



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



Digital Tools in USAID Agricultural Programming Toolkit



USAID
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OVERVIEW

Digital technology has enormous potential to improve food security in [Feed the Future](#) countries and around the world. The purpose of this toolkit is to demonstrate the importance of digital tools in agriculture. It will give a brief overview of the digital tools that are currently being used in the field by U.S. Agency for International Development (USAID) Missions and implementers and resources for those attempting to implement digital tools in their programs.

This programming toolkit was created by the [Digital Development for Feed the Future](#) (D2FTF) team, which is a collaboration between the U.S. Global Development Lab (the Lab) and the [Bureau for Food Security](#) (BFS) at USAID. Launched in September 2015, D2FTF is a three year partnership aimed at integrating digital tools and approaches into the Feed the Future portfolio.

WHY ARE DIGITAL TOOLS IN AGRICULTURE IMPORTANT?

Digital tools can aid in every part of the agricultural value chain; the following are some of the ways that digital tools can be integrated into the agricultural value chain:

 PLANNING	 INPUTS	 ON-FARM PRODUCTION	 Storage	 POST-HARVEST Processing	 Transport	 ACCESS TO MARKETS
<ul style="list-style-type: none"> • Help farmers plan what, when to plant • Tighten relationship with buyers, processors • Adapt to climate change • Provide data for farmers to make business decisions on cash flow and maximizing profit 	<ul style="list-style-type: none"> • Reduce counterfeits • Reduce costs and risks for buyers • Increase access to quality inputs • Enable sellers to know demand in advance • Provide convenient and secure ways for farmers to purchase, save, and receive credit inputs 	<ul style="list-style-type: none"> • Help extension services reach more farmers • Provide timely reminders/alerts • Use behavior change media to promote best practices among farmers • Increase precision and/or adaptability of farming interventions and crop choices through applied data 	<ul style="list-style-type: none"> • Improve links between farmers, processors • Reduce post harvest loss with digitally-enabled harvest loans and digitally warehouse receipts • Inform harvest practices to reduce post harvest losses. • Monitor storage conditions 	<ul style="list-style-type: none"> • Increase farmer negotiating power by providing market prices • Track provenance for supply chain optimization and grading 	<ul style="list-style-type: none"> • Reduce costs of transport • Increase choice of different types of transport for farmers • Increase access to timely information so that farmers know if and when transport is arriving 	<ul style="list-style-type: none"> • Increase ability of smallholder farmers to sell to larger markets by allowing buyers to track crops to source (certification and provenance) • Increase market information available to farmers so that they have more choices

As a result, using digital tools can reduce crop loss, decrease herd death, increase yields, improve cost-effectiveness in production, create safety nets, increase storage, prevent spoilage, and increase income. Using technology across the value chain translates into tangible improvements in food security for vulnerable populations.

There is significant evidence (detailed in this [spreadsheet](#) and these summary [slides](#)) to support the promise of digital tools.

OPPORTUNITY: MOBILE CONNECTIVITY IN FEED THE FUTURE AND AFFILIATE COUNTRIES

The tables in Appendices 1 through 4 show both the absolute change and the percentage change in total mobile subscribers ([Appendix 1](#)) and total mobile connections (including M2M) ([Appendix 2](#)) between 2010 Q1, when Feed the Future began, and Q2 2017, the most recent data available. The third table shows only the absolute change in percentage points of 3G and 4G market penetration ([Appendix 3](#)) in the same time period. The fourth table shows the increase in population ([Appendix 4](#)) during this time. In these Feed the Future and affiliate countries, there has been enormous change in each of the mobile connectivity categories. Total subscribership increased by 127.82%, mobile connections increased by 152.10%, and 3G and 4G market penetration increased by an average of 27.96 percentage points in Feed the Future and affiliate countries. In comparison, the population growth in Feed the Future and affiliate countries was 18.46%, showing that the growth of these mobile ecosystem indicators clearly outpaces population growth. The fifth and final table ([Appendix 5](#)) shows the value added of agriculture in the economy in 2015, which makes up about a quarter of the economy of these countries on average. This demonstrates the impact that improvements in the agricultural sector can have on their economy as a whole.

PRINCIPLES FOR DIGITAL DEVELOPMENT

Digital technologies are playing an ever more important role in the lives of millions of individuals living in Feed the Future supported countries. USAID contributed to and endorses the [Principles for Digital Development](#), which are best practices for integrating digital technology into development projects.

THE PRINCIPLES

The nine principles are referenced throughout this toolkit and enumerated below:

1. *Design with the User*: Too often in the field of international development, technology tools are created--or tech-enabled projects are designed--without sufficient input from the stakeholders whose engagement and ownership are critical to long-term success. Principle #1: Design with the User provides recommendations to avoid this common pitfall.
2. *Understand the Existing Ecosystem*: To increase the relevance and sustainability of technology-supported international development, Principle #2: Understand the Ecosystem provides recommendations about how to ensure projects and programs are built, managed, and owned with consideration given to the local ecosystem.

