1. WHAT ARE THE DIFFERENT TYPES OF ICT SOLUTIONS?

Information and Communication Technology (ICT) is an umbrella term that generally covers computers, the internet, telecommunications infrastructure, cell phone, radio, television, newspapers and digital libraries. ICT solutions are meeting the information, communication and knowledge needs of farmers, agribusinesses, governments, and society more widely. Solutions that can make smallholder business model more effective are outlined below. Whilst examples of specific ICT solutions are referenced, this does not infer endorsement by Grow Africa and IDH and any users should undertake their own due diligence before adoption.

Solutions for farmer data collection — To implement traceable agricultural supply chains, technological innovations are needed for the collection, documentation, maintenance, and application of information related to all processes in the supply chain. These technologies include hardware (such as measuring equipment, identification tags and labels) and software (computer programmes and information systems).

At the farmer level, traceability takes many shapes. As GPS devices have evolved, farmers can now map their lands, geotag photos to display boundary lines and demonstrate improvements or setbacks, and push data to cloud-based systems maintained by companies via cell signal or WiFi. Increasingly, data collected is not only shared with the buyers, but also with farmers and communities as a measure that compliments farmer field schools and business school training.

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1. Note that many of the ICT solutions provide multiple services to farmers.
2. Additional data collection solutions include: GeoTraceability and the Ethiopian Coffee Exchange IBM-enabled national traceability system, known as eATTs
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**TaroWorks™** is a suite of mobile data collection and field management tools built on the Salesforce platform and accessed in the field via Android devices. It has a modular design to ensure flexibility for meeting the needs of field operations in remote areas as well as business analytics needs.

TaroWorks functionality includes: registration, training, monitoring & evaluation, case management, transactions (capturing orders, tracking inventory) and performance management. TaroWorks clients in agriculture include Unilever, Root Capital and Technoserve.

**Esoko** was created in Ghana and uses mobile and web technology to provide farmers with information on how to grow their crops better, what inputs to use, where to sell and at what price. The platform also enables businesses like buyers, input suppliers, financial institutions and mobile operators to gain better visibility into what’s happening on the farm and to know their customer. They currently work in 10 countries and reach more than 300,000 farmers.

One of Esoko’s clients is The Union Nationale des Producteurs de Mangue du Burkina (UNPMB), the largest mango association in Burkina Faso, which used the Esoko platform to coordinate fly spraying across the region and prevent flies from jumping from field to field to destroy crops. The SMS coordination helped the UNPMB members extend their harvest by two months and their yearly production by 3,000 metric tonnes. They also used the platform to get feedback on a new spray, with an 80% grower response rate.

**Solutions for knowledge transfer**

ICT can generate, capture and disseminate knowledge and information widely to reach large numbers of smallholder farmers and increase their access to the information they need to increase productivity and sell their crops at a good price. Knowledge and information transfer uses include: market demand and price information; weather, pest, and risk-management information; and best practices to meet quality and certification standards. Many electronic systems have been developed for the purpose of sending agricultural information between agricultural advisories/institutions and farmers.

**Solutions for farmer aggregation**

Smallholder farmers have small amounts of farm produce to market and often do not have access to systems of communication, finance and transport. Traditionally farmers have been aggregated through cooperatives, producer organizations, farmer organizations etc. ICT can contribute to “virtual” aggregation of farms and collective synchronization of farm inputs, processes, outputs and logistics, which will enable increased efficiency between off-takers and large numbers of smallholder farmers.

ICT solutions can link smallholder farmers directly with potential buyers through a mobile trading platform to help farmers to secure the best price for their produce. Mobile trading platforms help dealers locate new sources of food when supplies are limited and could help companies fulfill their commitment to sourcing from smaller and more diverse businesses.

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3 Additional knowledge transfer solutions include: mKRISHI developed by Tata Consultancy Services, which is part of the subsidiary of the Tata 3 Group that includes the global input supplier Tata Chemicals; and the Farm Business Plan (FBP) Module developed by GeoTraceability.

