goals	• Regulatory limitations on providing financial services, e.g. issuing e-money, on-phone advertising, etc. • Shareholder pressure for faster, higher returns • Strategic focus that may not include some rural applications
Mobile Platform & OS providers	• Technology and expertise to enable the simplified creation and distribution of applications • A successful platform would realize economies of scale that could accrue to app providers	• Provide the back-office, underlying systems for creating and/or distributing applications • Provide payment mechanism (m-money or operator billing)	• Provide an efficient, effective way to create and distribute useful applications to encourage providers and mobile network operators to embrace the platform	• Most platform providers have limited scale/scope • Strategic focus more often focused on urban and developed markets • Competition from other platform providers
Handset suppliers – Basic 2G	• Brand recognition • Extensive distribution networks • Large customer bases • Customer service structures	• Provide the software capabilities to enable a wide range of apps • Provide the hardware capabilities to make apps easy to use	• Increased app availability could improve handset sales • Meet CSR goals • Increased penetration among rural, lower income users	• Shareholder pressure for faster, higher returns • Strategic focus that may not include rural applications • Smartphones
Smartphone suppliers – 3G Mobile, Tablets, Netbooks	• Increased functionality • Rapidly expanding user base	• Provide the software capabilities to enable a wide range of apps • Provide the hardware capabilities to make apps easy to use	• Customer loyalty and lock-in	• Ecosystem providers (such as Google & Apple) • Commodification
Software/ Application Providers	• Creativity/Innovation, ideas • Technical skills to develop applications • Knowledge of a specific sector or part of society where need exists	• Develop applications • In developing countries, need to seek partnerships with platform providers, handset vendors, mobile network operators etc.	• Earn revenue from selling the application • Meet a community need / development objective	• Small-scale • Require platforms or partnerships to distribute applications
Content Providers				
Civil Society (Local Community based Organizations)	• Local contacts and knowledge in low-income markets • Credibility and trust • Relevant operations	• Undertake research, especially on lower income segments • Engage in operational partnerships with mobile app providers • Mobile app awareness & education	• Enhance social and economic impacts of their activities • Drive development in general, in line with organizational mission	• Philanthropy-based, not-for-profit funding models limit scale • Cultures and business processes may not lend themselves to partnering with business
Civil Society / NGOs, (Int'l)	• Credibility and trust • Financial resources or relationships • Expertise from international experiences	• Undertake research, especially on lower income segments • Build agents & small retailers' capacity	• Enhance social and economic impacts of their activities • Drive development in general, in line with	• Philanthropy-based, not-for-profit funding models limit scale • Cultures and business processes may not easily