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Market research about the needs and capabilities of users in the target area, as well as the network capacity in the region, should be conducted prior to diving into promoting digital technology in agriculture. This is an important step to ensure that digital tools are not being applied simply for the sake of using digital tools--they should be used only when they are the best way to address a defined problem. For more information, see the section on [Market Research](#).

3. *Design for Scale*: Too often international development projects fail to move beyond the pilot stage, or to reach anticipated scale. In some cases, scale is not a necessary criterion for success. In others, careful consideration of the necessary inputs can help projects reach their full potential. Principle #3: Design for Scale provides considerations for how to design a project for maximum impact.
4. *Build for Sustainability*: Too often international development projects fail to factor in the physical, human, and financial resources that will be necessary for long-term sustainability. Principle #4: Build for Sustainability outlines considerations that can support a project's longevity for the intended duration.
5. *Be Data Driven*: Too often international development projects fail to fully leverage data to support project planning and decision-making. Principle #5: Be Data Driven provides tips to identify the sources of and incorporate data into project design and decision-making.

While data-driven decision-making is important, data practices can have unintended consequences for smallholder farmers and other program beneficiaries. Therefore, it is necessary to adopt responsible data practices--regarding data collection, storage, analysis, and dissemination--that address privacy and security risks, transparency, accountability as well as legal and ethical considerations. For more information, see the section on [Responsible Data Practices](#).

6. *Use Open Data, Open Standards, Open Source, and Open Innovation*: Too often in international development, scarce, public resources are spent investing in code, tools, and innovations that are either locked away behind proprietary, fee-based firewalls or created in a bespoke way for use in sector-specific silos. Principle #6: Use Open Data, Open Standards, Open Source, and Open Innovation provides a framework to consider an "open" approach to technology-enabled international development.
7. *Reuse and Improve*: As the use of information and communications technologies in international development has matured, so too has a base of methods, standards, software, platforms, and other technology tools. Yet, too often we see scarce resources being invested to develop new tools when instead existing tools could be adapted and improved. Principle #7: Reuse and Improve highlights ways that adaptation and improvement can lead to higher quality resources available to the wider community of international development practitioners.

8. *Address Privacy and Security*: Information is power, as the old adage goes, and this is certainly true in the context of technology-enabled global development interventions. How information is collected, stored, analyzed, shared, and used has serious implications for both the populations about whom data are being transmitted and the organizations transmitting the data. Principle #8: Address Privacy & Security provides a framework for considering how to protect user privacy and the security of data, devices, and tools.
9. *Be Collaborative*: The proverb “if you want to go fast, go alone. If you want to go far, go together” could easily be a mantra for technology-enabled development projects. Principle #9: Be Collaborative suggests strategies for leveraging and contributing to a broader commons of resource, action, and knowledge to extend the impact of development interventions.

Resources

- [The Principles for Digital Development](#): In conjunction with the Principles for Digital Development, [From Principle to Practice: Implementing the Principles for Digital Development](#) provides practical advice for following through on these principles.
- [Integrating Mobiles into Development Projects](#): Since the mobiles for development space is evolving rapidly, the handbook is intended to equip readers with a set of questions to ask when using or considering mobiles, rather than providing a prescription for how to use mobiles in a given country or sector. It is split into five sections: understanding mobiles for development, understanding the mobile ecosystem, project design, procurement, and monitoring implementation and program evaluation.
- [USAID Learning Lab](#): USAID’s Learning Lab is an interactive community where members can access and contribute to a growing repository of tools and resources on integrating collaborating, learning, and adapting (CLA) throughout the USAID Program Cycle.
- [Digital Services Playbook](#): The U.S. Government’s Chief Information Officer created a playbook of 13 key “plays” drawn from successful practices from the private sector and government that, if followed together, will help government build effective digital services. Though aimed primarily at domestic users/services, many of the principles are useful for international digital development as well.

MARKET RESEARCH

Digital tools should only be used where the ability and potential for impact are clear. Market research about the needs and capabilities of users in the target area as well as the network capacity in the region, should be conducted prior to diving into promoting digital technology in agriculture. This is an important step to ensure that digital tools are not being applied simply for the sake of using digital tools--they should be used only when they are the best way to address a defined problem. Research should also take note of existing infrastructure and consider scalability of all digital interventions. It is impossible to design an

effective approach without a thorough understanding of the ecosystem and possible changes in the environment.

Resources

- [Understand the Existing Ecosystem Guides](#): Guides by organizations involved with developing the Principles for Digital Development or recommended by members of the working group.
- [Integrating Mobiles into Development Projects](#): Since the mobiles for development space is evolving rapidly, the handbook is intended to equip readers with a set of questions to ask when using or considering mobiles, rather than providing a prescription for how to use mobiles in a given country or sector. It is split into five sections: understanding mobiles for development, understanding the mobile ecosystem, project design, procurement, and monitoring implementation and program evaluation.
- [Tools for Innovation Programming Step 1: Identify & Define the Problem](#): This document will explain and offer guidance on the following activities: Assembling the Team, Identifying the Problem, Drafting the Concept Note, Conducting the Barrier Analysis, Finalizing the Challenge Statement. Though this guide is directed specifically towards prizes/grand challenges, much of the advice is useful for identifying development problems to focus on more generally.
- [Digital Services Playbook, Play 1: Understand What People Need](#): This provides some useful questions to ask and a suggested checklist to ensure that the user is at the center of a digital intervention.