4 Additional ICT solutions for farmer aggregation include: e-Choupal, developed by ITC - one of India's largest exporters of agricultural commodities – as a tool to improve supply chain efficiency; and Kenyan startup SokoNect.
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**M-Farm** is an app developed in Kenya to provide access for farmers to the prices of different crops in the major markets via a mobile phone short code (the farmer dials 3555). A farmer can then sell her produce using the same short code. The first service is real-time, daily price information and the second is a ‘selling together’ service. ‘Selling together’ is an agricultural trading platform designed to help stakeholders communicate with each other, establish and maintain business relationships and manage the flow of goods and services. The platform is used in 17 African countries. In Rwanda, mFarms is expected to facilitate data sharing among the Ministry of Agriculture, agrodealers and buyers.

**Solutions for payment services & other financial services** – Traditionally, financial service providers offer a range of financial services (credit, insurance and savings) and non-financial products (training and market access support) to smallholder farmers. Digital solutions are making these products more accessible, by reducing the cost of reaching remote areas and by increasing the data and understanding with regard to smallholder farmers and agriculture.

Both financial service providers and digital service providers are expanding offerings to reach smallholder farmers with digital services. Both approaches are nascent and there is currently more relevant experimentation among financial service providers.

Currently, financial service providers are exploring three primary uses of ICT to overcome delivery challenges:

- **Mobile money platforms and mobile wallets** – facilitating loan / insurance disbursement and payment; and monitoring and managing accounts.
- **Data collection platforms** – collecting data on farmers e.g. land size, loan repayment rates etc.
- **Credit scoring platforms** – analysing farmer mobile data e.g. airtime purchases, and mobile-based decisions.

**Juhudi Kilimo (JK)** provides over 20,000 Kenyan smallholder farmers with asset-backed loans to access high-quality and productive agricultural assets, coupled with business/finance training. Farmers must form groups of at least 15 members and receive group loans at a 35% declining interest rate, for a maximum of 36 months. Group lending limits risks and costs of lending to unbanked, small-scale farmers, resulting in a 95-97% on-time payment rate. Loans finance dairy, poultry, and horticulture projects, and micro businesses (e.g. purchase of land and inputs for farming, or working capital to grow a retail business).

JK uses a single IT platform - MFI Flex “Salesforce” – which allows loan officers to capture and store realtime data on their tablet. Loan applications can be processed within 6 days, which has improved client satisfaction and is now a key competitive advantage for JK. It also helps to track and manage both loan officers’ performance and client repayment. Clients can communicate directly with JK via Echo Mobile, a platform for instant messaging and mass or targeted SMS between clients and JK head office. JK has piloted instalment reminders using this system, which has reduced the proportion of late payments.

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5 Additional financial services solutions include: an electronic payment systems developed by Dunavant Zambia with IT company Mobile Transactions Zambia Limited.
2. WHAT ARE THE COSTS AND BENEFITS OF THESE SOLUTIONS - FOR BOTH THE COMPANY AS WELL AS THE SMALLHOLDER?

For companies

Benefits

- ICT applications (hardware and software), guided by business logic, can foster smallholder inclusion by introducing **efficiencies and reducing transaction costs**. For example, Dunavant perceived potential cost-savings and efficiencies from the solutions that MTZL created and purchased an equity stake in the ICT company once they realized how valuable the system was to them.

- ICT applications developed by a company to engage with its supply chain are typically exclusive to the suppliers, so can increase **competitive advantage**.

- ICT driven innovations make it easier to acquire, manage, and process information and allow **closer integration** between adjacent steps in the value chain. The rapid flow of information between buyers and producers that such applications allow minimizes misunderstandings, allows for risk management, provides higher levels of transparency, and ultimately fosters trust.

- ICT enables service providers to have **direct access to farmers**, so they can reach their customer base at a much lower cost than traditional channels. For instance, banks and insurance companies can acquire information pertinent to farmers obtaining loans or developing more personalized insurance packages.

- ICT systems that promote traceability are expected to **increase exports** of high-quality crops world-wide and **enhance market access**. They may also enable incorporation of smallholder farmers into the value chain in circumstances where lack of traceability mechanisms results in exclusion of smallholders.

- Better communication between farmers and procurers, and systems that allow farmers to be paid faster, can **build trust** between stakeholders and reduce side-selling. If farmers know that sideselling this season will have repercussions in the next because the company keeps electronic records, they might be less likely to engage in this behaviour.