Players	Assets & Capabilities	Roles	Incentives & Business Model	Limitations , Constraints & Threats
		• Engage in operational partnerships with mobile app providers • Mobile app awareness and education	organizational mission	lend themselves to partnership with business
ARD Government Departments	• Reach into rural areas • Information about the people / economies in rural areas • Financial, technical resources of the government	• Making their services/ information available through m-apps • Promotion/ marketing • Financing through PPPs	• More efficient, effective provision of government services • Rural development	• Lack of technical knowledge to develop applications
Extension workers	• Knowledge • Presence in rural areas	• Provide training, advice via mobile apps • Support rural users to learn to use the apps	• Improve training, knowledge, skills of rural people	• Lack of technical knowledge about mobile or ICT apps
Educators & trainers	• Knowledge • Presence in rural areas • Trust	• Provide educational tools via mobile apps • Support app development through capacity building	• Improve educational outcomes	• Lack of technical knowledge about mobile or ICT apps
Employment agencies	• Contact with a network of employers and job seekers	• Provide job seekers and employers with relevant contacts & opportunities via m-apps	• Improve service to both job seekers and employers	• Lack of technical knowledge about mobile
Employers	• Existing periodic payroll distribution to employees	• Offer direct deposit of wages into mobile money accounts • Provide information and benefit dissemination through mobile apps	• Reduce cost of payroll processing, risk of cash handling • Offer greater employee convenience	• Cultural resistance
Media - Broadcasting	• Branding • Reach • Network infrastructure	• Provide content for applications	• Increase audience • Increase revenues • CSR	• Lack of technical knowledge • Lack of rural knowledge
Media - Print	• Branding • Reach • Distribution network	• Provide content for applications	• Increase audience • Increase revenues • CSR	• Lack of technical knowledge • Lack of rural knowledge • High cost
Financial service providers to users				
M-Money services / engines (mobile network operator or bank based, or independent)	• Existing infrastructure which enhances and increases usefulness of transaction apps	• Provide payment engine for apps with transaction component • NFC payments	• Acquire customers &/or increase volumes	• Existing financial services, e.g. credit cards, PayPal
Credit card or payment network operators	• Existing infrastructure which could enhance & increase usefulness of some transaction apps	• Provide payment facilities for some customers in apps with transaction component	• Make new inroads, acquire customers	• Mobile money, NFC payments via mobile phone
Banks / MFIs	• Banking infrastructure • Ability to facilitate forex clearing & settlement • Regulatory compliance expertise • Retail outlet networks • MFIs have service presence among low-income segments • MFIs conduct regular communication with low-income clients	• Offer banking services via mobile • Hold float or accounts in customers' names • Handle cross-border transactions, manage foreign exchange risk • Ensure compliance with financial sector regulation • Introduce low-income segments to mobile	• Gain access to new clients • Reduce cost of delivering financial services • Establish presence in new customer segments and new areas • Meet service obligations and CSR goals • Capture add'l revenue • Safer & lower-cost methods of disbursement and collection	• Narrow customer base • Lack of experience with, and in some cases interest in, low-income customers • Stringent regulatory requirements with significant compliance burdens • Back office systems may not be linked with mobile money platforms

Players	Assets & Capabilities	Roles	Incentives & Business Model	Limitations , Constraints & Threats
	• MFIs have knowledge of low-income clients' habits and needs	money • Educate end users	• Improve business efficiencies	• Cultural resistance
Insurance companies	• Infrastructure • Regulatory compliance expertise • Provide a potentially valuable service that is under-utilized in rural/agricultural regions of developing nations	• Offer insurance services via mobile • Ensure compliance with financial/insurance sector regulation • Introduce low-income segments to mobile insurance • Educate end-users	• Reduce cost of delivering financial services • Establish presence in new customer segments and new geographic areas • Capture additional revenue • Safer and lower-cost methods of disbursement and collection • Improve business efficiencies	• Narrow customer base • Lack of experience with, and in some cases interest in, low-income customers • Lack of data about low-income customers • Cultural resistance
Financial Service Agents (E.g., mobile money agents)	• Physical points of presence • Customer trust • Knowledge of customer usage habits and needs	• Perform cash-in and cash-out functions • Identify potential new m-apps	• Earn commissions on transactions • Increase traffic and sales potential (for agents who are retailers)	• Liquidity shortfalls • Basic business skills gaps • Limited ability to partner with large corporations
Financiers				
IFIs & Donors	• Financial resources • Best practices expertise	• Provide financing • Provide business development assistance • Provide technical assistance	• Support development objectives • Creation of profitable businesses	• Lack of local knowledge, legal systems, etc. • Lack of integration with business/ commercial communities
Venture Capital providers	• Private capital	• Flexible, informal or formal financing for new businesses	• New opportunities for investment • Exclusivity period for investment	• Usually want high Return on Investment • High levels of competition remove incentive to invest
Commercial Banks	• Access to capital and large balance sheets	• Provide loans to businesses • Advise on exit strategy for investors (such as VCs)	• Expand customer base	• High cost infrastructure • Low risk model, only prepared to invest in businesses at Stage 2 level
USFs & ICT Development Agencies	• Capital assets which can be used to finance ICT projects with RD/Universal Access focus	• Provide smart subsidies to private sector players to develop or expand rural m-apps	• Promotes Universal Access and expands the USF's role in ICT growth and development	• Staff capacity may be limited
Government ARD Departments	• Funds to support government development objectives	• Support pilot projects / test concepts	• Expand agri services	• Few funds • Inflexible
Users				
End users (farmers, householders, youth women)	• Relevant needs	• Use mobile apps to improve their lives	• Reduce risk of carrying cash • Increased access and affordability of payment, remittance, & other financial services • Convenience of remote payment, remittance, and other services	• Lack of awareness • Limited mobile literacy • Cultural and psychological resistance
Cooperatives	• Local contacts and knowledge in low-income markets • Credibility and trust • Relevant operations • Co-ops conduct regular	• Build the capacity of agents and small retailers • Engage in operational partnerships with mobile app providers • Mobile app awareness	• Increase sales of co-op members • Enhance social and economic impacts of their activities • Drive development in	• Lack of technical capacity to develop applications • Little incentive to expand to nonmembers or small farmers