RESPONSIBLE DATA PRACTICES

Data-driven decision-making is important, but the way that data is collected, stored, analyzed, shared, released and ultimately communicated can have unintended consequences for smallholder farmers and other program beneficiaries. Digital technologies increasingly used in development accelerate the speed and volume of data collection and sharing, amplifying both potential benefits and harms to individuals and communities. USAID and other development actors have identified privacy protection as one of the [Principles for Digital Development](#) that is perhaps most [challenging](#) to put into practice. Good practices must balance needs for mitigating privacy and security risks with the need for data use and data sharing, while promoting transparency, accountability and public good by making data open, and taking legal and ethical considerations.

Resources

- [Responsible Data in Agriculture](#): This publication from the Global Open Data for Agriculture and Nutrition network provides a broad overview of some of the responsible data challenges facing actors in the agricultural sector, with a focus on the power imbalance between actors, and looks into how that inequality affects behavior when it comes to the agricultural data ecosystem. This publication gives an overview of different types of agricultural data, identifies challenges and tensions around agricultural data, and lays out best practices for managing data responsibly at a high level.
- [World Food Program Guide to Data Protection and Privacy](#): These guidelines lay out principles for protection of personal data for beneficiaries and prospective beneficiaries within the context of WFP programs and are intended for WFP staff primarily. The guidelines also provide model templates for informed consent, self assessment compliance checklists and resources on conducting a privacy impact assessment.
- [Address Privacy and Security Guides](#): A list of guides from various sources - Amnesty International, OECD, UN, etc. - that address privacy and security.
- [The Need for Responsible Data Practices within Agriculture](#): (audio) Ana Maria Cuenca, Deputy Director in FHI 360's Social and Economic Development Department – who presented at the ICTforAg 2017 Conference with independent technology consultant, Linda Raftree – talks about risks that are present throughout the data collection cycle and what's needed to establish clear guidance on good data practices.
- [Digital Services Playbook, Play 11: Manage security and privacy through reusable processes](#): This provides some useful questions to ask and a suggested checklist to ensure that a proper security and privacy process is adopted.
- [Data Starter Kit Cash Learning Program](#): The Electronic Cash Transfer Learning and Action Network (ELAN) Data Starter Kit is designed to help humanitarians plan and improve data management practices. Building upon the CaLP's Protecting Beneficiary Privacy, the Starter Kit

comprises of tip sheets and a glossary that align with the project and data management lifecycles, and provide concrete tips to help humanitarians assess data risks, minimize data collected, and protect and securely share data. While the ELAN developed this Starter Kit for field staff implementing e-transfer programs, many of the concepts are not cash or e-transfer specific and may be useful to other types of programs.

Examples

- [Musoni Case Study](#): Musoni became the first completely cashless microfinance institution in the world, by enabling customers to receive and repay their loans via Safaricom's M-PESA system, rather than in cash. As of July 2017, Musoni had disbursed 207,823 loans to 91,454 clients.

EXAMPLES OF DIGITAL PROJECTS SUPPORTED BY USAID

The Agency recognizes the promise of Digital Development in Agriculture and is addressing it in a number of innovative ways:

- The U.S. Global Development Lab (the Lab) and the Bureau for Food Security (BFS) are collaborating in an effort called “Digital Development for Feed the Future” (D2FTF) to demonstrate how the results and cost effectiveness of the U.S. Government’s Feed the Future initiative can be increased when a Feed the Future country team leverages digital approaches holistically and according to best practices. The three-year collaboration, set to end in September 2018, is focused on integrating a suite of coordinated digital tools and technologies into Feed the Future activities, demonstrating how doing so can accelerate progress towards Feed the Future high-level indicators of increasing agricultural income and improving nutrition in 12 target countries and beyond. D2FTF has three primary components -- technical assistance to Feed the Future programs, capacity building for USAID staff in Washington and the field working on Feed the Future programs, and strengthening the knowledge base on best practices in digital agriculture. D2FTF addresses best practices in digital agriculture through four key areas: (1) precision agriculture, both on- and off-farm; (2) more effective data collection, analysis and dissemination; (3) information delivery through mobile-enabled extension services, and (4) financial inclusion through digital financial services.
- In 2012, the U.S. Agency for International Development (USAID), Vodafone, and TechnoServe launched a new partnership to increase the productivity, incomes and resilience of smallholder farmers in Kenya, Mozambique, and Tanzania. [The Connected Farmer Alliance](#) leveraged mobile phone-enabled solutions to improve supply chain efficiency and increase farmers’ ability to access secure, timely payments and other financial services. The partnership connects hundreds of thousands of smallholder farmers by expanding the use of mobile financial services pioneered by Vodafone’s existing mobile money platform, M-Pesa—a highly successful SMS-based money transfer service already at scale in Kenya, where 15 million people exchange \$850 million via the system every month. Kenya, Mozambique, and Tanzania are home to Vodafone affiliate companies. Vodafone and TechnoServe will work with farming communities and supply chains in

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these countries to develop and scale mobile applications that enable rural households to transfer and receive payments securely, access other financial services, and facilitate linkages to local and multinational agribusinesses, especially those looking to serve smallholder farmers working in Feed the Future priority value chains.

