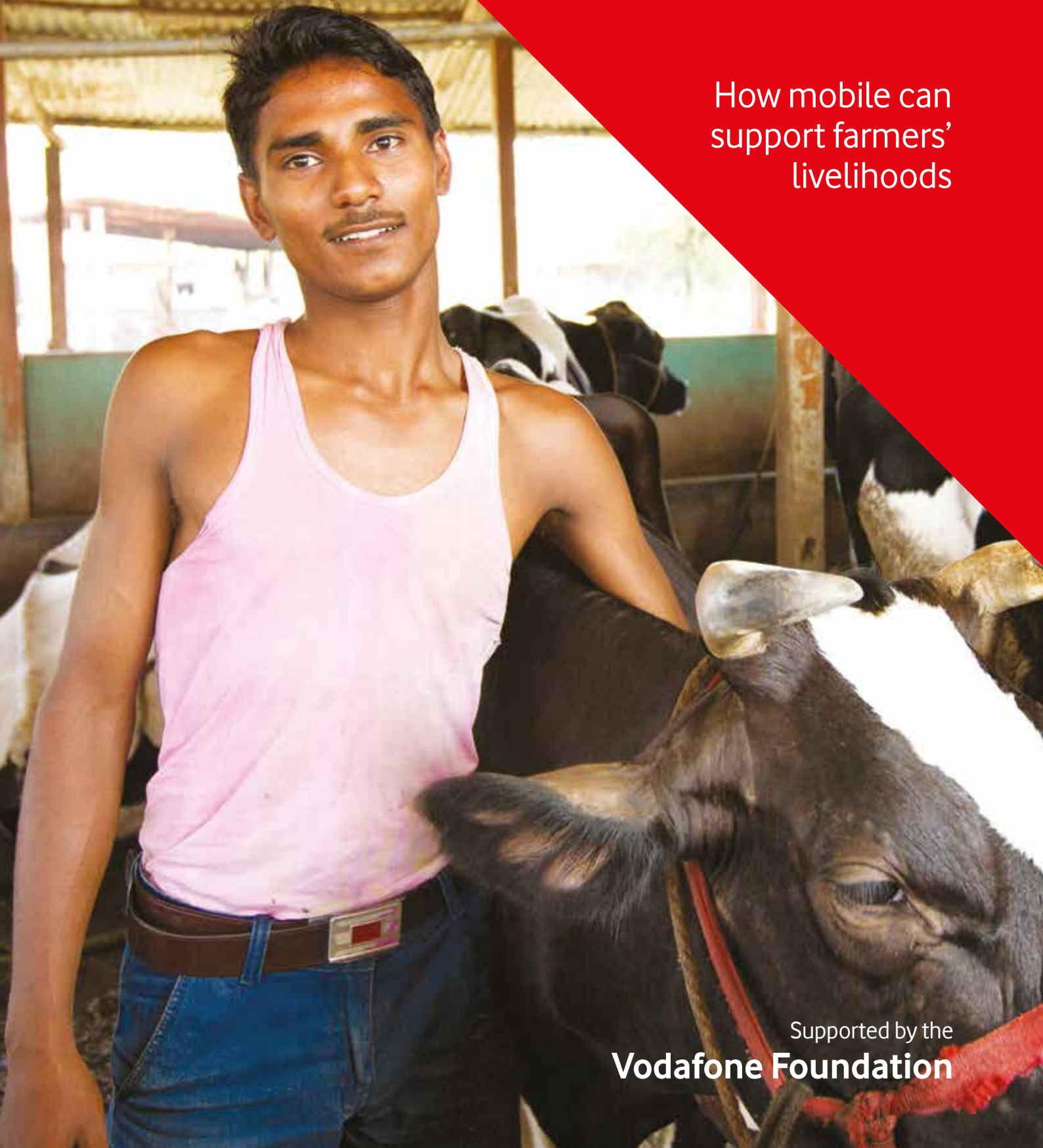




Connected Farming in India

How mobile can
support farmers'
livelihoods



Supported by the
Vodafone Foundation

Welcome

This report has been produced by Vodafone Group, supported by the Vodafone Foundation and in collaboration with Accenture Sustainability Services.

It explores how mobile solutions are helping to improve agricultural productivity, efficiency and rural livelihoods in emerging markets, with a focus on six services.

Accenture Sustainability Services was commissioned to conduct research on the six services and to assess their potential economic, social and environmental impact in India in 2020.

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About Vodafone

Vodafone is one of the world's largest telecommunications companies and provides a range of services including voice, messaging, data and fixed communications. Vodafone has mobile operations in 26 countries, partners with mobile networks in 55 more, and has fixed broadband operations in 17 markets. At the end of March 2015, Vodafone had approximately 445 million mobile customers and 12 million fixed broadband customers.

Vodafone plays an active role in seeking to address the challenges faced by today's emerging economies through the use of technology. This includes working with enterprise customers, non-governmental organisations (NGOs) and government agencies to develop mobile services that increase agricultural productivity and efficiency and improve the livelihoods of smallholder farmers.

Foreword

from Serpil Timuray,
Regional CEO – Africa, Middle
East and Asia Pacific Region

Today, hundreds of millions of people are still chronically hungry¹ and over half of these are smallholder farmers. To improve their livelihoods and increase production to meet growing demand, farmers in emerging markets must overcome significant challenges such as lack of infrastructure and information, financial barriers and the growing impact of water scarcity and climate change. They need new solutions.

Four years ago, we published our Connected Agriculture report², exploring how mobile services could help transform agricultural value chains and enable smallholder farmers in emerging markets to improve their livelihoods. Our research at that time showed that 12 different types of mobile services could boost agricultural income in 26 markets by 11% – an estimated \$138 billion in 2020.

Since 2011, we have seen some of the exciting potential of mobile agriculture solutions being realised. At Vodafone we have been working with our partners in government, the private and non-profit sectors and gained practical experience and new insights from developing and testing new solutions in a wide range of countries.

70 million Indian farmers could benefit in 2020

In this report, we share some of these successes and show how the lessons learnt can be applied to India, a critical market for Vodafone and one of the world's largest food producing countries. More than 200 million people work in agriculture in India, and there is a pressing need to improve rural livelihoods to help take more people out of poverty³.

Our research has looked in detail at the potential impact from rolling out six exciting services at scale in India. These services are designed to help farmers and agricultural businesses to increase yields, to improve efficiency and to boost incomes and rural livelihoods, often while cutting their environmental



footprint. They range from information services that enable small farmers to access up-to-date information on agricultural practices, weather forecasts and market prices to solutions that help agricultural businesses to boost production, reduce losses and bring more small farmers into their supply chain.

Together our research has shown that the six services could positively impact the lives of nearly 70 million Indian farmers in 2020, generating over \$9 billion in additional annual income for farmers. This represents an average \$128 increase in income for over 60% of Indian farmers.

\$9 billion in additional annual income generated for farmers

These six services demonstrate the real potential of mobile agriculture, but we know we are still just scratching the surface of what can be achieved. Over the next decade, we will see even more innovation in both the types of services available and how these are combined to create compelling commercially sustainable propositions. We will see significant progress on the scale at which services are delivered and, most importantly, the opportunities these create for farmers, businesses and communities across emerging markets.

Through this report, we aim to share what has been learned on the journey so far, to identify areas that offer potential for further innovation and investment and to show how experience gained can be applied to India. We hope to spark further action both in our own business and among our partners and our peers in the industry. This is important – we need to speed up the pace of change in agriculture to change lives for the better for rural communities today and to help businesses and farmers across our emerging markets to prepare for the future.

Introduction

from Andrew Dunnett,
Director, Vodafone
Foundation

The Vodafone Foundation invests in the communities in which Vodafone operates, using innovative mobile technology to mobilise social change and to improve people's lives.

Mobile technology can play an important role in efforts to end hunger and poverty in rural communities in emerging markets. It can give small farmers new tools to increase efficiency and productivity and provide access, even in remote rural communities, to the information, financial services and markets that farmers need to increase their income. The impact on livelihoods can be significant, helping to improve the prospects of farmers and their families.

This report explores a number of innovative mobile solutions for agriculture and assesses what the benefit to farmers, economies and wider society would be if these solutions were taken to scale in India – a country experiencing rapid economic development but where rural communities still suffer high levels of poverty and malnourishment.

To realise the full potential of mobile services for agriculture, a wide range of partners need to work together to create change.



In developing this publication we have sought the views of many different organisations working in the areas of mobile, agriculture and development. We hope that by sharing these insights and the lessons learnt so far, we can contribute to further expansion and innovation in mobile agriculture services, enabling more smallholder farmers to improve their productivity and livelihoods and creating positive change for rural communities.

Summary of methodology

This report includes a summary of research conducted by Accenture Sustainability Services.

Accenture modelled the potential social, economic and environmental impact for six types of mobile agriculture service. It analysed data on the current penetration and growth rates of existing mobile services for agriculture provided by the Vodafone Foundation, Vodafone Group companies and third-party organisations.

The opportunity for rolling out these types of services at scale in India over the period from 2015 to 2020 was explored and the potential impact this would have on farmer livelihoods was estimated. This calculation of livelihood benefits did not incorporate the costs of any service fees charged.

The service opportunities modelled are:

- ◆ Information services
- ◆ Receipt services
- ◆ Payments and loans

- ◆ Field audit
- ◆ Enabling access to local markets
- ◆ Smartphone-enabled services

In conducting its research, Accenture interviewed a wide range of stakeholders working in agriculture and mobile services, including representatives from multilateral organisations, governments, funding organisations, NGOs, mobile services providers, the financial services sector and businesses sourcing agricultural produce from emerging markets.

For a list of contributors and stakeholders see Appendix 1, page 38. Further information on Accenture's methodology for modelling is included in Appendix 2, page 40.



Context

By 2050, the world's population will exceed nine billion and, to meet increased demand, agricultural production will grow by 60%⁴. Achieving this significant increase in agricultural productivity will be a major challenge, made more acute by the impacts of climate change and water scarcity and growing competition for land and agricultural resources.

The challenge for agriculture

Agriculture productivity is increasing across the world, but often not quickly enough. Food security remains a serious issue in many countries and the UN's Food and Agriculture Organization (FAO) has estimated that there are still 805 million chronically hungry people in the world⁵.

There are still **805 million** chronically hungry people in the world

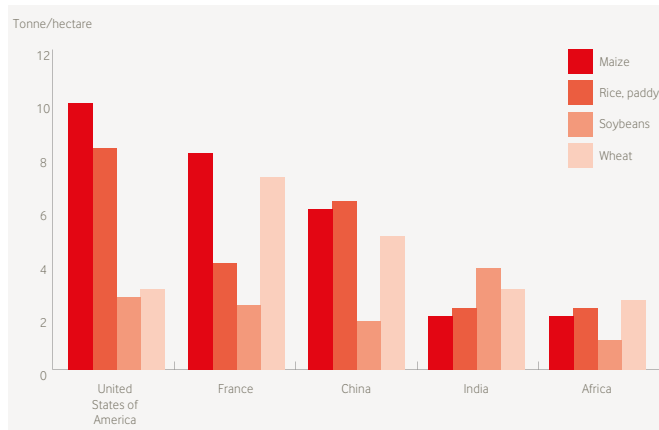
The Organisation for Economic Co-operation and Development (OECD) and FAO have identified a number of challenges that the agricultural sector must overcome to help meet growing demand for food⁶. These include:

- ◆ **Changing land use and availability:** increasingly agriculture will need to compete with urban settlements and industrial developments for land. Land availability for food production will also continue to be squeezed by demand for other agricultural produce, such as the use of crops for biofuel. In countries such as India, landholdings are also becoming more fragmented.

- ◆ **Growing water scarcity:** demand for water is expected to grow by 55% by 2050⁷ and, by 2025, two-thirds of the world's population could be living in water-stressed countries. Water use for irrigation and food production accounts for 70% of global water withdrawals and can exceed 90% in some emerging countries, meaning the availability of freshwater will be an increasing challenge⁸.
- ◆ **Climate change:** farmers will need to adapt to increasing temperatures and changing weather patterns that can reduce yields, degrade soil quality and interrupt growing cycles, making farming less resilient and productive.
- ◆ **Food wastage:** around one-third of all food produced around the world is lost or wasted through the supply chain, a staggering 1.3 billion tonnes per year⁹. Reducing waste could significantly improve availability.

In emerging economies farmers often face many additional challenges in improving productivity and livelihoods. These range from lack of access to vital information, resources and financial services to barriers such as low levels of mechanisation and poorly developed infrastructure. These issues all contribute to comparatively lower yields in many emerging markets.