Players	Assets & Capabilities	Roles	Incentives & Business Model	Limitations , Constraints & Threats
	communication with low-income clients • Co-ops have knowledge of low-income clients' habits and needs	and education	general, in line with organizational mission	
Rural Produce Buyers/ Food Processing Plants	• Warehouses • Transfer points to end buyer	• Aggregation points and provide economies of scale	• Lower cost of supply • Increase quality of supply by supporting apps that improve farmers' position	• May be short of funding (though Kenya & Sri Lanka example showed buyer willing to invest in improved quality and efficiency)
Product companies with interest in the rural market (e.g., FMCG)	• Financial resources to spend on marketing & research	• Participants	• Broaden customer reach • Reduce customer acquisition costs	• Strategic focus that may not include using RD oriented apps
Marketing organizations	• Knowledge of market characteristics and needs • Reach • Ability to create awareness of applications	• Create awareness, education • Targeting • Sales outlet for rural producers	• Generate income through sales • Increase the use/membership of a given organization's services	• Size, reach • In some cases have limited technical capabilities • May require complex, multi-partner structure to create an application
Retailers / traders	• Physical points of presence	• Accept mobile payments • Use mobile payments in B2B transactions, payment of wages • Build customer trust	• Reduce costs	• Customer demand (or lack thereof) • Business partner willingness to transact by mobile
Veterinarians	• Ability to help maintain, improve animal health	• Provide advice, expertise	• Improved animal health • Increase income	• Lack of knowledge of mobile technology
Others				
ICT & Banking Regulators	• Authority to impose regulation and monitor and enforce compliance	• Provide enabling environment for m-apps • Protect stability of financial system • Encourage and protect behavior change	• Financial stability • Growing sector	• Lack of experience with convergence of financial and telecom regulatory regimes • Lack of financial and technical capacity
Government ICT & allied Policy Makers	• Enabling policy environment	• Reduce cost of doing business • Support entrepreneurial skills development through education & policy	• Promote financial inclusion • National socio-economic development	• Limited funds

Annex E: Summary of Lessons by Subsector

Mobile Applications	Country	Lessons		
		Development Impact	**Ecosystem (players, platform, hyper-local content/service, etc)**	**Business Model (objectives, revenue, sustainability, scalability, financing)**
1. Agriculture, Animal husbandry, Fisheries & Forestry				
Manobi KACE, DrumNet, b2bpricenow.com GoogleTrader	Senegal, Ghana, Kenya Philippines Uganda	• Better access to market information leads to increased income. • Linking suppliers and buyers directly, cutting out the middlemen, removing information asymmetry leads to increased income.	• Local content on market prices created by local staff in market resource centers (MRCs) is responsible for KACE's value creation as well as supporting their virtual market using broadcast radio and linkages between buyer & seller • Platforms, such as Ovi Life Tools (OLT), could ensure wider availability of applications and therefore scalability. • Partnerships with mobile network operators are vital for leveraging their networks and services, reaching users, cost management, etc.	• Affordability can limit the entry of smallholder farmers, thus planned multi-level services are effective (market info at no cost, leading to value added market linkage assistance at a price can migrate beneficial participation).
DrumNet	Kenya	• As above	• Pilot integrated major buyers, buyer-producer contracts, bank, farm produce pick-up & transportation, mobile recording & accounting, and value chain management.	• But trying to do everything (i.e., incorporate all players in a value chain) at once can lead to failure, even of a well-conceived and potentially impactful application. Organic step-by-step growth is more feasible (see Virtual City below). • Attempting to transit from NGO developed applications with donor support to a private sector technology owner in one step seems challenging.
Virtual City	Kenya	• Supply chain automation improvements (mobile & ICT) in specific market segments lead to reduced transactional and logistical costs • These benefits, as well as greater accuracy of farm gate measurements impact farmer (income), buyer (cost reduction) & market productivity for the segment.	• This model has relied on one major player (e.g., national scale buyer) financing an application that is deemed good for the buyer dominated ecosystem • Also improved farmer credit worthiness and can indirectly draw banks to the value chain.	• Applications focused on meeting/ automating specific customer needs without including full value chain can grow at a rate that matches need and capabilities.
Dialog Tradenet, RML, DatAgro	Sri Lanka, India, Kenya, Chile	• Micro, granular information (market pricing, weather advisories) results in increased income.	• A specialized agriculture information company can be key to providing trusted information. • Farmers trust and see value in specialized hyper-local	• Popularity and impact still do not guarantee profitable scalability without either the benefit of large market size or effective packaging for efficient multi-market