- **[Feed the Future Malawi Mobile Money](#)** is a four-year long project that seeks to increase mobile money adoption in Malawi and enhance product development through collaborative, targeted interventions that demonstrate the advantages of mobile money. The program supports and advances the growth of mobile money in Malawi through a series of coordinated interventions that include strategic pilots as well as targeted technical assistance to key public and private sector stakeholders.

DIGITAL TOOLS IN AGRICULTURE

There are four broad categories of digital tools used in agriculture programs: (1) [Data-Driven Agriculture](#), (2) [Precision Agriculture](#), (3) [ICT-Enabled Extension](#), and (4) [Digital Financial Services](#).



Different categories of digital tools should not be taken alone, but rather as aspects that reinforce the others' effectiveness. Better and higher quality data enables precision agriculture and extension services, allowing for digital financial services. These tools work in concert to promote better development outcomes.

DATA-DRIVEN AGRICULTURE

Access to metrics like soil moisture and weather data can help farmers make decisions about when to irrigate crops, and satellite imagery can be combined with existing data to make soil quality predictions. Effective data usage has the potential to have a significant impact on smallholder farmers, as discussed in this [blog post](#). Digital technology can make a difference in data collection, as described in the table below:

FUNCTION	HOW TECHNOLOGY CAN MAKE A DIFFERENCE
Data collection	<p>Many digital tools can aid in the data collection process. One of the most promising forms of data collection is the "Internet of Things," (IoT) or sensors that can be used to provide real-time data on things like temperature, soil moisture, and weather conditions. Other tools include geographic position systems (GPS) or unmanned aerial vehicles (UAVs) to collect spatial data. For example, remote sensing (through tools such as satellite imagery and UAVs) can be used to predict yields in a given season, helping governments to immediately know and take action if there is a food shortage. Mobile data collection is another way that technology can help: transferring data to a computer from a phone or tablet makes data transfer faster and more accurate.</p> <p>See: Low-Cost Sensors for Agriculture</p>

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A vital step in using data for agriculture is communicating results to farmers. Some digital tools, such as low-cost sensors, send measurements directly to mobile phones or can be checked manually by farmers. The type of complex analysis performed by outside groups, such as [aWhere](#), can be delivered to local farmers electronically. [LandPKS](#) delivers its information via a mobile app.

Resources

- [Innovation for Data-Driven Agriculture](#): This document discusses 1) the opportunities and challenges surrounding data collection, analysis, open sharing and appropriate distribution, 2) the need to better understand and incorporate smallholder farmer concerns throughout the design and implementation of programs and ventures and 3) defining and engaging an “innovation ecosystem” of cross-sector actors addressing smallholder needs with data-driven approaches to agricultural development.

Examples

- [A Philippine Climate Change Adaptation Strategy](#): The USAID-funded Bicol Agri-Water Project (BAWP) aims to improve the management of irrigation water through extensive data analysis.
- [Big Data for Climate-Smart Agriculture](#): Researchers have applied Big Data analytics to agricultural and weather records in Colombia, revealing how climate variation impacts rice yields. These analyses identify the most productive rice varieties and planting times for specific sites and seasonal forecasts. The recommendations could potentially boost yields by 1 to 3 tons per hectare. The tools work wherever data is available and are now being scaled out through Colombia, Argentina, Nicaragua, Peru, and Uruguay.
- [A Mobile-based Survey in Mozambique](#): With support from USAID/Mozambique and DFID, mSTAR recently completed the large-scale Mobile Access and Use Study (MAUS), employing a mobile-based survey component. The study examined the availability and accessibility of mobile technologies and the dynamic ways they are being used in the daily lives of Mozambicans.

PRECISION AGRICULTURE VIA GEOSPATIAL ANALYSIS

Geospatial analysis is the gathering, display, and manipulation of imagery, GPS, satellite photography and historical data, described explicitly in terms of geographic coordinates or implicitly, in terms of a street address, postal code, or other identifier as they are applied to geographic models. Geographic data analysis and visualization allows us to investigate geographic patterns and relationships over space and across time. This helps us answer geographic questions that lead to place-based understanding and action.

This type of analysis is often performed with Geographic Information Systems (GIS) software. Using GIS technology and geographic data is increasingly important in development donors’ efforts to geographically target investments and effectively monitor and report on their scope and impact.

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The type and quality of geospatial analysis that can be conducted depends on the available data. The more precise/specific the level of data, the more options that are available to analyze it. Geospatial data can be gathered in different ways, such as remote sensing technologies, interviews, and crowd-sourced information.