**Benefits of ICT for Agribusiness: GAVL, India**

Godrej Agrovet (GAVL) is a diversified agribusiness company which has interests in oil palm plantations, agriinputs, animal feed, and poultry. In 2010, GAVL extended the use of their current ERP software by implementation of SAP software in order to manage their smallholder suppliers.

The new system gives GAVL leadership improved visibility of sales, costs, and margins across locations and products. It has improved efficiency with automated produce tracking and payment processes for farmers. It provides opportunities to transform the business with improved process efficiency and greater profitability.

Costs

- The application of ICTs can be expensive from the perspective of software development or purchase, implementation, training, and so forth. The costs may not be justified in all cases.

- Platform infrastructure sharing, such as sharing the use of power, telecommunication, data networks, or data management is useful in driving down the cost of investment in technology, which will have the effect of making the use of ICT solutions more affordable.
2. WHAT ARE THE COSTS AND BENEFITS OF THESE SOLUTIONS - FOR BOTH THE COMPANY AS WELL AS THE SMALLHOLDER?

For farmers

Benefits

- Eliminating costs in the supply chain deliver higher farm gate prices and potential lower net costs of procurement.

- Farmers can increase productivity if knowledge, access, and incentives align along the value chain in support of farmers.

- Better access to information such as market prices can reduce information asymmetries for farmers. In addition to linking farmers to local markets, the internet is connecting smallholders to international markets. Coffee farmers in East Africa and cocoa producers in West Africa, for example, can follow the commodity exchange in New York on a daily basis via the Internet and mobile phone. The internet is effectively levelling the playing field as the farmer becomes empowered to demand fair prices based on international markets.

- Receiving market prices electronically can increase income through providing choice around market options.

- Improvements in sustainability and traceability incentivize farmers to use the best techniques to grow and harvest different commodities. Innovations in processing stations also guarantee global best practice methods are used to grade and certify commodities before they are traded.

- Easier access to credit, microloans and crop insurance services (see box).

AgriManagr builds trust for farmers and increases access to credit

Virtual City is a private Kenyan technology startup that developed the AgriManagr software. It is used by collection centres to manage the process of buying agricultural produce from farmers. The application runs on mobile phones or PDAs.

When a farmer brings her produce to the collection centre, it is weighed using an electronic scale that sends data via Bluetooth wireless technology to a handheld device. The data are appended to the farmer’s transaction record. The farmer (who is uniquely identified through information on her smartcard) is paid through a cashless mobile payment system and given a printed receipt recording the current transaction (the scale is wirelessly connected to a printer).

The receipt also contains a record of the farmer’s previous transactions at the collection centre. It serves as a proxy for the farmer’s creditworthiness, which the farmer can use as collateral for credit.

Costs

- ICT solutions are adapting to the technology accessible to smallholder farmers, so we don’t see direct costs incurred at farmer level.
According to McKinsey, technology-driven agricultural services have already shown their ability to improve crop yield, expand access to markets, and boost revenue for farmers, thus improving livelihoods and boosting the broader economy. Such services could also create a valuable market in and of themselves, growing to some $3 billion a year across Africa by 2025. This section provides some indications of success for companies and farmers.

**Impact on the business model**

- **Cost-effectiveness** - Collecting information accurately is important for firms to manage their operations optimally. Private-sector demand for technological solutions appropriate for developing contexts has created a market for ICT applications and spurred innovation in private companies in developing economies, particularly in India and Kenya. Development of ICT solutions can generate significant revenue for companies.

- **Opening of new markets** - Companies are reaching out to provide services in new areas. For instance, the mKRISHI platform developed by Tata Consultancy Services works with farmer groups to access financial services. As a result, nine further projects have been developed by the company and 28 are at discussion stage.

- **Expanding service supply to smallholders** - The use of ICTs can enable companies to offer new services to their existing farmer networks. For instance, the recent provision of micro-insurance in rural areas. Offering crop or weather insurance to smallholder farmers was until recently a complex and costly endeavour due to the need for in-person due diligence to assess insurance amounts and handle pay-outs in case of adverse events.