Mobile Applications	Country	Lessons		
		Development Impact	Ecosystem (players, platform, hyper-local content/service, etc)	Business Model (objectives, revenue, sustainability, scalability, financing)
			content from trusted suppliers (e.g. based in local market centers or cooperatives)	replication • Partnerships with farmer cooperatives to define the types of information they need
Manobi	Senegal, Niger & Mali	• Produce traceability yields global markets • Better supply chain linkages improve revenues • Market knowledge increases everyone's income	• Mobile operators provide access • Market researchers input market data into system via mobile device • Financial service providers offer financial/payment services • Local government provides government services	• Freemium model: Free entry-level services, Added value services for a fee, 3rd party services for a higher fee. • Financing: 1st (free stage) is funded by donors; second (added value) stage has fee to the farmers, 3rd (3rd party services) stage is multiple fee model with all participants in the value chain paying a fee.
b2bpricenow.com	Philippines	.	• Attaching an application to a successful bank guarantees transactions by piggybacking on the bank's existing clientele (i.e. guaranteeing transaction flows) and through the bank's due diligence on participants, use of the bank's existing infrastructure such as account and card facilities (thereby lowering the cost of customer acquisition. • The bank also shouldered the cost of promotion, roadshows and cooperative training, since it gained on transaction volume.	• It is possible to launch an e-marketplace economically if the objectives appeal to several interested stakeholders, such as technology suppliers, agri media, bank, which all share costs. • Also, the primary players were limited to cooperatives, cooperative buyers & buyers, thus publicity was easily targeted. • The application started as an e-commerce service for the cooperatives and major farmers. b2bpricenow.com is expanding the service to include farmers that are not account holders with LandBank. b2bpricenow strategy to add more subscribers is premised upon migrating services to mobile phones, though the functionality on mobile phones is not totally fulfilled yet.
e-Dairy, 1920, Farmers Texting Service	Sri Lanka, Philippines	• Targeted relevant information, like expert advice, can result in increased production	• Government information on productivity and sector issues combined with ICT implementing resources can generate practical m-ARD concepts	• Clear objectives (such as increasing milk production by 30 percent) are correlated with apps that graduate from the pilot/ concept stage. • Main challenge is formulation of plan to migrate from Government led to effective PPP to leverage private capacity for efficiency & growth
Esoko	N. Sudan, Burkina Faso,	• Reduced travel and communications costs by	• Platform can be applied to any application or industry that	• Private businesses can be leveraged to participate and