Uses of geospatial analysis in agriculture include:

- Identification of a zone(s) of intervention during program/project design. e.g. A Maize Value Chain project will want to invest in areas where the soil is suitable for the growth of maize, most farmers are growing maize as the main crop, roads are practicable to inputs and maize distribution, demand for maize is high and profitable, etc.
- Monitoring and Evaluation. e.g. Has the use of improved seeds, pesticides, herbicides and improved management led to an improved yield? Is the yield gap the same across the zone of intervention? What were the drivers?
- Using data (such as distance to market, population density, and arable land) to determine target geographies. e.g. maize target zones
- Targeted variety selection and distribution across the zone of intervention. e.g. Inventory of input dealers and their distribution points, identification of farmers clusters and roads network classification will help improve inputs distribution flows.
- Identification of crops and estimation of yield and growing seasons. e.g. The use of unmanned aerial vehicles (UAV) and satellite imagery could help remote monitoring of projects and cut costs of lengthy and expensive surveys.
- Landscape and watershed analysis. e.g. This could help improve water (NRM) resources management for a fair and efficient community-based irrigation system, water rights, water savings, etc.

Resources:

- [GeoCenter Remote Sensing Program](#): This program, sponsored by the GeoCenter, provides USAID Implementing Partners with access to high resolution satellite imagery.
- [Youth Mappers Program](#): This USAID program connects a network of over 4000 student mappers from around the world to project areas in need of improved spatial data. The student mappers create new open geospatial data in the OpenStreetMap platform to support responders and aid organizations.
- [OpenStreetMap](#): OpenStreetMap is built by a community of mappers that contribute and maintain data about roads, trails, cafés, railway stations, and much more, all over the world.

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- [AidData](#): Search, query and download geocoded dataset of development programs. Datasets are available at different sub-national levels
- [Geospatial Toolkit](#): map-based software applications for 23 countries that integrate resource data and other geographic information systems (GIS) data for resource assessment.

Examples:

- [Bangladesh Livelihood Map: Household Nutrition](#): A visualization of food consumption data in Bangladesh.
- [PREMPT](#): Pest Risk Mapping and Establishment Tool. It helps users visualize the current global presence of any invasive pest, and compare future risks across various what-if scenarios. PREMPT integrates diverse data-sets and leverages state-of-the-art methods from computer science, ecology, economics, epidemiology and transportation. We believe that when fully developed, it will help policy makers manage and respond to pest outbreaks. The current prototype focuses on *Tuta absoluta*, a devastating tomato pest. Native to South America, in the last 10 years, it has spread throughout parts of Europe, Africa and Asia. Here is an accompanying [video](#) and [paper](#).
- [Fararano](#): Funded by USAID's Development Food Assistance Program, the Fararano project in Madagascar uses geospatial data to optimize the cost of its food inputs. Read more about the project [here](#).

ICT-ENABLED EXTENSION

ICT-enabled Extension is information delivery via digital channels (including SMS, Interactive Voice Response (IVR), interactive radio, low cost video) allows extension workers (or other information delivery providers) to reach more farmers and provide more timely reminders and alerts, helping to prompt behavior change and enhanced ways of learning for farmers and value chain actors.

ICT-enabled Extension uses digital tools to enable farmers to increase their productivity. Farmers do not always have the information they need to adapt to droughts, storms, and changing weather and soil conditions, or may not know about new technology or practices to increase yields. This type of service has traditionally been provided person-to-person by agronomists, but technology can achieve the same effect more efficiently.

While there are a number of ways to reach farmers in order to help them improve their productivity, in most cases, extension enables the following:

1. *Raise Awareness*: make farmers aware of the tools/methods that are available to them
2. *Convince*: persuade farmers that it is worth trying these tools/methods.
3. *Educate*: show farmers how to use the tools/methods they have been convinced to try
4. *Remind*: follow up with farmers as appropriate to ensure they are using this knowledge

Types of ICT-enabled Agricultural Extension:

- *Low-Cost Video*: this is a way to convey the experience of local farmers and agronomists to a broader audience in a compelling multi-media form. [Digital Green](#) is one of the organizations using this type of agricultural extension.
- *Mobile*: mobile applications can be split into the categories “push” and “pull.” Push applications focus on sending information at the right time, generally based on detailed farmer profiles, which ideally have information about the farmer’s location and crops/crop cycles. Pull applications allow farmers to seek out information about agricultural topics, for example, a specific crop.
- *Radio*: information about best agricultural practices can be disseminated to wide audiences on the radio. Groups such as Farm Radio International are combining mobile and radio technology to create an interactive experience where farmers can react to the radio content using SMS messaging.

Principles for Extension:

- *Adapted to the local context*
For example, in areas with low bandwidth, it is difficult to disseminate videos; and where literacy rates are low, voice messages will be more effective than text messages.
- *Demand-driven and farmer-led*
[See: Demand Driven Agricultural Advisory Services from the Neuchâtel Group](#)
- *Market-oriented*
[See: Common Framework on Market-Oriented Agricultural Advisory Services from the Neuchâtel Group](#)
- *Pluralistic*
The public, private, and civil society sectors and stakeholders should all play a role and be integrated.
- *Accountable*
Common metrics for measuring cost effectiveness and impact that ensure accountability across all actors and dimensions involved with extension and advisory services
- *Sustainable*
- *Scalable*

Resources:

- [Organizational Guide to ICT4D](#): This guide gives practical guidance to building organizational capacity in Information and Communications Technologies for Development (ICT4D). Drawing

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from the experience of the international development community, the guide connects established principles with processes for implementing new technology.