- **Gender** - certain ICT solutions can lead to more gender-differentiated strategies. For instance, Grameen Foundation’s Community Knowledge Worker (CKW) programme, uses ICT to analyse the individual needs of women smallholder farmers and tailors products to meet those needs. In Uganda and Colombia, where women comprise a significant portion of smallholder farmers, this approach was used to safeguard against homogenizing users, especially women, and delivers equality and sustainability outcomes. The service offers a last-mile solution, reaching isolated rural villages with a combination of mobile technology and human networks to help smallholder farmers get accurate, timely information to improve their businesses and livelihoods. A network of local advisors drawn from the communities they serve use smartphone applications to provide their fellow farmers with information on weather and marketing prices, advice on good agricultural practices and treating pests and diseases. The use of behaviour data enhances the provision of mobile financial products.
3. WHAT IS THE IMPACT OF THE ICT SOLUTIONS?

Impact on farmers

- ICT solutions have increased productivity. The mKRISHI mobile and web based platform for farmers, offering crop advice and collective bargaining power, has increased farmers’ productivity in India by 15% since implementation in 2011, with a projected revenue of $500 million over five to seven years.

- In a recent study of 600 smallholder farmers in northern Ghana, the French National Institute for National Research (INRA) found that farmers have seen a 10% revenue increase since they began receiving and using Esoko SMS market prices.

- Access to mobile phones has been associated with increased agricultural income. A World Bank study conducted in the Philippines found strong evidence that purchasing a mobile phone is associated with higher growth rates of incomes, in the range of 11–17%. This is because farmers equipped with information have a stronger bargaining position within existing trade relationships and are able to seek out other markets. A study of farmers who purchased mobile phones in Morocco found that average income increased by nearly 21%.

- Where farmers are organized into groups, bulk purchasing can reduce costs by around 10%.

- Using ICT platforms can facilitate farmers to negotiate significant reductions in interest rates for loans.

- Access to internet is levelling the playing field and farmers are more empowered to demand fair prices based on international markets.

- The impact on smallholders’ inclusion in commercial value chains is not yet known. There is a general consensus that participation has a positive effect, but to what extent ICT enhances or dilutes that effect is unknown and requires research. A key factor to success is effective design of ICT solutions.
4. CHALLENGES

For companies

- The problems encountered while setting up and managing ICTs are primarily of **infrastructural inadequacies**, including power supply, telecom connectivity and bandwidth. Infrastructure challenges can be addressed by several alternative and innovative solutions - some of them expensive – including power back-up through batteries charged by solar panels, upgrading BSNL exchanges with RNS kits, installation of VSAT equipment, or a 24/7 helpdesk.

- Scaling up is a difficult issue for most existing services, due in part to a **shortage of technical skills**. One approach to filling the skills gap is to outsource product development work to business incubators—but to achieve broader scale, government support may often be required. The private sector will also need to innovate to create new revenue streams by including other services, such as warehousing and logistics, micro-financing, insurance, or market information. However, governments may also need to play a role in funding internet-powered agricultural services, potentially through public private partnerships with commodity exchanges.

- Digital solutions that offer price information and market linkages address some of the obstacles to agricultural technology adoption. However, other constraints, such as the **risk of crop losses, lack of insurance and limited finances**, are often harder to address. Therefore in order for digital solutions to be effective, they need to be embedded in complementary support programs to tackle other limitations.

- **Banking agent & Know Your Customer (KYC) regulation** will impact the degree to which financial service providers can integrate digital into their product delivery to smallholder farmers. For instance, some countries only allow commercial banks to use agents (e.g. Philippines and Nepal), whilst others also allow MFIs to use them (e.g. Ethiopia and Rwanda). KYC regulations also differ between countries, with some requiring physical signatures from smallholder farmers, whilst others permit the use of electronic signatures to open savings accounts.

- **Competition regulation**, which dictates the practices that digital service providers must adhere to, will affect whether financial service providers can leverage mobile money platform infrastructure to provide financial services to low-income clients. For instance, the Central Bank of Kenya ordered Safaricom to open the M-Pesa agent network to other mobile money operators to improve fair competition and encourage lower fees for customers.

While unique challenges exist for each use, the overall potential for financial service providers to leverage digital services is dependent on the **maturity of the local mobile ecosystem**, which varies significantly across markets. For instance, mobile money platforms will only operate effectively if there is sufficient mobile phone penetration. Equally, mobile financial services require high mobile money penetration, which includes the availability of a supply of rural mobile money agents with sufficient liquidity to manage deposits, disbursements & payments.