Mobile Applications	Country	Lessons		
		Development Impact	**Ecosystem (players, platform, hyper-local content/service, etc)**	**Business Model (objectives, revenue, sustainability, scalability, financing)**
	Cote d'Ivoire, Ghana, Nigeria, Mali, Rwanda, Tanzania, Zambia, Kenya, Mozambique, Uganda, Malawi, Mozambique, Madagascar	offering targeted procurement or extension messages to different users • Increased cross border trade through more transparent facilitation of supply and demand information • Reduction in market inefficiencies through improvement in supply chains, more equitable pricing and better access to markets for farmers and buyers. • Stabilize supplies (by avoiding over production) as well as prices. • Awareness improves farm-gate prices, reduces spatial arbitrage between markets, enables the introduction of new products such as weather insurance	would benefit from direct access to a mobile phone based-population, specifically one that requires low-cost usage. • Challenging to develop a flexible platform that can be offered in multiple countries to overcome limited market sizes (i.e. limited market size because based in one country).	subsidize the cost for lower income groups • Offer different tiers of subscriptions for individuals, businesses, and enterprises • Franchises are used for replication/scaling-up
2. Resource Management				
Lifelink, Nano Ganesh, Water Reporter, SMSONE	Kenya	• Improved access to clean and safe water facilitated by using m-apps for purchase and payment • Increased convenience and cost savings in managing and safeguarding water pump sets in agriculture areas, by using mobile phone as remote control for these pumps • Improved water quality monitoring, by using field workers and local people provided with mobile phones to overcome geographic challenges	• Use of m-Money for direct payment makes a water supply system ecosystem (finance, technology supplier, local community, user) more feasible • Local teams collect data that is directly useful to subscribers	• Educating people on the value of clean water is important to adoption of a good ground water supply project. • Local development (irrigation) is also important to increase value. • Alternative income streams are needed to sustain projects, such as promotional messages
3. Labor, Migration & Human Development				
Text2Teach	Philippines, Tanzania, Chile	• Increased access to updated educational content through downloads of teaching materials via mobile networks • Improved coordination of rural education through improved contact with local teachers • Improved student performance and classroom environment as witnessed from the high average scores in science; improved teacher-pupil, and pupil-pupil interaction, and generally upbeat classroom	• Working in collaboration with government departments	• Engaging the public sector to put in their share of resources to match the grant provided by Nokia helps in securing the projects' sustainability because of the stake they have placed in the project.

Mobile Applications	Country	Lessons		
		Development Impact	**Ecosystem (players, platform, hyper-local content/service, etc)**	**Business Model (objectives, revenue, sustainability, scalability, financing)**
		environment		
Project Mind	Philippines	• Rural inhabitants can take distance learning programs through courseware in SMS format, and SMS based testing systems		• Needs to have high mobile phone penetration rates and familiarity with text messaging
MILLIE	India	• Improved education outcomes through the use of context-specific games for language learning	• Handset vendors (Nokia in this case) appear willing to sponsor children and education related initiatives	• Challenge is creating partnerships to fund the roll-out of the games, and local educational partners to allow the usage of the MILLEE games as part of their curricula
BBC Janala	Bangladesh	• Access to affordable English language lessons via mobile phones (each 3-min lesson costs less than half the price for a cup of tea in a Dhaka tea store)	• mobile network operators partnership and sponsorship is vital as they agreed to cut the cost of calls to the service by 75%	• There can be significant interest in English language learning m-apps (750,000 calls after first month of launch)
Mobile for Good (Kazi560), Souktel	Kenya, Cameroon, Tanzania, Uganda, Nigeria, Nepal, Palestine, Iraq, Somaliland	• Inform and empower disadvantaged individuals by delivering vital health, employment and community content via SMS. • In Kenya 60,000 have found employment through the Kazi560 job service	•	• Applications could be designed to enable franchises, in order to facilitate deployment in other countries • Revenues from premium services can be used to subsidize services to lower income users • Employment m-apps has high potential of becoming financially sustainable m-apps (Kazi560 is already financial sustainable, and Souktel covers over 80% of its running costs)
Jana, Mobenzi	All countries, South Africa	• Addition income streams by using mobile phone for microwork/microtasks outsourced by local or overseas clients, such as market research and surveys • Access to flexible work opportunities as it can be conducted during spare time • Use of automated algorithms to evaluate quality and compensate workers encourages high quality delivery	• Network of mobile phone based microworkers can be developed, and individual agents mobilized to provide large scale services as private contractors • Mobile-based platforms can be built to conduct simple microwork • Brings commercial companies & advertisers into the rural ecosystems	• Some companies are interested in marketing amongst low income groups • Challenge in finding sufficient work for agents/microworkers • Jana provides interesting approach for commercial companies to limited rural affordability & could support m-applications while creating income for the targeted rural end users
Open Data Kit (ODK), RapidSMS, Frontline SMS, JavaRosa	Sub-Saharan Africa, UNICEF, over 50	• Numerous areas related to tracking, monitoring, and/or coordination of health programs, human rights, disaster relief, election	• Open source community developed kits/ platforms could be very useful for m-apps focused on development purposes	• Open platform can be utilized for various data collection needs. Already used by numerous projects/ organizations such as