- **[Integrating Low-Cost Video into Agricultural Development Projects](#)**: This toolkit is designed to help projects and organizations use low-cost video to augment the traditional agricultural development activities and extension services they are providing.
- **[How To Use Mobile Data Solutions for Better Development Outcomes Course](#)**: This interactive self-paced online course (approximately 2 hours, free) helps global development organizations explore opportunities to use mobile technologies to improve the efficiency and quality of the data they collect, manage, analyze, and share and offers a comprehensive introduction to key terms, concepts, technologies, and strategies.

Examples:

- **[Partnering with Indonesia on Mobile Extension Services for Improved Regional Fish Farming](#)**: An example of “pull” type mobile extension service, where farmers can access information through AquaFIS, a service that provides real-time data and extension services through SMS, mobile applications, and online forums.
- **[Akorion Services](#)**: Akorion delivers its innovative services to smallholder farmers through its value chain digitization platform, EzyAgric.
- **[Harnessing ICT to Increase Agricultural Production: Evidence from Kenya](#)**: Sending SMS messages with agricultural advice to smallholder farmers increased yields by 11.5% relative to a control group with no messages. These effects are concentrated among farmers who had no agronomy training and had little interaction with sugar cane company staff at baseline. Enabling farmers to report input provision delays to the company reduces the proportion of delays in fertilizer delivery by 21.6%. There is evidence that reporting a complaint has positive geographic spillovers, since it induces the company to deliver inputs to several neighboring plots.
- **[Teleconferences and Telecenters for Training in Peru](#)**: In order to facilitate the transition from illegal coca farming to the formal economy, “telecenters” were built to support online connectivity and offer trainings on digital and financial literacy.
- **[Ethiopian Agricultural Transformation Agency Creates a Hotline to Help Smallholder Farmers Nationwide](#)**: The Interactive Voice Response (IVR)/Short Message Service (SMS) system currently provides smallholder farmers free access to information on cereal, horticulture, and pulse/oil seed crops, as well as a wide range of agriculture-related activities. A push-based voice and SMS alert system also notifies extension workers and smallholder farmers of any pertinent agriculture issues.

DIGITAL FINANCIAL SERVICES

Digital finance services (DFS) are inclusive electronic payments, such as mobile money, that reduce costs and increase transparency, helping to combat poverty and improve public financial management. Increased use of the existing systems and technical assistance to strengthen the supply, demand, and regulatory and policy frameworks contributes to the development of robust digital finance ecosystems in targeted developing countries.

Digital financial services can help to address specific chronic challenges across the agricultural value chain—especially where the traditional finance sector is not fully addressing the demands in rural markets. This sector often faces high infrastructure costs and a lack of incentives to adapt products to the unique needs of farmers. Digital finance expands access to the formal financial system through both basic transaction accounts and branchless banking. Basic transaction accounts are supervised by banking regulators, taking advantage of the rapid growth of digital and mobile telephone infrastructure; branchless banking offers the ability to transact outside of a traditional bank branch. These factors have a direct link to increasing farmer income and decreasing malnutrition.

Using DFS to address specific challenges in agriculture has significant spillover effects. Integrating DFS helps to engage the private sector in the rural economy due to the rapid growth of digital finance providers in Feed the Future priority markets, spurring lasting market growth (the goal of Feed the Future's market systems approach).

Uses of DFS in agriculture include:

- *Savings/Credit Products*: credit (in the form of loans, notes, bills of exchange, banker's acceptances, etc.) and savings can be used to finance agricultural transactions, such as, improved seeds or agricultural tools. These mechanisms can be adapted to farmers' specific needs, based on planting, harvesting, and marketing cycles.
- *Digitally-Enabled Index Insurance*: insurance that is tied to weather events can help farmers' mitigate risks and increase profits with digital purchase, claims filing, resolution, and payout.
- *E-vouchers*: governments can subsidize the purchase of improved agricultural inputs through a digital platform
- *Basic Transaction Account*: a mobile wallet allowing for funds storage and for farmers to easily receive payments in times of need increases farmers' ability to withstand shocks (related to climate or other threats to household resiliency)

Resources

- [Guide to the Use of Digital Financial Services in Agriculture](#): The goal of this Guide is to identify specific challenges in value chains that can be addressed by improved payments or financial services, and then to identify corresponding DFS solutions to these specific challenges,

with the aim of improving the ability of value chains to increase farmer incomes. It is split into five sections: introduction, analytical framework, intervention types, case studies, and procurement.