Comparative yields, 2013



Source: FAOSTat, UN FAO Statistics Division, <http://faostat3.fao.org/download/Q/QC/E>

Overcoming these challenges is critical, since most of the expansion in agricultural production needed by 2050 must come from emerging economies. The OECD and FAO, for example, have said that 75% of additional agricultural output predicted over the next decade will come from developing regions¹⁰.

Half of all people living with hunger are smallholder farmers



Agriculture and food security – challenges for developing countries

MACK RAMACHANDRAN, Head of Strategy, Performance & Risk (Procurement), UN World Food Programme

Despite great progress, there are still more than 800 million people living with hunger. Half of these are smallholder farmers, and a further 25% are people living in the same rural communities. Improving the lives of smallholder farmers is absolutely central to meeting our goal of ending hunger by 2030.

One of the main challenges is that smallholders lack access to formal financial structures and markets. Without a bank account or credit history, they can't get an affordable loan. Without access to markets for high-quality seeds and inputs, they are reliant on local supplies, often of poor quality. Together these factors conspire to limit agricultural yields and access to food.

If we can find new ways to overcome these challenges, we can empower smallholders to increase their yields and income. This is a huge opportunity. Research by the FAO shows that investment in agriculture is five times more effective in reducing poverty and hunger than investment in any other sector.

At the World Food Programme, we see technology as an absolutely critical part of the solution. With technology, we can enable communication and collaboration between smallholders and vital players like banks, input providers, buyers and aggregators. We can reduce transaction costs, making it economically viable for businesses to source from smallholders, providing more possibilities for farmers to boost their incomes. We can give smallholders the information and tools they need to break out of the cycle of poverty.

Mobile and agriculture

Mobile technology has great potential to improve agricultural productivity in emerging economies through services for small-scale farmers and agricultural businesses. Mobile products and services have the ability to deliver real-time information direct into the farmer's hand to improve traceability, quality control and logistics systems and to enable agricultural businesses to operate more efficiently.

Mobile financial services can enable farmers to receive and make payments and access financial services. At each stage of the agricultural value chain, mobile can help to improve communication and efficiency, supporting increased food production and better livelihoods.

Progress since 2011

In 2011, we published our Connected Agriculture Report exploring the potential of mobile agriculture services. The report identified four areas in which mobile solutions had the potential to help farmers and agricultural businesses to increase productivity and incomes and to deliver economic, social and environmental benefits. These were:

- **Improving access to financial services** – increasing access to financial services tailored for agricultural purposes such as mobile payments, insurance and lending platforms
- **Provision of agricultural information** – delivering information relevant to farmers, such as commodity prices and weather forecasts and advice on agricultural techniques, where traditional methods of communication are limited
- **Improving data visibility and supply chain efficiency** – optimising supply chain management across the sector and delivering efficiency improvements for transportation logistics, including through tracking systems and mobile management of supply and distribution networks
- **Enhancing access to markets** – strengthening the link between commodity exchanges, traders, buyers and sellers of agricultural produce, including through mobile trading, tendering and bartering platforms

In the four years since 2011, mobile agriculture services have expanded significantly, with a range of players involved in developing and delivering services, including mobile network operators, NGOs, niche service providers and agribusinesses. There has been particular growth in mobile information and financial services for agriculture, with a range of different business models used.

Successful services have also been developed, enabling businesses sourcing agricultural produce from small farmers to improve communication and efficiency in their supply chains. A range of funding models have been used, including subscription fees and business-to-business sales, and donor funding has played an important role in catalysing the development of new services and supporting their success in the early stages.



Designing effective mobile services

ALVARO VALVERDE, Private Sector Adviser (ICTs), Oxfam

Mobile agricultural services are becoming more valuable for development because they can increase the reach, while reducing the costs, of implementing livelihoods programmes. In agriculture they can play a key part in improving access to knowledge and farming practices and linking farmers to markets.

In designing and implementing mobile services, we have found that partnership is central to success. This avoids duplication, increases efficiencies and is more likely to promote behavioural change. Governments must be on board from the start to create the right policy environment, while the involvement of mobile network operators provides the drive to roll services out at scale. Information services will succeed or fail depending on the quality, relevance and timeliness of their content, so working with the right content providers is also critical.

It is essential to really understand the true needs of farmers and to create simple-to-use services, based on human-centred design principles. This sounds obvious but these principles aren't as widely applied as they should be.

We also need to address hidden constraints for farmers in emerging markets, including financial, cultural and technical barriers. Some of these we're just beginning to understand. For example, time constraints are a particular barrier to women working in agriculture because they also shoulder most of the burden of running their households and taking care of family members. This can severely restrict their ability to act on new information to improve their farming practices and limit uptake of mobile agricultural services.

A paradigm shift is needed to move us to a sustainable agricultural system, in which we can increase productivity while protecting the environment. For that we need behaviour change on a huge scale, from the political economy to transformation in practices. Achieving this is extremely time and knowledge intensive. Mobile agricultural services could and should play an important role in making this systemic change possible.



India: challenges and opportunities for agriculture

India is home to 1.24 billion people – one-sixth of the world's population on just 2% of its land¹¹ and its population is anticipated to reach 1.67 billion by 2020. It is one of the world's largest food producing countries, with 68% of its population living in rural areas¹². Like many other emerging markets, India has a pressing need to improve agricultural productivity and food production as its population grows. Around one-fifth of its population is malnourished¹³. However, challenges such as historical underinvestment in agriculture, rural poverty and fragmented landholdings are significant obstacles to achieving this.

Market context

India's economy and agricultural sector are in transition, with huge opportunities for growth and innovation.

The transition from rural to urban economy

In 2011, agriculture employed 45% of India's workforce, down from more than 80% in 1951¹⁴. This is anticipated to fall further to less than 35% by 2020¹⁵ as more people seek employment in India's towns and cities, driven by the prospect of higher wages. However, this still represents more than 200 million people working in the sector.

As the service and industrial sectors continue to grow rapidly, agriculture's share of gross domestic product (GDP) is in decline. However, it will remain a significant contributor at around 10% of GDP by 2020¹⁶.

Improving productivity

India has seen a significant increase in food production, largely driven by improvements in productivity resulting from increased mechanisation, greater use of irrigation and fertiliser and the introduction of high-yield variety seeds. This has been particularly pronounced in previously less productive states; for example, the Chhattisgarh, Jharkhand and Rajasthan regions improved their yields by more than 50% between 2005 and 2014¹⁷. However, productivity and mechanisation levels remain relatively low compared with developed countries and economies such as China.

200 million people will be working in agriculture in India in 2020

Growing commercialism

Increased investment in agriculture by the Indian Government and private sector has helped stimulate improved productivity by enabling increased use of irrigation and improvements in storage facilities for agricultural produce. A growing number of farmers and agribusinesses in India have seized on export opportunities, with the agricultural export market reaching almost \$40 billion in 2014¹⁸ with a focus on rice, cotton and meat. In addition, farmers are increasingly switching land area to growing cash crops, including fruit and vegetables.

Government policy supports agriculture through extension services (educational services for farmers), credit facilities and tax allowances. However, public spending on agriculture research, education and extension is relatively low at about 0.65% of agricultural GDP, compared with international averages of 2%¹⁹. The ratio of extension workers to farmers is also relatively low at 1:1,000, limiting their impact²⁰. Financial institutions, NGOs and agricultural businesses are bridging some of this gap with their own advisory services.

A number of structural challenges also remain, such as the requirement for farmers to sell produce via government-sanctioned auction markets.

Rural poverty and food security

Despite improvements in productivity, India still faces major challenges in meeting its growing population's nutritional needs. The value of food production per capita has only risen moderately and, since 2005, there has actually been a 4% decline in per capita food consumption²¹. In 2014, around 15% of the population was malnourished²² and one in every three of the world's malnourished children was from India²³.

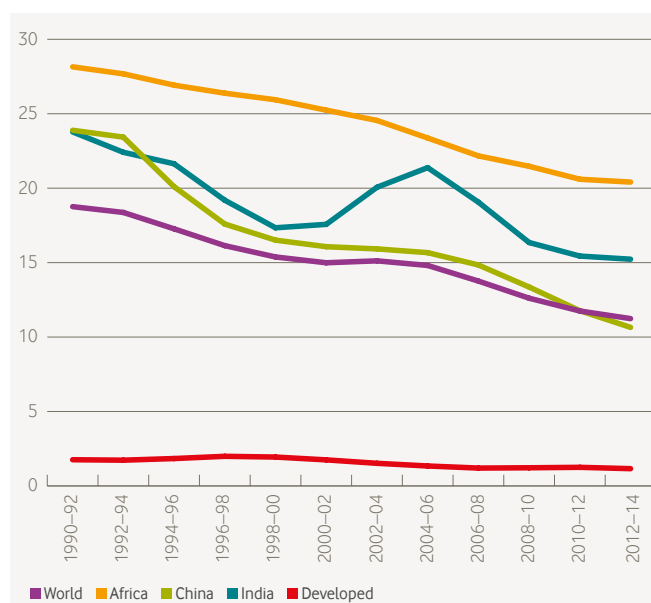
Although agricultural wages are rising, agricultural workers in India still earn significantly less than those in other professions, with average incomes for farming households at \$3.85 a day (including income from non-farming sources)²⁴.

Gender and agriculture

In India, agriculture plays a very important role in the lives of many women. More than 60% of all employed women work in the sector and in rural areas the percentage of women who depend on agriculture for their livelihood is as high as 84%²⁵. However, women working in agriculture are estimated to earn around two-thirds of the wages their male counterparts take home for the same work²⁶, with many additional women contributing unpaid labour²⁷. Up to 75% of women engaged in agriculture are illiterate, posing further barriers to improving their status²⁸. Addressing the challenges facing women in agriculture is key to addressing hunger and malnourishment²⁹.



Prevalence of malnourishment (% population)



Source: Food Security Indicators, UN FAO, <http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#VCLQ-PIdVf>

Challenges and opportunities for India

DILEEPKUMAR GUNTUKU, Global Leader – Knowledge Sharing and Innovation, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

Agriculture is becoming more and more knowledge intensive. Millions of food-insecure smallholder farmers in India could improve their yields, incomes and resilience if they had access to the appropriate information and knowledge to make informed choices about their farms.

Despite there being many forms of extension services and information and communication technology pilot initiatives, reaching out to these farmers with the right information at the right time is often still a challenge.

Mobile phone technology is addressing many of the connectivity issues affecting earlier ICT initiatives, and enabling new services such as ICRISAT's GreenPHABLET powered by the GreenSIM mobile mediated advisory services.

The continued rise of mobile phones and tablets powered by mobile SIM will create further opportunities for user-friendly information tools and enable improved agricultural advice services that inform farmers about weather, nutrients, pest and disease management, quality inputs and market access. It will create job opportunities for info-entrepreneurs who can bring crucial added value for farmers. Recent research will provide the insights for creating a sustainable backbone communication network that will improve the quality and convenience of information for smallholder farmers and provide greater transparency within value chains.

To significantly scale up this knowledge to the poor revolution, research and development organizations have to work together and support local capacity development. The knowledge revolution will be the basis for the next green revolution in India, and technology, particularly mobile, will be a key enabler.

Barriers to development

To achieve the further gains in productivity needed to feed its growing population, to pull rural communities out of poverty and to take advantage of the profitable export trade, Indian agriculture must contend with a number of challenges.

Land ownership

In India, 44% of total land is employed in agriculture. Land ownership is highly fragmented, with 62% of farmers holding less than one hectare of land³⁰. The number of marginal farmers with landholdings below one hectare has increased rapidly by 49% from 1990–2010 to a total of 92 million marginal landholdings. The average marginal landholding size is just 0.38 hectares³¹.

62% of farmers in India hold less than one hectare of land

Small-scale farming is less productive because there are fewer opportunities for economies of scale, lower levels of mechanisation and smallholders often lack access to the information they need to adopt the latest agricultural techniques, to track market prices or to access support services. Small farmers are also more reliant on middlemen.

Agriculture also faces competition for land from non-agricultural purposes, including special economic zones, housing, tribal areas and development projects³².

Water and weather

Just 34% of the population in India currently has easy access to clean, safe water supplies³³ and water scarcity is a growing problem in agriculture with the availability in India of water for agricultural use predicted to fall by 21% by 2020³⁴.

There has been a 200% increase in irrigated land in the past decade, yet 47% of farm land is still reliant on monsoon rains³⁵, leaving farmers vulnerable to unpredictable or changing weather patterns.