Mobile Applications	Country	Lessons		
		Development Impact	**Ecosystem (players, platform, hyper-local content/service, etc)**	**Business Model (objectives, revenue, sustainability, scalability, financing)**
	countries	monitoring, missing persons in natural disasters, etc. • Improved access to food programs in Ethiopia and Malawi due to improved food distribution • Connect and amplify voice of women and youth by virtually linking rural individuals, groups, and communities; and providing virtual platform for information exchange, broadcasting ideas, and organizing advocacy work (refers to Jokko Initiative in Senegal, which uses the RapidSMS platform)	• Virtual communities/networks can be formed using simple SMS platforms, allowing instantaneous two-way communications on a large scale	Google.org and Google Earth Outreach, Grameen's Community Knowledge Worker program, Episurveyor, etc. • ODK is limited to Android based phones
4. Governance / Political				
Ushahidi	Kenya + several other countries	• Access to critical geo-referenced information; on issues such as political instability, violence, natural disasters, health related epidemics, etc. • Can be applied to track natural resources such as water, soil types, land fertility, etc.	• Crowd-sourcing can be viable way to aggregate contributors from all over the world • Crowd-sourced players have been found to provide better information than mainstream media due to higher quantity of information and wider geographic coverage	• Leveraging crowd-sourcing can provide accurate and critical information about specific events, which can be harnessed for social objectives • Challenge in filtering and quality control of user generated data • The model is inherently useful for public sector, security & aid scenario purposes and has thus relied on external finance, but has potential to level its GIS features into commercial marketing
TXT CSC, 1919, SMS e-Service	Philippines, Kenya	• Improved access to public information and services through a convenient, voice-based hotline • Access to public information and services, and tracking service status on a 24x7 basis • Time and cost savings by not having to travel to larger cities/centers for such information	• Other government ministries' support to the fronting agency is needed • Government agencies in-charge of e-Government can be leveraged to deploy m-apps	• Integrated government information from different departments bring more value • Challenge in moving beyond being a library of information, to a transactional basis • Need to ensure that other ministries update their information on a regular basis • Users can be charged and may be willing to pay for m-apps provided by the government (five shilling per call) if it brings sufficient time and cost savings
CGNet Sawa	India	• Access to citizen journalism for disenfranchised tribal groups through voice calls for hyper-local news, and improved public accountability as news items have resulted in concrete	• Buy-in from the affected political players can reduce resistance • Moderators are needed to ensure quality of news	• Users' willingness to pay up to half of daily spent for call charges • Possibility of selling news feeds to local media for sustainability

Mobile Applications	Country	Lessons		
		Development Impact	**Ecosystem (players, platform, hyper-local content/service, etc)**	**Business Model (objectives, revenue, sustainability, scalability, financing)**
		corrective actions		
5. Rural Finance, Infrastructure and ICT				
Kilimo Salama	Kenya	• Small scale farm input insurance can be transacted using mobile phones, and transaction cost can be reduced to cost of an SMS • Increased farmers' security against crop losses, and more diversified crop types and higher yield • Potential to protect rural inhabitants against other forms of unexpected life events, as usage can be extended to other insurance products such as funeral coverage and personal accident	• Identifying farmers and their crop types and farming methods (such as inputs) means that other extension services can be offered. • Higher quality inputs, such as drought resistant crops, could potentially reduce potential losses.	• Good extension services, such as training, are essential in order to educate the market about a product or new technique that could carry risk, to increase usage and adoption. • A win-win result in the early stage of implementation creates trust.

Annex F: Detailed Case Study Information Sheets

Completed information sheets for the 92 m-ARD apps studied are available at http://www.worldbank.org/ict/m-ard.

Annex G: Kenya Case Study

Annex H: Philippines Case Study

Annex I: Sri Lanka Case Study

These Annexes are attached as separate documents.

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