- **[Making the Journey from Cash to Electronic Payments: A Toolkit for USAID Implementing Partners and Development Organizations](#)**: The Toolkit is intended to be a practical “how-to” guide divided into step-by-step modules explaining how to use electronic payments for development. It is split into three sections: introduction, analysis, and implementation.
- **[Procurement Executive’s Bulletin on Guidance for Electronic Payments under USAID awards](#)**: The purpose of this Bulletin is to provide guidance to the Acquisition Workforce on promoting electronic payments under contracts, grants and cooperative agreements.
- **[Mission Critical: Enabling Digital Environments for Development](#)**: This USAID Opportunity Brief is a guide to help USAID and other government employees engage with policy makers and regulators in emerging markets to advance enabling environments for digital financial services" or "enabling environments for digital payments. By highlighting stories and lessons from around the world, this brief aims to inspire ideas and action to propel digital payments forward in countries where USAID operates.

Examples:

- **[ADVANCE Case Study](#)**: As the main value chain project of USAID/Ghana’s Feed the Future efforts, the Agricultural Development and Value Chain Enhancement II (ADVANCE II) project aims to improve the livelihoods of 113,000 smallholder farmer beneficiaries by boosting the productivity of rice, maize, and soy value chains. ADVANCE II has integrated a full suite of digital tools into its programming. In doing so, the project aims to increase the earnings and security of the smallholder farmers it supports throughout Ghana.
- **[Musoni Case Study](#)**: Musoni became the first completely cashless microfinance institution in the world, by enabling customers to receive and repay their loans via Safaricom’s M-PESA system, rather than in cash. As of July 2017, Musoni had disbursed 207,823 loans to 91,454 clients.
- **[Serving Smallholder Farmers in Nigeria: Recent Developments in Digital Finance](#)**: Introduces some recent developments in DFS for smallholder farmers in Nigeria. The featured case studies (i) identify traditional pain points in serving smallholder farmers (such as the cost and risk of making payments to farmers and delivering subsidized credit), (ii) discuss how DFS are being used to overcome these pain points, and (iii) highlight some initial obstacles and successes.
- **[Mobile Money, Smallholder Farmers, and Household Welfare in Kenya](#)**: Analyzes impacts of mobile money technology on the welfare of smallholder farm households in Kenya. Using panel survey data and regression models, we show that mobile money use has a positive impact on household income. Mobile money users apply more purchased farm inputs, market a larger

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proportion of their output, and have higher profits than non-users of this technology. These results suggest that mobile money can help to overcome important smallholder market access constraints that obstruct rural development and poverty reduction.

PROGRAMMING RESOURCES

WORK PLANNING AND PROCUREMENT CONSIDERATIONS

Guidelines for Procurement:

- In general, “Digital” in its many forms is a tool, not a goal, and should be used where it enables the achievement of development objectives, reduces the cost of delivery, or both. Unless expanding access to digital tools (such as investing in mobile or internet connectivity, supporting related government policy, or partnering with technology firms or network operators) is part of the stated objective of an activity or program their use should not be mandated within a procurement without evidence that a mandated tool or approach is demonstrably better than other methods. (The exception is in monitoring and evaluation where digital tools should be the default unless there is strong justification for manual collection and reporting.)
- While “digital” should not generally be mandated, implementing partners should be encouraged to explore digital tools.
- Implementing partners should also be encouraged to consider non-traditional partnerships to engage the technology community, innovators, and incubators as a way to spur investment in digital approaches.
- Digital language does not go in just one place in the procurement document: it should be in several places (e.g., the program description/SOW/SOO, the evaluation criteria), both because some of it may be cut out during the editing process and because it should be considered together with the task at hand, not as a separate requirement.
- Ask that implementing partners mention, emphasize, and adhere to the [Principles for Digital Development](#) and describe how any technology solution will be consistent with the Principles.
- Promote open-source, or at least open platform, solutions. Discourage proprietary or closed technology solutions that cannot be owned or afforded by local actors
- Consider “total cost of ownership” in evaluating technology solutions.
- Technology can be transformative, opening up new possibilities beyond incrementally improving existing methods.

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Resources

- [Procurement Executive's Bulletin on Guidance for Electronic Payments under USAID awards](#): The purpose of this bulletin is to provide guidance to the Acquisition Workforce on promoting electronic payments under contracts, grants, and cooperative agreements. It encourages staff to ensure that the default payment mechanism that implementing partners rely on is electronic where feasible. USAID staff have the discretion to waive the expectation for electronic payments if the implementing partner demonstrates that doing so is not feasible in the context in question.
- [ADS 579: USAID Development Data](#): Data, and the information derived from data, are assets for USAID, its partners, the academic and scientific communities, and the public at large. The value of data used in strategic planning, design, implementation, monitoring, and evaluation of USAID's programs is enhanced when those data are made available throughout the Agency and to all other interested stakeholders, in accordance with proper protection and redaction allowable by law.
- [ADS 201: Program Cycle Operational Policy](#): The Program Cycle is USAID's operational model for planning, delivering, assessing, and adapting development programming in a given region or country to advance U.S. foreign policy. It encompasses guidance and procedures for: (1) Making strategic decisions at the regional or country level about programmatic areas of focus and associated resources; (2) Designing projects and supportive activities to implement strategic plans; and (3) Learning from performance monitoring, evaluations, and other relevant sources of information to make course corrections as needed and inform future programming. Program Cycle implementation also facilitates USAID's compliance with many requirements of the Government Performance and Results Modernization Act (GPRAMA).