Market linkage

The Indian market is characterised by a large number of middlemen who play an important role in aggregating produce from small suppliers but who take a large share of the value. In this long and complex agricultural supply chain, farmers in India typically only realise a low percentage of the final price of their produce, often well below that of farmers in other countries³⁶.

Lack of infrastructure, including poor roads, unreliable logistics services and limited cold storage facilities, lead to high losses of produce after harvest and affect product quality. For example, around 40% of India's fresh fruit and vegetables, worth \$8.3 billion annually, perish before reaching consumers³⁷. A key obstacle to the proper functioning and development of cold storages and food processing industries is poor power supply in some Indian states.

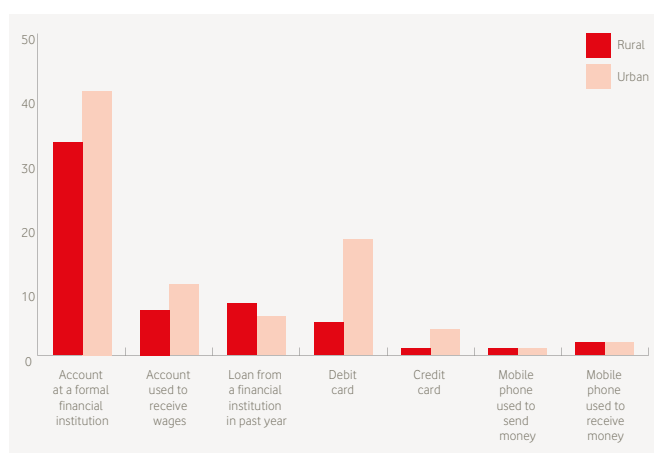
Access to finance

Only around one-third of India's rural population has a bank account and only 8% have had a loan. The figures are even lower for women, with just 25% of working age women in rural areas having a bank account³⁸.

With limited access to bank branches and ATMs in rural areas, smallholders need to travel to access loans, insurance and receive payments, causing delays and creating significant barriers to productivity.

For seasonal farmers, loans are often vital to support productivity by enabling investment, the purchase of seeds and fertilisers and to pay for labour before harvest. Lack of access to credit is a major challenge, which leaves many farmers reliant on the informal lending sector and subject to very high interest rates, often of 25%–30%³⁹.

Financial inclusion in India (% of population aged 15 and over)



Source: World Bank. <http://datatopics.worldbank.org/financialinclusion/country/india>

Mobile in rural India

India is the second largest mobile market in the world, with an estimated 405 million unique subscribers in 2013⁴⁰. Mobile ownership is not confined to urban centres, with rural India estimated to account for around half of mobile subscribers – 36% of the rural adult population⁴¹.

Around 22% of mobile users are estimated to have data connections⁴², around 110.4 million users. Smartphone usage is still relatively low compared with other countries. However, there are 111 million smartphones in use in India⁴³ and this is growing at nearly 50% every year⁴⁴.

Mobile plays a key role in enabling internet access. In rural India, 70% of those accessing the internet do so via their mobile, with rural mobile internet use growing from less than a million in 2010 to 25 million people in 2014⁴⁵.

This rapid spread of mobile technology in rural areas of India offers a new channel for delivering agricultural services and an opportunity to engage rural communities in new ways.



Introducing the six services

This report draws on the experiences gained through six services implemented by Vodafone and other organisations across different emerging markets. We have explored the current benefits of these services in increasing productivity and improving livelihoods by widening farmers' access to information and finance, tackling fraud, strengthening relationships between farmers and co-operatives, and improving efficiency for agricultural businesses and buyers.

Using real data from each case study, we have modelled what the impact could be if these types of services were rolled out at scale in India. This included looking at the number of potential users in 2020 and calculating the impact this could have on farmers. Where relevant, we have also calculated other environmental and social benefits.

	Type of service	Case study
Information services	Provides tailored agricultural information over mobile phones to the farming community.	Reuters Market Light Organisation: Reuters Market Light Location: India
Receipt services	Provides transparency in daily commodity supply chains through use of mobile registration services and receipts.	Ndumberi Dairy receipting service Organisations: Ndumberi Dairy Farmers Co-operative Society, Vodafone, USAID, TechnoServe, Safaricom Location: Kenya
Payments and loans	Integrates farmers into a registered database and enables access to loans and payments via mobile money.	Multiflower payment and loans service Organisations: Multiflower, Vodafone, USAID, TechnoServe, Vodacom Location: Tanzania
Field audit	Uses tablets to improve efficiency for auditors monitoring quality, sustainability and certification requirements.	ECOTAB Organisations: Unilever, Vodafone, Rainforest Alliance Location: Turkey
Enabling access to local markets	Enables small-scale producers to transact with local co-operatives through a buy/sell platform with integrated mobile payments.	RUDI Sandesha Vyavhar Organisations: Self-Employed Women's Association, Vodafone Foundation, Cherie Blair Foundation for Women Location: India
Smartphone-enabled services	Provides a combination of smartphone-enabled information services, with mobile payments, loans, insurance and receipting and a virtual marketplace.	Vodafone Farmers Club Organisation: Vodafone Turkey Location: Turkey

Information services

Building knowledge among India's smallholder farmers

Lack of information is a major barrier to improving yields and therefore incomes for India's smallholder farmers. Since 2007, the Reuters Market Light (RML) mobile information service has helped many farmers overcome this challenge by delivering personalised agricultural advice and news, local weather forecasts and updates on market prices direct to their phone.

In India, around 95% of farmers work landholdings of four or less hectares⁴⁶. For these farmers, getting access to the information they need to make informed decisions can be a major challenge, particularly if they have low literacy levels or live in remote areas.

With RML, farmers receive around five SMS alerts a day with information that can help them to plan their planting and harvesting, improve crop cultivation, manage pest and disease outbreaks, access government subsidies and negotiate better prices for their crops. This includes local weather forecasts and market prices, as well as advice on the latest farming techniques.

Information is provided in real time and is highly personalised thanks to RML's network of 300 agriculture specialists and content developers. Farmers can select from around 35 parameters to tailor the information to their needs, including crop type, soil type, planting cycles, farm location and choice of markets. The service covers 450 different crop varieties and has information on prices for 1,300 local markets. Users can receive the information in one of nine local languages and can also contact a multilingual call centre for support and advice.

Farmers pay a small subscription charge to use RML and can receive information alerts via SMS if they have a basic handset or, if they have a smartphone, via the recently launched myRML mobile app. RML also uses the data and insights gained on farmers, crops, markets and prices to provide commercial data and intelligence services to agribusinesses and financial organisations.

RML was incubated at Thomson Reuters and, since 2013, has been an independent company. Planned developments to the service include predictive analytics services; for example, using data to predict pest outbreaks after certain weather conditions, enabling farmers to take preventative action, or predicting crop yields and quality so buyers of agricultural produce can plan ahead. RML is also exploring how the service could use data on farmers' input requirements to enable bulk purchasing of fertilisers to reduce costs for farmers.

The RML service has been recognised for its positive impact on small farmers with awards from organisations such as the United Nations Development Programme, the *Financial Times* and India's Marico Innovation Foundation and NABARD.

Farmers using RML have increased their income by an **average 5–15%**

What's the impact?

RML reaches 1.4 million unique subscribers and covers 70% of the total farming population across 17 Indian states.

By using RML farmers have sold more of their products at markets offering higher prices. This has resulted in a

12% reduction in the price differences between markets, as many lower price markets have sought to increase their prices.

Farmers using the service have benefited from an average increase in income of 5–15%.

Service key facts

- Information service covering farming advice, weather forecasts and market prices
- Enables farmers to improve cultivation, protect crops and negotiate better prices
- Data gathered by agriculture specialists and content developers
- Funded by subscription charges for farmers and user fees for commercial enterprise customers
- Easy-to-use SMS service with a mobile app option for farmers with smartphones

“

With the information I get from RML via my mobile I can compare prices for ginger from different markets and keep track of price trends. I've been able to increase my profit by selling my ginger at the market offering the highest rate. I've also avoided losses countless times by using the RML weather information and planning spray and fertiliser applications according to the weather forecast.”

Umesh Bhosale is a farmer and ginger grower in Satara District, Maharashtra state, India. His farm covers 12 acres and supports his 12 family members.



The opportunity for India

Market context – the information challenge for India's smallholders

Lack of information about farming techniques, prices, weather and support services can have a significant impact on yield and income for smallholder farmers. In recent years, the Indian Government, NGOs and private sector input companies have increased investment in agricultural extension services (educational services for farmers) to try to bridge this knowledge gap. However, public spending on agriculture research, education and extension remains relatively low at around 0.65% of agricultural GDP, compared with an international average of 2%⁴⁷.

Most extension services rely on in-person training delivered by extension workers and it has been estimated that the ratio of extension workers to farmers is just 1:1,000, limiting their impact⁴⁸.

Growth of mobile information services

Mobile information services can be more cost effective than traditional extension services, enabling large numbers of farmers to be reached with daily information updates. There are now multiple providers of these services in India, using a range of commercial and donor funding models.

An estimated five million farmers use these services, mostly on small to medium land holdings (one to four hectares). Growth rates are strong, with the number of users increasing by an estimated 45% a year⁴⁹.

Our modelling

Our research looked at the potential impact of mobile information services for farmers in India. We modelled a service providing personalised and semi-personalised (location and crop-type specific) agricultural information via SMS and call centres. We have assumed the service would be funded by user subscription fees.

63 million Indian farmers could be using the service in 2020

All farmers with access to mobile are potential service users. The total population of farmers and labourers with mobiles in India is expected to grow from 100 million to 155 million by the end of 2020.

Our research suggests that 63 million farmers could be using mobile information services in 2020. We looked at the potential livelihood benefits for this group associated with increased yields and higher prices due to access to better information.

Livelihood benefits

Information services help farmers increase yields through better crop management and use of inputs, and enable them to identify the best time and place to sell their produce, therefore increasing incomes. Our research shows this could create additional income worth an average \$89 per farmer in 2020, representing a 15% increase in average farming income. This is a total of an extra \$5.6 billion in income for smallholder farmers. Women are likely to account for 30% of the overall users of information services, creating benefits for women farmers worth an estimated \$1.7 billion. With such large numbers of users, the benefits of the service could provide a significant boost to rural Indian economies.

\$89 a year additional income per farmer in 2020, a 15% increase in average farming income

Environmental benefits

Our research showed that by implementing best practices as a result of access to better information, farmers could reduce the amount of fertiliser and water used on their farms per unit of agricultural output. This could reduce fertiliser use by one million tonnes in 2020 and save 26 billion m³ of water – representing 3.3% of all current fresh water withdrawals in India.

The value of information services

PREMPRAKASH SABOO, CHIEF FINANCIAL OFFICER,
REUTERS MARKET LIGHT (RML)

Farmers in India get only 20–25% of the price of their final produce compared with 40–50% in the developed world. The lack of timely and reliable information around critical factors such as market prices, localised weather forecasts, government schemes and sources of finance and productivity tips is a major contributing factor.

Mobile information services can help farmers overcome this challenge and successful services have been shown to have a direct impact on farmer livelihoods by increasing their incomes and reducing costs. To be effective, an information service needs to be personalised based on a wide range of factors like location, crop, practice preference, mechanisation level, irrigation type, farm size and soil type. Quality of information is key and scale is needed to make delivering this type of information commercially viable.

We have seen huge growth in mobile information services in India, and we are now starting to enter the next phase of innovation with services that enable key transactions such as buying inputs and selling produce. In addition, as rural smartphone usage grows there is great potential for mobile internet to make doing business even easier for farmers.

Looking ahead

Success factors

To successfully scale up services like RML, providers must make sure that information is sufficiently tailored to the needs of individual farmers and is accurate and reliable.

Farmers need to see the direct income benefits to encourage take-up and ensure continued use of services. This is particularly important for marginal farmers and women farmers, whose incomes are typically lower than their male counterparts, and where affordability of subscription costs may limit uptake.

Challenges to scale-up

The core challenge for scaling up information services is the need to fund the collection of high-quality data while remaining affordable for smallholder farmers. Low literacy levels in rural India and the large number of local languages used can also be barriers to the take-up of information services.

Future opportunities

Information services have the potential to generate further impact through increased specificity of information tailored to the needs of individual farmers. However, scale is required to help fund the cost of this data collection and analysis. Creating service bundles combining information services with other types of services for farmers could help to improve profitability.