For farmers

- **Penetration of smartphones and tablets** among many farmers remains low, so many of the projects to date have been limited to basic mobile platforms and text messaging. This will change over time, but the short-term solution has been to adopt a multi-platform approach that places primacy on SMS messaging to achieve maximum product recognition, scale, and impact while developing applications that can work on more sophisticated devices as smartphone and tablet penetration grows in the future.

- In some cases, **SMS has been cumbersome** leading to a switch to USSD where one has to enter *# for immediate response. USSD is an interactive mobile phone query service application platform.

- The extent of **literacy and numeracy skills** influences the accessibility and impact of many existing ICT systems.

- For internet-based applications, many farmers are **first time internet users** so imparting skills takes time and incurs costs.

- **ICT affordability** – costs for airtime, utilizing ICT services, and recharging phones can be a barrier to poorer farmers.

- Often mobile data platforms are only presented to users in English, rather than using local languages.
About the organization

The Syngenta Foundation for Sustainable Agriculture (the Foundation) is a non-profit organization established by Syngenta under Swiss law. The Foundation can access company expertise, but are legally independent. Core funding is provided by Syngenta.

The Foundation supports pre-commercial smallholder farmers in developing countries and emerging markets to become more professional producers. The Foundation works with partners on agricultural research and delivery of results to farmers (often through public private partnerships), providing access to quality inputs, risk management through weather insurance, and linking smallholders to markets in profitable ways.

Farmforce: the ICT solution

Farmforce was developed in 2012 by Syngenta Foundation and was co-funded by the State Secretariat for Economic Affairs of Switzerland to help smallholders gain access to higher value, formal markets and improve the effectiveness of outgrower schemes.

Farmforce is a comprehensive solution for agricultural businesses, aggregators, cooperatives exporters and agricultural processors to manage relationships with smallholder farmers. Formal markets require traceability and compliance to food safety standards, which are barriers to entry for smallholder farmers. Farmforce uses mobile technology for traceability, compliance and productivity for every farmer and fields over time, which ensures that farmers follow protocols and enables planning with large numbers of smallholder farmers through aggregation of data.

The software is suitable for private companies as well as public sector. For instance, the Clinton Development Initiative, which is a hybrid between commercial agri-business and a non-profit organization, has used Farmforce in Malawi for the last 2 years to measure impact of their work with 50,000 farmers in Malawi. They also use it to manage demo plots and monitor field officers.

Farmforce is active in 15 countries for a variety of crops, such as horticulture, cereals, coffee, cocoa and works with more than 150,000 smallholder farmers.
5. THE CASE OF SYNGENTA FOUNDATION FOR SUSTAINABLE AGRICULTURE: FARMFORCE ICT SOLUTION

Benefits of Farmforce

- Enables companies to transfer from paper-based systems to an electronic system with realtime management
- Provides visibility on activities and progress at different levels, which can result in improved yield forecast accuracy
- Traceability and compliance tool
- Increased oversight improves farming practices. Access to technical support for farmers. Field agents have more time available for supporting farmers with advice
- Sustainability e.g. measurement of soil quality
- Increases reliability and reduces transaction costs, which improves economic viability of sourcing from smallholders
- Being able to meet higher standards de-risks the production system and creates new opportunities for smallholder farmers, including access to formal markets

Challenges

- Scaling up can be a difficult issue for some outgrower schemes, mainly due to weak internal capacities of the user. One approach to fill this gap is to improve supply chain processes and technical skills for company employees.
- The use of several digital solutions at the same time can be complex to manage. Therefore, in order for Farmforce to be effective, they need to be embedded into the system.
- While unique challenges exist in each case, the overall potential of Farmforce highly depend on the maturity of the local organizational structure, which varies significantly across geographies and cropping systems.

Scalability

- The software was initially designed with a view to reaching hundreds and thousands of farmers and expanding across multiple markets. This served as a basis for finding the right development tools, software architecture, and other technical requirements. As such, the product is a cloud-based platform, which multiple users can access through private accounts.
- Reaching a wider customer base requires the system to function in different languages. The service is currently offered in English, French, Spanish, Portuguese, and new languages can be added.
- Technical support is provided to users, particularly for set up.
- Standards are constantly evolving and changing and Farmforce was designed with the flexibility to integrate new standards into the system and adapt to changing regulatory environments.
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