As providers capture more data on farmer performance, they can begin to offer new services. This could potentially include predictive analytics services, for example, predicting pest outbreaks after certain weather events and encouraging farmers to take preventative action or predicting future crop yields and quality for buyers. Data could also be used to inform the development of insurance and financial products or to enable the bulk buying of inputs based on aggregate demand.



Receipt services

Boosting incomes for dairy farmers

Mobile receipting has enabled small-scale dairy farmers in Kenya's Ndumberi region to raise their incomes by improving efficiency and eliminating fraud in the local dairy supply chain. The service has also enabled the local co-operative to cut costs and increase daily milk supplies.

The Ndumberi Dairy Farmers Co-operative Society in central Kenya has more than 5,000 members, mostly small-scale farmers owning 1 to 10 cows. Milk is brought from the farms to local collection centres each day, usually by farm workers, with deliveries logged by the co-operative's auditors.

Fraud and losses were a major concern with just 8kg of milk recorded at collection centres for every 10kg of milk leaving members' farms, meaning loss of important income. It can be challenging for farmers to spot fraud since they often do not make milk deliveries themselves and, while deliveries are made daily, receipts are usually issued just once a month. Now a mobile receipting pilot project has transformed this situation.

The service was developed by the Connected Farmer Alliance (CFA), a public-private partnership between Vodafone Group, the US Agency for International Development (USAID) and not-for-profit organisation TechnoServe. CFA seeks to promote commercially sustainable mobile agriculture solutions and increase productivity and revenues for 500,000 smallholder farmers across Kenya, Tanzania and Mozambique. In Kenya the service is being supported by Safaricom.

Now when milk is delivered to collection centres, the quality and quantity is logged on to a web portal. Within 24 hours, farmers receive a receipt by SMS, indicating the quantity of milk received that day and the monthly total, making it easier to track what they have sold and to identify losses. A central customer care function has been created, with farmers able to call a telephone hotline with questions or complaints, allowing the co-operative to log customer feedback and respond more quickly.

All 1,885 farmers in the pilot are registered on the web portal, meaning the co-operative and its partners can analyse farm data and easily communicate with members via mobile. This has included providing tailored advice to farmers on the use of inputs and keeping farmers updated with information on prices and training courses. The co-operative can also track credit payments made to farmers and monitor whether loans are being repaid.



Service eliminated fraud previously causing loss of **20%** of daily milk supplies

What's the impact?

Since it began in September 2013, the pilot has had a significant impact. SMS receipts mean that theft or fraud is easy to spot and those responsible have been quickly identified.

A total of 431,000 SMS were sent during the first year, including daily receipts, information updates and event invitations. Farmer attendance at training sessions and meetings has significantly increased with, for example, a 25% rise in attendance at the co-operative's AGM.

The new system has increased loyalty to the co-operative because farmers

are more confident that they will receive the right price for their milk and are getting more value from their membership due to better information and access to training. The number of farmers regularly supplying milk increased from 810 to 1,900 during the course of the project and there was a 9,000-litre increase per month in milk deliveries. The co-operative has been able to reduce its operating costs by 40%, enabling it to spend more time on farmer advisory services. A contract has now been signed to run the service on an ongoing basis.

Service key facts

- Mobile receipting and auditing system
- Prevents fraud and improves communication between co-operatives and their members
- Suited for high-frequency produce like milk, fish, poultry, eggs, vegetables and flowers
- Works with a basic mobile handset
- Can be integrated with mobile payments and other financial services

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I've been a dairy farmer for 15 years and look after the cows with my wife. Joining the Connected Farmers programme has made a big difference to us. Previously, our workers were stealing a lot of milk, selling it for themselves rather than delivering it to the co-operative collection point. Now I get an SMS message each day confirming my morning and evening sales. I'm always up to date and my workers can no longer steal milk. We also receive other useful information on farming practices from the co-operative via SMS that is helping us too. Our sales have gone up, which has benefited our family.”

Peter Waweru Ndirangu is a dairy farmer in Ting'ang'a, Kiambu County, Kenya



The opportunity for India

Market context – a need for receipting and auditing services

Supply chains for daily commodities in emerging markets are often inefficient and complicated, with many opportunities for loss and theft, particularly in the initial stages of collection and distribution. This often means loss of income for both farmers and co-operatives. In addition, when levels of fraud are high, farmer loyalty may be affected, resulting in them supplying less of their produce via the co-operative.

The Indian dairy sector

India is the world's largest producer of dairy products by volume, accounting for more than 13% of the world's total production⁵⁰.

It is estimated that up to 50% of Indian dairy farmers are employed by the organised sector, selling their produce to large buyers and co-operatives⁵¹. This leaves almost 60 million low-volume dairy farmers currently outside this organised sector.

Improving transparency and reducing fraud through the introduction of mobile receipting services could encourage more farmers to sell milk via the organised sector and to benefit from this reduction in losses.

Our modelling looked at this group, a predicted market of 45 million farmers with mobile access in 2020, and assessed the livelihood benefit from reductions in fraud and theft.

Livelihood benefits

Our modelling found that this type of service could reach one million Indian dairy farmers in 2020. This could save \$271 million for farmers in 2020 through a reduction in fraud. This means an annual saving worth \$260 per farmer in 2020, representing a 25% uplift on their original dairy income.

\$271 million livelihood benefit in 2020

Efficiency and output benefits

Co-operatives using mobile receipting would benefit from more efficient back-office processes and increased supplies of milk resulting from greater loyalty among co-operative members due to a reduction in losses and fraud.

Our modelling

Our research modelled the potential impact of mobile receipting services on the Indian dairy sector based on the Ndumberi model. This includes farmer registration on a web portal, the use of SMS receipts for daily deliveries and SMS notifications for training events and price updates. We have assumed services would be funded via SMS and subscription charges.

\$260 annual saving per farmer in 2020, a 25% uplift on their original dairy income

Many Indian co-operatives already use daily printed receipting systems and mobile receipting could further improve efficiency for these organisations. However, its most significant impact would be the elimination of fraud and losses for farmers currently in the unorganised sector who join a co-operative following the introduction of mobile receipting.

The role of public–private partnerships

JUDITH PAYNE, ICT ADVISOR FOR AGRICULTURE, BUREAU OF FOOD SECURITY, US AGENCY FOR INTERNATIONAL DEVELOPMENT

Mobile is increasingly essential to our work in agriculture and development and is a key means for our implementing partners to equip smallholder farmers with the tools, skills, resources and linkages needed to improve their livelihoods. It is used in a wide variety of ways from improving agriculture extension services, to the use of sensors to control irrigation or monitor the weather in remote locations, paying farmers faster, and receiving feedback from them. With even basic mobile technology we're now able to reach 100,000s of poor smallholder farmers in developing countries and make a difference in their lives.

Partnership between the public, private and NGO sectors is vital to everything we do at USAID and plays a key role in delivering successful mobile services for agriculture. Our private sector partners bring market access, cutting-edge business practices and innovative insights to the development table. Collaboration advances the impact of our projects, leverages private sector investment in emerging economies to support development and fosters private sector-led growth, which is fundamental to reducing poverty, fighting hunger and improving nutrition.

Successful initiatives, such as the Connected Farmer Alliance (CFA), show the impact partnership can have. The CFA has used public and private funds to enable the development and testing of new models and approaches to providing services to smallholder farmers. Long-term sustainability has been built into CFA from the outset so that when our role comes to end, we can be confident that the services will continue.

Looking ahead

Success factors

A lack of transparency and potential for theft in agricultural supply chains mean significant growth potential for mobile receipting systems. Market expansion will also be dependent on the development of attractive pricing offers for co-operatives.

Buy-in from the co-operative senior management team is important. A key success factor at Ndumberi was the commitment of the Ndumberi Dairy Farmers Co-operative Society's executive board, led by the chairman, who instituted a monthly review meeting to ensure the organisation was fully engaged in the project.

Challenges to scale-up

Education and change management among farmers, labourers and co-operative workers will enable successful scale-up. The service is not complex to use, but lack of familiarity with technology and resistance to change are potential obstacles to growth.

Mobile solutions may need to integrate with digital and paper-based weighting, analysis and receipting systems already established in India.

Future opportunities

Mobile receipting can be integrated with other services that add value for farmers and co-operatives, including mobile payments and financial services, and can be used for improving traceability and quality control processes. Co-operatives could also integrate marketplace solutions, enabling them to aggregate demand for input products and negotiate a better price for their members.

The current model targets fraud in just one stage of the supply chain and could be extended to address losses at other stages. For example, there is potential to incorporate a tracking and loading module to improve transparency around logistics and enable the weight of trucks to be measured on loading and arrival.



Payments and loans

Mobile credit enhances productivity and cuts costs

Access to mobile loans and payments is enabling flower farmers in Tanzania to improve efficiency and reduce time and money spent travelling. The new service is also benefiting Multiflower, a local agriculture business, through more efficient quality control and auditing and a reduction in travel and security costs.

Multiflower is a successful flower seed and cuttings business based in Arusha in northern Tanzania, exporting its products to European markets. It sources from 3,500 contract farmers spread over a 150-kilometre radius.

Many suppliers to Multiflower do not have bank accounts but often need a loan at the start of the growing season to buy inputs and pay workers. To receive their loan or to get paid for their crops they must travel to Multiflower's head office and receive payment in cash. For farmers, this can mean delays in getting paid, as well as time and money wasted on travel and cash flow issues. For Multiflower it means costs and security risks from holding significant cash volumes on site during payment periods.

With its suppliers spread over such a wide area, communication can also be challenging and this has proved a block to Multiflower further expanding its supply base.

A pilot project developed by the CFA, a public-private partnership between Vodafone Group, USAID and not-for-profit organisation TechnoServe, is addressing these problems.

The service, run by Vodacom (a Vodafone operating company), enables farmers to receive loans and payments via their mobile. Farmers are now registered on a central database, enabling Multiflower agents to submit loan requests via mobile from the field and get quicker head office approval. Farmers receive their loans and get paid for their crops via the M-Pesa mobile payment system, saving time and money and reducing risks involved in handling cash. Multiflower can more easily track loans and repayments, deduct any amounts due when paying farmers for their crops and issue SMS receipts.

Behind the scenes, the service also provides a more efficient audit and quality control process for the company. Multiflower staff can use the system to log the quality and quantity of produce and the results of quality control tests. Multiflower can provide better feedback to farmers on their produce and use the audit data in its planning. It can also communicate with farmers more easily, keeping them updated on training and events.

\$74,000 in mobile payments and loans made to farmers during the pilot

What's the impact?

304 farmers took part in the pilot, accessing loans averaging \$70 per farmer. Total loans and payments made via M-Pesa were worth \$74,000.

Timely access to credit can enable farmers to purchase fertiliser and other inputs to improve yields, and the service can make it easier to obtain loans meaning less need to rely on high-cost lenders.

Previously, each trip to Multiflower, to receive payments and loans took an average of eight hours and cost around \$12. Now farmers incur only minor costs when withdrawing cash from a mobile money agent.

Multiflower achieved time and cost savings from needing to make fewer trips to the field, reduced security costs because fewer payments are made in cash and efficiency savings from a reduction in time spent processing payments and loan requests.

Service key facts

- Mobile payments combined with quality control and audit system
- Enables agribusinesses to provide loans and pay farmers in their supply chain
- Suited to a range of farming businesses, including seasonal crops and daily commodities
- Farmers can use the service with just a basic handset

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The M-Pesa payment system is very good because money comes to me wherever I am. It's a very good system that has brought farmers a lot of benefits. I do not have to travel all the way to Arusha to collect my payment as this is sent to me at home. I can also withdraw and spend my money according to my plans.”

Barbina John Bherehi, farmer in Karatu, Tanzania

The opportunity for India

Market context – cash flow and credit

Cash flow management is a challenge for many farmers of seasonal produce in emerging markets. Farmers need relatively large quantities of cash to pay for inputs and labour at the start of the growing cycle but must wait to be paid following the harvest.

In India, high levels of debt and servicing costs place a large burden on smallholder farmers. Farmers are heavily reliant on access to credit, with debt accounting for around 80% of total capital investment each year⁵².

While efforts are being made to increase financial inclusion, only around a third of India's rural population have access to a bank account⁵³ and, with many farmers living in remote areas, use of informal debt providers is common, resulting in high costs of borrowing. Interest rates on these types of loans are typically 25%–30%⁵⁴, making finance a significant cost.

Farmers also face significant travel costs and cash-handling risks due to time spent travelling to banks and to buyer premises and processing centres. Crime and poor education about cash management have an impact on the amount of income that gets reinvested into farming.

Our modelling suggests that, in 2020, around 420,000 farmers could be using mobile loans and payments, with significant benefits for both farmers and the businesses they are supplying.

Livelihood benefits

Our research shows that there is potential to significantly impact the lives of smallholder suppliers through the provision of mobile payments and loans. This benefit could be worth \$292 million a year in 2020 for this group of farmers, equivalent to \$690 per farmer. This represents a 39% increase in average farming income.

This benefit includes the impact of farmers being able to increase their yields because of timely access to credit for fertilisers and other inputs, savings on interest rate charges from reduced use of informal lenders and reduced travel costs⁵⁵.

Efficiency and output benefits

Our research shows that access to credit to buy inputs can catalyse improvements in productivity, with the potential for farmers who were previously unbanked to increase their yields by around 50%⁵⁶.

Agricultural businesses using these services will gain from access to increased supplies of high-quality crops, as well as a potential \$28 million annual saving from reduced cash handling, office and administration costs.

Our modelling

Our research modelled the impact of mobile loans and payments for contract farmers in India based on the service used by Multiflower. This includes the ability for the buyer to approve and make loans and payments remotely and for farmers to access loans and payments and to make repayments using mobile money via a basic mobile handset. We have assumed the service would be funded by an annual licence fee and transaction fees from mobile payments.

\$690 annual livelihood benefit per farmer in 2020, a **39% increase** in average farming income

Our research shows this type of service generates most impact in seasonal markets where farmers have high one-off delayed payments for produce; for example, seasonal crops such as maize, wheat and corn. In India, there is an estimated potential market of almost 700,000 farmers growing seasonal crops under contract from large-scale agribusiness who have access to mobile.

\$28 million cost saving for agribusinesses in 2020

Environmental benefits

The service could save 178,000 tonnes of CO₂ a year due to farmers not needing to travel by bus to collect loans and payments.

Versatility of mobile for different supply chains

MICHAEL ELLIOTT, PROGRAM DIRECTOR, TECHNOSERVE

Given the opportunity, hardworking men and women in even the poorest places can generate income, jobs and wealth for their families and communities. For smallholder farmers in developing countries, it is increasingly technology that provides the opportunity – because it provides the link to information, capital and markets.

Mobile services like those being developed through the CFA enable communities to use technology to change their lives. What's particularly exciting is that these services can be tailored to all types of agricultural supply chains and market contexts, and can help tackle a wide range of efficiency, productivity, quality and traceability challenges. When it comes to agriculture, one size does not fit all so having this versatility is vital.

Versatility comes with a cost, and the challenge we face is a common one – how do we provide solutions that work for a variety of businesses and value chains, while maintaining high levels of reliability and service? Mobile cloud-based platforms are one solution. By leveraging a mature set of core services, they deliver high levels of reliability and scalability. And because they are customisable, they can be tailored to fit the unique needs of agribusinesses.

Now mobile operators and their technical partners must invest in their capacity to sell and deliver these services, which requires a simplified go-to-market approach focused on the end-customer experience, so they can be rolled out more widely.

Looking ahead

Success factors

To scale up these services successfully, it is important that the attractiveness of mobile money services exceeds that of traditional banking providers and that these benefits are clearly communicated to farmers. The right regulatory framework for mobile banking services is needed to allow farmers without bank accounts to access mobile loan and payments.

In addition, a strong training and change management strategy will help to drive trust among farmers and to make sure that uptake and continued usage is high.

Challenges to scale-up

The technical reliability of the system is critically important as problems such as delayed payments could have a significant impact on farmers' attitudes to the service. Outreach to farmers is key and field officers play a vital role. They will need the right training and support, particularly as services evolve and become more complex.

Future opportunities

Farmer registration, loans and payment services like those used at Multiflower provide a strong basis for developing integrated services and platforms to support contract farmers. They could be bundled with information services and marketplace solutions that could enable farmers to group together to bulk buy inputs. Access to insurance could also be included, potentially increasing the resilience of farmers to drought and other major risks.



Field audit

Improving supply chain efficiency and auditing

Unilever's Lipton tea brand has improved efficiency in its Turkish supply chain with a mobile auditing application. By making it quicker and easier to monitor farmer performance, Lipton can support farmers to improve their practices and bring more producers into its sustainable tea supply chain. This will enable more small-scale producers to access premium markets for certified produce.

Lipton aims to reduce its impact on the environment and to improve the livelihoods of tea farmers. It sources its tea from producers that have been certified by the Rainforest Alliance for meeting high social and environmental standards, with a goal of 100% certified tea in teabags and teapot bags by the end of 2015 to meet growing consumer demand.

In Turkey, the world's fifth largest tea producer, Lipton has more than 15,000 tea suppliers, mainly smallholder farmers. It previously used a cumbersome paper-based auditing system to monitor standards and to check its farmers were meeting Rainforest Alliance criteria. With each auditor needing to cover a thousand farmers, the system was time-consuming and inefficient, with paper records needing to be retyped then archived on return to the office.

Now ECOTAB – a mobile auditing application developed by Vodafone and Unilever working with the Rainforest Alliance – has significantly improved efficiency. With ECOTAB, field auditors have been provided with and trained on the use of tablet devices. They input audit data directly into a central database from the field, via easy-to-use forms on the ECOTAB app. Audit results are uploaded quickly and can be tracked in real time.

Soil sampling and analysis to optimise fertiliser usage and reduce the environmental impact of excess application of fertilisers is key to monitoring compliance with Rainforest Alliance standards. Samples are collected by field auditors and sent to the lab for analysis. Previously, the tracking process was inefficient, with paper labels that often came unstuck and the need for auditors to manually input data. With ECOTAB, the auditor takes the sample and creates a digital label using GPS coordinates. The sample can be tracked with one unique digital ID, removing the need to input data manually and reducing the opportunity for samples to be lost or mislabelled.

The ECOTAB application was recognised as Best Business-to-Business Partnership by the Ethical Corporation's Responsible Business Awards in 2013.



With ECOTAB, auditors **saved one day per week** by eliminating paper records

What's the impact?

With auditors inputting data directly into the app, there is less opportunity for error, so data quality is better and staff can monitor trends on a daily basis.

By eliminating paper records, auditors save one day a week previously spent on administration. Communication is more efficient and farmers can respond more rapidly to auditor recommendations, reducing the time taken to improve practices on the farms.

Over time, these improvements will enable Unilever to engage with more farmers. As they expand their certified supply chain more small farmers will benefit from the improved yields and reduced environmental footprint received by becoming Rainforest Alliance certified.

Unilever is exploring opportunities to extend the service to other markets including Kenya.

Service key facts

- ▶ Mobile field auditing system that reduces paper work and improves data quality
- ▶ Enables auditors to reach more farmers across the supply chain
- ▶ Suited to high-value commodities like tea and coffee
- ▶ Improves monitoring of supply chain social and environmental standards
- ▶ Reduces audit costs, enabling more small-scale suppliers to access markets for certified produce

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With the application that was developed for our exclusive use, Vodafone enabled the instant and online streaming of data. Our auditors no longer need to come to the centre to enter the data from paper records to the system. We have transitioned to digital media from on-paper media. This provided us with a saving of about 20%.”

Toloy Tanrıdağlı, Food Marketing Director, Unilever

The opportunity for India

Market context – a growing demand for field auditing

Agribusinesses and consumer goods companies are increasingly focused on the quality and sustainability of agricultural produce, leading to a rise in field auditing and testing. This is particularly important where buyers need to ensure compliance with certification standards such as Fairtrade and Rainforest Alliance, a large and growing market. For example, global Fairtrade sales were worth €5.5 billion in 2013, while the Rainforest Alliance now works with more than 980,000 farms globally and accounts for 14% of global tea sales.

Audit programmes can be labour and cost intensive, particularly where buyers are interacting with small farms spread over a wide area. Paper-based systems are inefficient and lack of real-time data can impede supply chain planning and stock control.

Tablet-based apps and mobile services offer the potential for improved transparency and efficiency. By reducing the cost to audit small suppliers, they can enable buyers to source from more small-scale producers, giving more farmers access to premium markets for certified produce.

Tea and coffee production in India

Mobile field audit services can be particularly impactful in high-value commodity markets such as tea and coffee.

India is one of the world's largest tea and coffee producers. A growing portion of tea and coffee produced for export has been certified as sustainably produced by one of the major certification schemes, and the domestic market for certified tea and coffee is also increasing. In total, around 20% of tea produced in India is certified.

With 480,000 small-scale tea and coffee growers in India, often in remote areas, the field auditing and traceability processes required for certification can be challenging.

Our modelling

Our modelling looked at the potential impact of services like ECOTAB for agribusinesses and small-scale growers of tea and coffee in India. We modelled a service with two key elements:

- User input data: auditors inputting survey data directly into tailor-made forms on a tablet app during inspections to improve accuracy and efficiency
- Automated data: the gathering of information such as location, altitude and direction by the tablet device, which is integrated into audit reports

The research assessed the livelihood benefit from more farmers being able to participate in certified supply chains due to increased auditing efficiency and reach. We have assumed that the service would be funded by licence fees.

\$612 a year additional income per farmer in 2020, a 12% increase on average farm income

Livelihood benefits

Our research suggests mobile field audits could reach 215,000 Indian tea and coffee farmers in 2020. Only 20% of these farmers are currently estimated to be members of international certification schemes, so this level of deployment could bring an additional 172,000 farmers into certified supply chains in 2020.

\$132 million livelihood benefit for farmers in 2020

These farmers would benefit from an estimated uplift of at least 5% in the value of their produce from certification. This is due to the price premium potentially achieved on certified produce, as well as reduced operating costs and improved quality⁵⁷. This equates to a total livelihood benefit of \$132 million in 2020, a significant \$612 a year additional income per farmer. This represents a 12% increase in average farm income.

Demand for certified products is on a strong growth trajectory and access to this market is likely to enable farmers to further improve their livelihoods over time.

Buyer efficiency and output benefits

Our modelling indicates that buyers using mobile field auditing can expect to make savings worth around \$200,000 a year for each deployment in 2020 through faster data collection, reduced errors and improvements in back-office efficiency. Traceability will also be improved with buyers better able to track produce from farm to factory.

Business benefits of mobile agricultural services

CHRIS BRETT, SENIOR VICE PRESIDENT, HEAD CORPORATE RESPONSIBILITY & SUSTAINABILITY, OLAM INTERNATIONAL LTD

Olam sources from 3.9 million smallholder farmers around the world and these farmers play an essential role in many of our key supply chains. However, connecting to such a fragmented supply base is a major challenge, which makes it harder to improve productivity, monitor quality and ensure traceability.

Mobile technology is now providing a bridge, bringing us closer to small farmers and creating mutual benefits for them and our business. The impact on efficiency is huge. Now if we want to invite farmers to a meeting we just send them a text. Previously, field agents would have to spend a week travelling to get the same result. Before we had to move large sums of money to pay for crops, now farmers can get paid via their mobile without leaving the farm. This is better for them, more cost effective for us and eliminates the security risk from cash handling. What's more, financial transactions are recorded so we have a clear idea of each farmer's credit history and cash flow, which makes it easier for them to get loans.

This is just the start. Over the next five years, we will see mobile bring further efficiency and productivity gains and enable the emergence of new services that achieve outcomes not previously possible.

Looking ahead

Success factors

The roll-out of services like ECOTAB is dependent on auditors having the technological literacy to use the system and to deal with any issues that arise. Agribusinesses and/or certification schemes may need to invest in training to ensure successful implementation.

A simple interface is needed to minimise the risk of mistakes being made during data entry.

Challenges to scale-up

The system needs to be customised to each commodity, survey situation and supply chain and across different languages. This can lead to higher development and implementation costs that could be a barrier for lower value commodities.

To achieve the full benefits of the service strong mobile coverage is required, without which data can only be uploaded when the auditor has returned from the field, reducing the positive impact on efficiency.

Future opportunities

These services could be extended to other commodity crops such as spices and cocoa and used in non-certified supply chains where buyers need to monitor compliance with their own quality or sustainability standards. Mobile field auditing could also be integrated with Enterprise Resource Planning systems to enable better stock management and analysis.

The service generates data on yields and produce quality across large numbers of farms. This could be used for enhanced planning and predictive analytics services (for example, using data to predict future crop yields and quality for buyers). Analysis of the data could lead to identification of best practices and high-performing varieties and allow buyers to track individual farmer performance.

Mobile field auditing could be integrated with mobile payments, credit and receipting services. The extensive database of farm information could be used in credit checks and affordability assessments for mobile credit services.



Enabling access to local markets

Connecting producers and retailers to boost local economies

The Rural Distribution Network (RUDI) is a unique network of women retailers selling farm produce to 1.1 million households in India's Gujarat and Rajasthan states. In 2013, SEWA, the co-operative that runs RUDI, introduced mobile ordering and payments for its retailers, enabling them to cut travel time and boost incomes. Now it plans to further strengthen its supply chain by introducing mobile services for its smallholder farmer members.

SEWA, the Self Employed Women's Association, established RUDI in 2004. It aims to improve farmer and retailer livelihoods by creating local markets for produce from smallholder farms and gives rural communities access to quality produce at competitive prices. Today the network includes 3,000 women retailers, known as RUDIbens, who buy farm produce to sell to customers in their local communities under the RUDI brand.

Previously, many RUDIbens had to travel long distances to place orders and collect stock. Journeys were frequently wasted because not all the produce required was available once they reached the warehouse. Now the introduction of an SMS-based ordering system means they can check stock levels and submit orders by SMS and have their produce delivered to them, saving time and money. The system, developed through a collaboration between SEWA, the Vodafone Foundation in India and the Cherie Blair Foundation for Women, also enables RUDIbens to record their transactions, track sales and reduce paperwork.

RUDI produce is purchased from a network of 15,000 smallholder farmers and brought to local distribution centres for sorting, processing, packaging and labelling. Managing stock levels and orders with this large network of farmers can be challenging.

SEWA is now working with the Vodafone Foundation to explore how mobile services can be extended to improve communication with its network of smallholder farmers. This will enable orders to be placed with farmers by mobile and paid for using the mobile payment system M-Pesa. The system will be integrated with current stock management systems and be designed to improve efficiency in the transportation of produce between the farms and processing centres.

The new service will also enable RUDI to improve its data on the number of farmers in its supply chain, the size of their landholdings and the quality and types of produce they supply, and to provide farmers with information and advice on weather, prices and crops, helping them to increase yields and sell their produce for a better price.

RUDI aims to reach 15,000 farmers with the new system by 2017.



15,000 farmers supplying RUDI stand to benefit from mobile ordering and payment

What's the impact?

The introduction of mobile ordering for 2,500 RUDIbens has had a significant impact, with RUDIbens able to increase their income by up to 300% through reductions in travel time and improved efficiency. RUDI has eliminated inefficiencies that previously contributed to lost sales worth up to 20% of revenue.

Extending the system to farmers will improve communication and create a more integrated supply chain. It will also enable farmers to extend their customer base and benefit RUDI and the RUDIbens through more reliable supplies of produce.

Better access to information and market prices will help farmers increase their yields and income, while RUDI will be able to streamline many processes. Anticipated benefits include an improvement in transport efficiency due to more intelligent routing between farms and the processing centre, improvements in stock management, more efficient office administration, a reduction in cash-handling expenses and a lower risk of fraud.

Service key facts

- Mobile ordering and payment system
- Enables local retailers to order their produce via SMS
- Extended service will allow orders to be placed with farmers via SMS and paid for using M-Pesa
- Expected benefits for stock management and intelligent routing

“

I have a small farm and grow lily flowers as well as crops like wheat and millet. Before I couldn't keep in touch with all the markets so I bought a mobile phone with my savings. Now I can continuously be in touch with the flower markets at Ahmedabad and Vadodara. Every morning at 6 am I get the prices of lily flowers and I take orders based on that.

Since getting my mobile phone I have also become a RUDIben entrepreneur. Through the Rudi Sandesha Vyavhar application on my phone I send customer orders to the processing centre and keep track of my sales, inventory and earnings. The processing centre gets the orders ready and I can deliver them to my customers on time. So my customers are satisfied and I have increased my customer base.”

Kapilaben Bhailalbhai Vankar is a small farmer and RUDIben retailer in the Anand district of Gujarat. Since her husband died she has been solely responsible for farming, her retail business and educating her three daughters.



The opportunity for India

Market context – Indian smallholders and co-operatives

Marginal farmers, producing crops from less than one hectare of land, make up 62% of farmers⁵⁸ in India and the number of smallholders is growing as landholdings become more fragmented. These farmers typically achieve low prices for their produce due to a lack of access to market, inability to transport their produce readily and reliance on middlemen. Low incomes and limited access to credit restrict their ability to invest to improve productivity.

Co-operative membership can give farmers a more secure market for their produce, as well as access to information and support. The Indian Government has established the National Co-operative Farming Advisory Board to promote co-operative farming in the country and already 20% of all rice and wheat produced in India is bought by co-operatives⁵⁹. However, there is considerable scope for improving the efficiency of co-operatives and their supply chains, which would enable more small farmers to benefit from co-operative membership.

Mobile services can support integration in local supply chains, improving communication between small-scale farmers and co-operatives. This would allow greater price certainty for farmers, improve efficiency and support development in rural economies.

Our modelling

Our modelling looked at the impact of using mobile technology to better integrate farmers into the supply chain of local agricultural processing co-operatives. The service type modelled included: a sales platform enabling co-operatives to place orders via SMS; aggregated collection and distribution of produce between farms and processing locations; and mobile payments for farmers.

This service would be most suited to small and medium-sized producers who have access to a mobile phone and who sell their produce to the local co-operative – an estimated potential market of around 13.5 million farmers in 2020.

Our research found that 65,000 farmers could benefit from the mobile service in 2020.

Livelihood benefits

This local markets access service could increase livelihoods for farmers in two ways: by increasing the value of their crops due to co-operatives paying fair prices and farmers being less reliant on middlemen; and from cost savings from less time spent travelling to deliver produce or receive payment. We estimate that this service could generate increased income for farmers worth

\$17 million in 2020. The majority of the benefit comes for farmers joining co-operatives for the first time. This service is estimated to be worth an additional \$271 a year in income per farmer, which represents a 46% increase in the average farming income.

\$271 a year additional income per farmer in 2020, a 46% increase on average farming income

More opportunities for women

Beyond the impact for farmers, under the SEWA RUDIbens model, this service can catalyse significant additional benefits for women by creating jobs through the local supply chain. Each farmer supports around 0.5 female retailers to sell their produce and each rural retailer requires approximately four other female workers in the supply chain to undertake a range of jobs, including to: procure, load, process and pack produce; undertake quality inspections; lead sales promotions; and provide back-office support.

Our modelling shows that rolling out the service using the SEWA RUDIbens model would support an additional 180,000 jobs for female workers in the supply chain, including 36,000 retailers. This in turn would generate income for these workers of \$59.5 million in 2020.

180,000 additional jobs for women in the supply chain in 2020

Efficiency gains and environmental benefits

The service would enable co-operatives to operate more efficiently and benefit from a more integrated supply chain and more reliable supply of produce to support the downstream retail network. Co-operatives could save up to \$1 million a year by avoiding expenses and losses associated with cash handling.

The service could save 4,000 tonnes of CO₂ a year from farmers making fewer trips to sell produce or to collect payment.

Creating more resilient rural economies

REEMA NANA VATY, DIRECTOR, SELF EMPLOYED WOMEN'S ASSOCIATION OF INDIA (SEWA)

The Self Employed Women's Association (SEWA) is a member-based organisation of poor self-employed women workers. We have over 1.93 million women members across 14 states. Agriculture is a key source of livelihood for our members in rural areas.

Despite putting in long hours of work to produce food, small and marginal farmers and agriculture labourers are hampered by many different factors including having only a small marketable surplus to sell, reliance on local traders and middlemen, low market rates for their produce and lack of access to storage facilities. As a result, many are not able to provide adequate food for themselves, their children and family members. They are also more vulnerable to the impacts of economic crises and climate change.

To help improve food security for farmers and communities, we designed a Rural Distribution Network (RUDI), which now reaches 1.1 million households and provides an income for 3,000 self-employed women retailers. The institution is owned and managed by poor grassroots women and employs hundreds of poor women at every stage of the supply chain.

By integrating mobile solutions into our network, we've seen significant benefits for women retailers. The technology enables them to operate more efficiently and improve their income, which benefits their whole community and farmers in the supply chain too. Now, we want to extend the use of mobile to the farmers supplying RUDI. This will further improve efficiency across the whole value chain and contribute to more resilient local economies in rural areas.

Looking ahead

Success factors

This system could be used in any agricultural market where there is local production, processing and distribution, and strong local demand for produce. Co-operatives with downstream retail operations will be most suited to the service.

The service must be easy to use, even for those using a mobile for the first time, and customised to local circumstances and language. The co-operatives are critical partners to achieve this customisation and to deploy the service.

Challenges to scale-up

The RUDI initiative has been developed with donor funding and a key challenge with this service type is developing a self-sustaining commercial model. Incorporating a small charge for each transaction made on the platform would be one way to enable this.

Future opportunities

Deploying this service will result in large quantities of data being collected on farmer production and rural agricultural markets. There are opportunities to use this data to further extend the service to incorporate producer loans and crop insurance products and to make improvements in service delivery such as truck routing.



Smartphone-enabled services

Towards integrated, smartphone-enabled solutions

The Vodafone Farmers' Club in Turkey has generated an estimated \$140 million in annual efficiency savings for farmers through mobile information services and support. Members benefit from a range of services integrated into a tailored package including smartphone-enabled services and an online marketplace.

The Vodafone Farmers' Club, a mobile price plan and services package, was launched in 2009 by Vodafone in collaboration with the Turkish Ministry of Food & Agriculture. It includes mobile products, information services, education activities and a loyalty club to help farmers save money and improve efficiency and productivity. Farmers pay a small monthly fee to subscribe.

The Farmers' Club information service enables members, including those in remote areas, to get information on the latest agricultural practices, weather forecasts and prices through an SMS alert service, with advice tailored to a farmer's local area and crop types.

Members can also purchase affordable and hard-wearing handsets that have been specially designed to cope with life on the farm, and Vodafone has worked in partnership with Sekerbank, to offer an annual billing option. This means farmers can postpone paying their mobile bill until harvest time, when their income is highest.

To keep farmers engaged in the service and encourage new members, there are regular competitions and lottery events, with six club members a year winning a tractor for their farm. A Vodafone Farmers' Club truck tours farming communities around Turkey to raise awareness of the offer and provide

training to help farmers get the best value from the service. This has played an important role in raising awareness and engaging rural communities.

A major challenge for farmers is lack of market access, leaving them reliant on middlemen. This means they often get lower prices for their produce and can lose out on sales altogether if middlemen choose not to buy their harvest. The Farmers' Club helps tackle this by providing information and transparency on market prices, and has developed an online SMS-based marketplace for peer-to-peer sales, tarimsalpazarlama.com. Farmers can advertise their produce, machinery, equipment and goods directly to buyers via a simple text.

Vodafone Turkey has also launched the Vodafone Farming Guide Android app through which smartphone users can access all the Farmers' Club information services and check the latest news and offers whenever it suits them. Over time this will generate farm-level data that can be used to further tailor and improve information and other mobile services. It will also enable improved functionality on the marketplace site, allowing users to gain a better idea of the quality and type of produce advertised.

1.25 million farmers have benefitted from the Vodafone Farmers' Club

What's the impact?

More than 1.25 million farmers have benefitted from the Farmers' Club and the service has helped increase productivity and achieve efficiency savings worth an estimated \$140 million a year. To date, more than 700 million SMS alerts have been sent to members and since it was launched in 2009, 35,000 adverts have been placed on the mobile marketplace. The app for smartphone users has been downloaded 10,000 times.

Service key facts

- ▶ Mobile information and services package designed for farmers
- ▶ Enables farmers to access better information via an easy-to-use SMS service
- ▶ Includes a mobile marketplace for peer-to-peer selling
- ▶ Android app launched for smartphone users

“

I heard about the Vodafone Farmers' Club Advertisement Service. I sent an SMS just to try it. A buyer contacted me within a few hours and I sold my first batch of clover. Then I started to produce and trade clover bales, barley and corn silage. I established teams. Vodafone Farmers' Club changed my world. My annual turnover was TL3,000 before. Now it is TL300,000. Our target for this year is TL1 million. I have customers from all around the world thanks to the advertisement service. Before that, how would a bank's branch manager know about me? Now he calls me and addresses me as "Mr Mesut". I started the journey with a single SMS and now I am one of the most important actors in the roughage market.”

Mesut Orkçu, roughage farmer in Aksaray province, Turkey



The opportunity for India

Market context – the potential for bundled and smartphone-enabled services

Mobile information services for agriculture have proliferated in India since 2011. However, despite the important impact they have had for farmers, revenues achieved do not always support the high costs involved in development and information analysis. This is encouraging the beginning of a trend towards bundling – combining multiple tools and services, such as information, finance, payments and receipting, into packages that meet farmers' needs while generating the revenues needed for services to be financially sustainable.

Bundling of services is effective for users with basic mobile handsets and there is significant potential for growth and innovation in this area. In addition, the growth of smartphone usage could provide a further stimulus to convergence. Smartphone usage is still relatively low in India compared with developed markets, but has already reached an estimated 25 million people in rural areas and is growing at nearly 50% a year.

One of the major advantages of smartphone-enabled services is the ability to collect and analyse detailed and localised farm data, allowing services to be better customised to meet user needs. For example, while current information services can usually filter information provided to farmers on a few criteria, smart services could use larger numbers of filters and allow farmers to further customise their information feeds.

Our modelling

There is significant potential for the growth of integrated and bundled services for users with basic handsets. However, our research looked at the potential impact of smartphone-enabled services for farmers in India.

We modelled a service type combining smartphone-enabled information services, with mobile payments, loans, insurance and receipting, and a virtual marketplace. We have assumed that services would be funded through a mixture of annual subscription and data usage fees.

Our modelling assumed that these types of services will initially be most suited to medium-sized farmers (4–10 hectares of land) who are more likely to own a smartphone. This is a potential market of around 45.1 million farmers in India in 2020, of which our modelling suggests 4.1 million could be active users.

We have looked at the potential livelihood benefits for this group associated with increased yields, higher prices and the ability to make direct sales of produce.

\$675 a year additional income per farmer in 2020, a **30% increase** on average farming income

Livelihood benefits

Our modelling found that this type of smart service could generate increased income worth \$2.8 billion per year for farmers in 2020.

The total impact of smartphone-enabled services in 2020 would be lower than that for more conventional information services (\$2.8 billion compared with \$5.6 billion) because fewer farmers overall will have access to a smartphone. However, we estimate that the impact per farmer would be considerably higher at \$675 a year in additional income. This is due to the potential for greater levels of customisation and also because smartphone users tend to have larger farm sizes. This uplift represents a 30% increase in average farming income.

The uplift in farmer income includes improved yields thanks to better access to detailed information and advice, the ability to command higher prices through greater market visibility and the ability to sell produce directly via the mobile marketplace.

Environmental benefits

This service could have significant environmental benefits, with access to tailored information and advice enabling farmers to cut water usage by 13 billion cubic metres and save 508,000 tonnes of fertiliser a year in 2020.

13 billion m³ water saved through adoption of better farming practices in 2020

Further potential for mobile agricultural services in India

S. PADMANHABAN, CHIEF GENERAL MANAGER, NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT, INDIA

There is great potential for mobile services to create positive change for farmers in India. Technology is a great leveller, and it can play a particularly valuable role in India where issues like caste, language, religion and income disparity can be barriers to farmers increasing their livelihoods.

We've already seen a number of successful mobile services being established on a push model, giving farmers access to better information on weather, farming techniques and market prices. Studies show this is having a measurable positive impact. There is also huge, and so far mainly untapped, potential for 'pull' services that aggregate and use farmer data. For example, this can enable farmers to join together to sell their produce and command a higher price by avoiding traditional middlemen. We will see a lot more innovation in this space.

Partnership is essential to establishing successful and commercially viable mobile services. Social enterprises often have an important role to play in services that seek to replace the role of middlemen. As services become more established there will be opportunities to offer packages to farmers that combine different services, and can help provide a sustainable funding model. When farmers can see the benefits of a service for themselves, they are prepared to pay for it.

Looking ahead

Success factors

The successful development of smartphone-enabled services will rely on cross-sector partnerships between providers, governments, suppliers, agribusiness, micro finance organisations, platform developers and others. This will enable attractive service bundles to be developed that meet farmer needs.

Challenges to scale-up

Bundled, smartphone-enabled services that include virtual marketplaces for agricultural produce could benefit farmers by enabling them to sell directly to buyers. To realise the full potential of smartphone-enabled virtual marketplaces, solutions that make it easier for buyers to assess quality as well as quantity of produce will need to be found. The ability of farmers to transport produce to buyers can also affect take-up of such services.

Future opportunities

As for other information services, smartphone-enabled services will facilitate the collection of large quantities of data, including information on local climate, productivity and farming practices. There is great potential to use this information to support further improvements in farmer livelihoods by, for example, enabling farmers to group together to purchase fertiliser at more competitive rates. There is also the potential for this information to provide market intelligence for buyers, input suppliers and financial service providers.





Summary and key findings

The six mobile services featured in this report could create significant benefits in India if rolled out at scale, improving productivity and livelihoods for millions of farmers.

We published our first Connected Agriculture report in 2011 exploring how mobile services could enable smallholder farmers in emerging markets to improve their livelihoods. Since then we have seen some of the exciting potential of mobile agriculture solutions being realised. Over this period, we have been working with partners and implementing mobile agriculture services in markets such as Kenya, Tanzania and Turkey. We have learnt key lessons, shared here, that can help to inform future service development and accelerate rollout of mobile services for agriculture.

The impact in India

The six mobile services for agriculture featured in this report, if rolled out at scale, could create compelling benefits for farmers and society in India. Our modelling shows that they could positively impact the lives of nearly 70 million farmers in India in 2020 through a range of information and functional services. This is equivalent to 60% of Indian farmers in 2020.

The benefits from these services include:

- Better access to information on, for example, agricultural best practices and weather forecasts
- Better access to information on market prices and the ability to connect more directly with buyers
- Improved communication and efficiency in agricultural supply chains
- Reductions in fraud and losses

- Easier access to financial services and credit for farmers
- Reduced travel time and costs

Together these benefits can support increased yields, improved crop quality and access to higher market prices, as well as reducing losses and inefficiencies for farmers. This could generate over \$9 billion in additional income for farmers annually in 2020, representing an average \$128 increase in income for over 60% of Indian farmers. This would enable them to improve their lives and those of their families and rural communities.

Average **\$128** increase in income for over 60% of Indian farmers in 2020

The six services can benefit co-operatives and agricultural businesses, by improving efficiency and communication in rural supply chains, enabling businesses to expand their supply base, reduce costs and positively influence the quality and sustainability of agricultural produce.

Scaling up these six services would also support the Indian Government's objectives by improving productivity and reducing the costs of running agricultural extension services. The services would deliver significant environmental benefits including reducing greenhouse gas emissions and water and fertiliser usage by improving farmers' access to information on agricultural best practices and reducing travel time.

Service uptake and benefits in India

These six services could deliver significant social and economic impacts in 2020 in India:

	Potential service users in 2020	Annual livelihood benefit in 2020	Annual environmental savings in 2020	Benefits and outlook
Information services Tailored agricultural information for the farming community.	63 million	\$5.6 billion additional income, \$89 per farmer	26 billion m ³ less water 1 million tonnes less fertiliser	Enables farmers to increase yields and sell produce for a higher price through access to better information. Services already established in India with potential for sustained growth.
Receipt services Transparency in commodity supply chains through mobile registration.	1 million	\$271 million saving, \$260 average per farmer	–	Improves farmer income by reducing losses and fraud. High-impact service for supply chains affected by theft and fraud.
Payments and loans Access to loans and payments via mobile money.	420,000	\$292 million additional income, \$690 per farmer	178,000 tonnes CO ₂ avoided	Timely access to credit via mobile enables farmers to pay for inputs and workers, to increase yields and reduce borrowing and travel costs. Reduction in the risks and costs of cash handling.
Field audit Improves efficiency for auditors monitoring quality, sustainability and certification requirements.	215,000	\$132 million additional income, \$612 per farmer	–	More farmers able to participate in certified supply chains and benefit from the associated price premium. Efficient auditing enables businesses to expand certified supply chains.
Enabling access to local markets Enables small-scale producers to transact with co-operatives through a buy/sell platform with mobile payments.	65,000	\$17 million additional income, \$271 per farmer	4,000 tonnes CO ₂ avoided	Farmers able to increase incomes by joining co-operatives and reducing travel time. Improved communication and efficiency for co-operatives.
Smartphone-enabled services Smartphone-enabled information services, mobile payments, loans, insurance, and receipting and a virtual marketplace.	4.1 million	\$2.8 billion additional income, \$675 per farmer	13 billion m ³ less water 508,000 tonnes less fertiliser	Enables farmers to increase yields and sell produce for a higher price through access to better information and an online marketplace. Bundling and convergence of services expected to drive the market for all mobile agriculture services.
TOTAL	68.8 million potential service users in 2020	\$9.1 billion livelihood benefit in 2020	38 billion m³ water saved 1.5 million tonnes less fertiliser 182,000 tonnes CO₂ emissions avoided	

Lessons learnt

The market for mobile solutions for agriculture has evolved significantly in India and other markets since our original Connected Agriculture report in 2011. In India there has been particularly strong progress on information services with slower uptake in other areas such as mobile money and mobile marketplaces.

Based on our own experiences over this period in developing, launching and running mobile agricultural services and the insights shared by other stakeholders in the course of the research for this report, a number of lessons have emerged that can inform the further development of successful services.

Lesson 1: Usability is the key success factor

Services that are designed to be simple and straightforward to use have succeeded, while those that are overly complex or poorly designed have experienced fast drop-off rates, even when initial uptake has been high. This is particularly true for services targeted at smallholder farmers who may be new to mobile technology and have limited literacy, but can be the case even for experienced users. For example, a simple and clear interface is important in services that involve gathering data – such as mobile auditing and receipting services – as this minimises the likelihood of mistakes being made during data entry. An important aspect of usability in India is the need to make services available in many different languages.

Lesson 2: An investment in training and awareness is needed

A focus on training and awareness raising among users and potential users can support take-up of new services and continued use. It can be beneficial to partner with organisations who have experience in field work and can help providers quickly reach large numbers of people.

Lesson 3: Quality of content is critical

For mobile information services, an important lesson has been the significance of quality and localised content to service success. Content that is tailored to a farmer's individual circumstances including location, crop, soil type, local weather and inputs such as fertiliser is more useful to their decision-making, and makes it more likely that they will stick with a service and be willing to pay subscription fees.

Lesson 4: Sustainable financing must be built in

Mobile services for agriculture are more likely to be sustainable over the longer term if a self-financing business model is identified at the outset, even if the service uses funding support in the initial stages as it becomes established.

Some early services created with the help of donor funding have faltered because they have been unable to establish a self-sustaining business model. Business plans need to be developed based on market research with a fully considered route to scale.

Lesson 5: Bundled services are most successful

Our research in 2011 identified four distinct types of mobile services for agriculture, but our experiences since then show us that in fact services are rarely this compartmentalised. In fact successful initiatives increasingly bundle together many different components. This can help providers to overcome reliance on any particular revenue stream, and to fund higher cost services and deliver greater benefits to farmers.

While the development of mobile financial services has been relatively slow in India, partly due to regulatory barriers, these services are now gaining good traction. Bundled services, which combine information services with mobile payment, financial services and market access facilities, have significant potential for growth.

Bundled services are not reliant on smartphone usage, however growth in the uptake of smartphone technology could facilitate further convergence between different types of services.

Lesson 6: Innovation needed for mobile marketplaces

Mobile information and other services have improved market access for farmers by increasing visibility of market prices and making it easier to connect with buyers. However, the development of virtual marketplaces for agricultural produce has proved more challenging. This is mainly due to the need for buyers to understand and verify the quality of produce, which is hard to do remotely with current technology, as well as logistical challenges, with many farmers lacking transport to deliver produce to online buyers.

Further innovation is needed to realise the opportunities in this area, as well as the potential from development of upstream mobile marketplaces that enable farmers to purchase agricultural inputs.

Looking forward

To realise the potential of mobile services for agriculture in India, all partners, including mobile network operators, content providers, governments, non-governmental organisations and funding bodies, will need to invest in developing capabilities, technology and partnerships.

In India, our research suggests that in 2020 much of the potential livelihood benefit for farmers from mobile services will be gained from the development of information services. Successful scaling will require capabilities in areas such as content provision, mass marketing and customer service. Practical and financial challenges involved in gathering detailed and quality content will need to be overcome and partnerships with specialist content providers are likely to be needed.

The other area of significant potential is the growth of services that support co-operatives and businesses to improve communication and efficiency in agricultural supply chains. Although these may reach fewer farmers overall, they can create significant positive impacts on a per user basis by enabling farmers to reach more customers and businesses to integrate more smallholder farms into their supply chains.

Our research suggests that bundling services will be key to creating compelling propositions that are financially sustainable. Partners will need to work together and innovate to deliver these service bundles, combining farmer registration, communication and payment services with specialist applications and information services.



Appendix 1

Authors, contributors and stakeholders

About Vodafone Foundation

The Vodafone Foundation invests in the communities in which Vodafone operates and is at the centre of a network of global and local social investment programmes delivered by 26 local Vodafone Foundations.

The Foundation is dedicated to mobilising communities around the world to improve their lives. To achieve this objective the Foundation uses its charitable giving and its privileged access to Vodafone's networks, technology, customers and employees to empower people with the necessary tools to make a difference in the world.

The Vodafone Foundation is a registered charity in England and Wales (charity registration number 1089625).

About Vodafone Group

Vodafone Group Plc is one of the world's largest mobile communications companies by revenue. We have a significant global reach through our activities, subsidiaries, joint ventures, associated undertakings and investments. At the end of March 2015, Vodafone had approximately 445 million mobile customers and 12 million fixed broadband customers. Approximately 70% of our customers live in emerging markets.

Mobile technology is already a vital tool in many people's lives, and our ambition is to increase access to Vodafone's mobile services to further improve people's livelihoods and quality of life, and contribute to sustainable living.

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About Accenture Sustainability Services

Accenture Sustainability Services helps clients improve performance and value for their stakeholders. It helps clients leverage their assets and capabilities to drive innovation and profitable growth while striving for a positive economic, environmental and social impact.

Accenture's holistic approach encompasses strategy, design and execution to increase revenue, reduce cost, manage risk and enhance brand, reputation and intangible assets. Accenture also helps clients develop deep insights on sustainability issues based on our ongoing investments in research.

Find out more at www.accenture.com/sustainability

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Expert stakeholders

Vodafone would like to thank the stakeholders who participated in interviews and supported the research and preparation of this report.

Interviews were conducted with a range of people including:

Multilaterals/development organisations

- ♦ Mr Padmanabhan, Chief General Manager, Department of Information and Technology, National Bank for Agriculture and Rural Development
- ♦ Judith Payne, ICT Advisor for Agriculture Bureau of Food Security, US Agency for International Development
- ♦ Mack Ramachandran, Head of Strategy, Performance & Risk (Procurement), UN World Food Programme

NGOs and foundations

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- ♦ Michael Elliot, Program Director, TechnoServe
- ♦ Rikin Gandhi, CEO, Digital Green
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- ♦ Reema Nanavaty, Director, Self Employed Women's Association of India (SEWA)
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Industry bodies

- ♦ Natalia Pshenichnaya, Acting Director mAgri Programme, GSMA

Private sector

- ♦ Chris Brett, Senior Vice President, Head Corporate Responsibility & Sustainability, Olam International Ltd
- ♦ Krishna Kumar, CEO, CropIn Technologies
- ♦ Nitin Puri, President & Country Head, Yes Bank
- ♦ Premprakash Saboo, Chief Financial Officer, Reuters Market Light (RML)
- ♦ Meenakshi Sharma, Sustainability Manager, India, SABMiller
- ♦ Dr Jonathan Shoham, Agricultural Economist
- ♦ Jatin Singh, Founder, Skymet
- ♦ Rajesh Sinha, CEO, NCDEX e Markets Limited (NeML)
- ♦ Sarang Vaidhya, Vice President – Rural Initiatives Group, HDFC Bank Limited
- ♦ Dimitri Verweire, Business Development Manager Africa Middle East, Syngenta
- ♦ Ganesh Yala, Accenture Connected Crop Solution, Accenture Technology Labs Bangalore

Appendix 2

Data assumptions and modelling

Data limitations

Given the type and origin of content, data was often limited in its availability and robustness.

Where possible, data points were sourced from internationally recognised bodies. In some instances, where data gaps were identified or specific country data was unavailable, then informed assumptions were taken to fill these gaps.

Data points used to calculate service adoption rates and livelihood benefits were developed using benchmarks from identified case studies or interview data.

Data collection methodology

Key data points were collected from available sources and assumptions made to address data gaps and project key data points to 2020.

Category	Metric	Primary source	Limitations	Assumptions
Basic demographics	Total population	World Bank and GSMA	–	Population projections till 2020 are from GSMA
	Population by age group	World Bank	–	Share of population by age group fixed at 2013 levels
	Urban and rural population	World Bank	–	Change in population share projected at historic CAGR
Employment metrics	Economically active population in employment	World Bank	Gaps in historic time series	Employment ratio is fixed up to 2020 using 2008–2012 average
	Employment by sector	World Bank, WDI	Gaps in historic time series	Employment distribution across sectors is extrapolated using historic sector CAGR
	Workforce in agriculture and allied activities	World Bank, WDI	Gaps in historic time series	Employment distribution across sectors is extrapolated using historic sector CAGR
	Income of farming household	Indira Gandhi Institute of Development Research	Data only till 2003	The income figure is adjusted for historic inflation and yield improvements to 2012. Projections to 2020 account for yield improvements at CAGR

Table continues on next page.

Category	Metric	Primary source	Limitations	Assumptions
Mobile penetration	Unique subscribers	GSMA	–	–
	Smartphone penetration	GSMA	Given as a percentage of connections	Smartphone penetration is given as percentage of connections. It is assumed the same penetration applies for unique subscribers
Agricultural data	No. of farmers in the workforce	India census	Gaps in historic time series	Projections use historic CAGR
	Dairy farmers in India	International Union of Food Workers (IUF)	Gaps in historic time series	2011 data carried forward to 2020
	Small-scale tea and coffee growers	Government of India – Ministry of Commerce	Gaps in historic time series	2011 data carried forward to 2020
Production data	Agricultural land	World Bank	Gaps in historic time series	2012 data carried forward to 2020
	Crop production data (Area, production and yield)	World Bank	Gaps in historic time series	2012 data carried forward to 2020
	Fertiliser usage in agriculture	World Bank	Gaps in historic time series	2012 data carried forward to 2020
	Water usage in agriculture	World Bank	Gaps in historic time series	2012 data carried forward to 2020

Modelling logic

Information services		
Base market	Metric	Farmers with mobile phones
	Assumption	• Excludes those borrowing or sharing mobile phones – borrowers do not benefit from the full range of capabilities ownership offers
Service adoption	Metric	Farmers with mobile using basic information services
	Assumption	• Growth rate based on the historic growth rate of existing information services
Livelihood benefits	Metric	Increase in farmer income using basic services
	Assumption	• Income increase of 15% based on yield and price impact achieved by existing information services
Additional livelihood benefits	Metric	Increase in production due to better yield
	Assumption	• Yield increase of 7% due to better information based on impact achieved by existing information services
Environmental benefit	Metric	Fertilisers and water savings due to improved yield
	Assumption	• Yield increases are achieved with no additional fertiliser or water use due to more efficient use of resources

Receipt services		
Base market	Metric	Unorganised dairy farmers with mobile
	Assumption	<ul style="list-style-type: none"> India has 90 million dairy farmers of which 65% are in the unorganised sector. Farmers in the organised sector already sell to businesses with automated procurement and payment systems
Service adoption	Metric	Dairy farmers using mobile receipt application
	Assumption	<ul style="list-style-type: none"> 0.5% market penetration in 2015 Growth rate based on information services
Livelihood benefits	Metric	Increase in farmer income due to reduced fraud
	Assumption	<ul style="list-style-type: none"> 20 % of milk previously lost to fraud based on case study information

Payments and loans		
Base market	Metric	Contract farmers selling to agribusinesses
	Assumption	<ul style="list-style-type: none"> Current area under contract farming is approximately 2.8 million hectares. Assuming an average size of four hectares the estimated number of contract farmers is 0.7 million
Service adoption	Metric	Contract farmers using financial services
	Assumption	<ul style="list-style-type: none"> Service launched in 2015 with rollout to three global agribusinesses. Subsequent growth rate based on information services adoption
Livelihood benefits	Metric	Increase in farmer income due to yield improvement
	Assumption	<ul style="list-style-type: none"> Farmers enjoy an estimated 50% increase in yield when they have access to credit to buy appropriate inputs Two thirds of farmers benefit from loans due to being previously unbanked. (Only 33% of rural working population has access to a bank account)
Additional livelihood benefits	Metric	Cost savings due to reduced travel and lower cost of debt
	Assumption	<ul style="list-style-type: none"> It is assumed that a farmer makes two trips per crop cycle Cost of debt is reduced significantly due to reduced borrowing from informal lenders
Environmental benefit	Metric	Emission reduction due to reduced travel of farmers to agribusiness
	Assumption	<ul style="list-style-type: none"> Average length of one-way trip is about 175 km based on case study experience and that travel would be by bus
Corporate benefit	Metric	Decreased cost of cash handling
	Assumption	<ul style="list-style-type: none"> 2% saving due to reduced cash-handling costs and security risks

Field audit		
Base market	Metric	Small-scale tea and coffee growers
	Assumption	<ul style="list-style-type: none"> There are approximately 480,000 small-scale tea and coffee farmers in India
Service adoption	Metric	No. of farmers covered by auditors of agricultural businesses buying from these farmers
	Assumption	<ul style="list-style-type: none"> Service deployed in 2015 with two agribusiness supply chains. Subsequent growth rate based on information services adoption

Table continues on next page.

Field audit		
Livelihood benefits	Metric	Increase in farmer income due to higher value of certified output
	Assumption	<ul style="list-style-type: none"> • It is assumed that farmers get 5% higher value if the product is certified, based on typical Fair Trade producer premium • It is also assumed that 20% of farmers in the tea/coffee supply chain are already certified and achieve no additional value from the service
Corporate benefit	Metric	Decreased auditing costs
	Assumption	<ul style="list-style-type: none"> • Agricultural business saves 20% in auditing expenses due to time saving in capturing and uploading data

Enabling access to local markets		
Base market	Metric	Farmers selling to co-operatives in India with mobile
	Assumption	<ul style="list-style-type: none"> • Approximately 20% of produce is procured by co-operatives in India. So it is assumed that 20% of total farmers are selling to co-operatives in India
Service adoption	Metric	Members of organisations like SEWA using local agri supply chain solutions
	Assumption	<ul style="list-style-type: none"> • Initial adoption based on planned pilots • Subsequent growth rate based on information services adoption
Livelihood benefits	Metric	Increase in farmer income due to better pricing and no middleman
	Assumption	<ul style="list-style-type: none"> • Farmer gets 25% higher value as middlemen taken out of supply chain
Additional livelihood benefits	Metric	Cost savings due to reduced travelling
	Assumption	<ul style="list-style-type: none"> • It is assumed that a farmer makes two to three trips per week to sell produce throughout the year
Environmental benefit	Metric	Emission reduction due to reduced travel of farmers to market
	Assumption	<ul style="list-style-type: none"> • It is assumed that average length of a one-way trip is about 5 km with travel by bus. Primary markets serve a radius of 8–16 km. It is assumed that most farmers walk a proportion of the distance
Corporate benefit	Metric	Decreased cost of cash handling
	Assumption	<ul style="list-style-type: none"> • 2% saving due to reduced cash-handling costs and security risks

Smartphone-enabled services		
Base market	Metric	Farmers with smartphones
	Assumption	<ul style="list-style-type: none"> • Excludes those borrowing or sharing mobile phones – borrowers do not benefit from the full range of capabilities ownership offers
Service adoption	Metric	Farmers with smartphones using advanced information services
	Assumption	<ul style="list-style-type: none"> • Growth rate based on the historic growth rate of existing information services
Livelihood benefits	Metric	Increase in farmer income using advanced services and trading platform
	Assumption	<ul style="list-style-type: none"> • Income increase of 30% based on exceeding yield and price impact achieved by existing information services • Additional income on products sold direct to the customer through the mobile platform
Additional livelihood benefits	Metric	Increase in production due to better yield
	Assumption	<ul style="list-style-type: none"> • Yield increase of 15% due to more personalised information based on impact achieved by existing information services
Environmental benefit	Metric	Fertilisers and water savings due to improved yield
	Assumption	<ul style="list-style-type: none"> • Yield increases are achieved with no additional fertiliser or water use due to more efficient use of resources

Appendix 3

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All the information, statements and proposals in this document are correct and accurate to the best of our present knowledge. Vodafone shall not be liable for any loss, expense, damage or claim arising out of statements made or omitted to be made in connection with this report

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