PRIZES AND CHALLENGES

Prizes and Challenges are a way to crowdsource innovative solutions to well-defined development problems, and often cut across all of the categories of technology and more.

Prizes are designed to award the achievement of a specific outcome, while challenges are designed to conduct a search for multiple broad solutions, make awards, and support their development. Common features of both include: a well-defined problem, a call to action, an active outreach campaign to attract a wide range of qualified competitors, an application cycle or investment window, an evaluation criteria and judging, and an incentive.

Examples:

- [Data-Driven Farming Prize](#): D2FTF launched the Data-Driven Farming Prize in collaboration with the Global Development Lab's iDesign team. The prize was designed to bridge new sources of agricultural data, and [insights from it](#), to smallholder farmers in Nepal. This prize was managed from Washington, D.C. with strategy, design, communications, and prize administration (cash transfer) help from an implementer.

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- **[Tech4Farmers Challenge](#)**: The Tech4Farmers Asia Challenge aims to identify and support innovative solutions from South or Southeast Asia which address critical constraints faced by farmers in the region. Our focus is on improving the productivity, sustainability and profitability of smallholders involved in vegetable and aquaculture production.

Resources:

- **[Innovation Programming, and Design Toolkit](#)**: This Toolkit, and its 10 individual resources was designed to help you think through how to design a challenge or a prize from beginning to end, including elements like communications and evaluation. It also helps you think about what comes after the award and how to help ensure the innovations you support have the best possible chance to have lasting impact. This was written by teams of experts and program managers who have designed and executed numerous prizes, grand challenges, and ventures.

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APPENDICES

- Appendix 1.** Change in Total Subscribers Since 2010
- Appendix 2.** Change in Mobile Connections Since 2010
- Appendix 3.** Change in 3G + 4G Market Penetration Since 2010
- Appendix 4.** Change in Population Since 2010
- Appendix 5.** Agriculture as % of GDP, 2015

APPENDIX 1: CHANGE IN TOTAL SUBSCRIBERS SINCE 2010

The table below shows the change in total subscribers between Q1 2010 and Q2 2017 in Feed the Future and affiliate countries. Total change ranges from 844,213 in Liberia to 49,553,632 in Bangladesh; percent change ranges from 20.25% in Honduras to 554.85% in Ethiopia. In total, total subscribers in these countries have increased by 127.82%, or 239,713,576.

TOTAL SUBSCRIBERS

COUNTRY	ABSOLUTE CHANGE IN TOTAL SUBSCRIBERS	PERCENT CHANGE IN TOTAL SUBSCRIBERS
Bangladesh	49,553,632	123.28
Cambodia	7,469,983	144.29
Ethiopia	30,697,049	554.85
Ghana	10,286,432	115.80
Guatemala	2,423,346	38.14
Haiti	1,847,803	63.99
Honduras	943,218	20.25
Kenya	15,988,624	121.93
Liberia	844,213	92.99
Malawi	2,740,613	128.51
Mali	8,501,827	245.56
Mozambique	9,793,886	206.48
Nepal	13,764,215	260.32
Niger	3,539,130	160.41
Nigeria	41,162,246	84.88
Rwanda	4,511,252	214.23
Senegal	3,918,478	90.43
Tajikistan	2,979,231	91.76
Tanzania	13,229,428	112.81
Uganda	9,393,025	108.81
Zambia	6,125,945	176.93
TOTAL	239,713,576	127.82

Source: GSMA Intelligence

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APPENDIX 2: CHANGE IN MOBILE CONNECTIONS SINCE 2010

The table below shows the change in mobile connections between Q1 2010 and Q2 2017 in Feed the Future and affiliate countries. Total change ranges from 1,057,209 in Honduras to 79,610,916 in Bangladesh; percent change ranges from 14.36% in Honduras to 382.31% in Nepal. In total, total subscribers in these countries have increased by 152.10%, or 421,950,952.

MOBILE CONNECTIONS

COUNTRY	ABSOLUTE CHANGE IN MOBILE CONNECTIONS	PERCENT CHANGE IN MOBILE CONNECTIONS
Bangladesh	79,610,916	145.66
Cambodia	19,745,886	227.08
Ethiopia	45,154,056	749.60
Ghana	23,104,140	144.99
Guatemala	7,225,861	62.54
Haiti	2,892,956	82.86
Honduras	1,057,209	14.36
Kenya	18,393,354	92.44
Liberia	2,139,794	167.52
Malawi	4,765,313	173.09
Mali	15,131,694	328.95
Mozambique	12,786,314	205.52
Nepal	26,878,153	382.31
Niger	5,926,500	214.97
Nigeria	88,128,344	115.26
Rwanda	7,660,375	287.23
Senegal	7,608,443	105.15
Tajikistan	5,080,498	115.77
Tanzania	22,604,268	128.47
Uganda	17,100,728	139.38
Zambia	8,956,150	197.16
TOTAL	421,950,952	152.10

Source: GSMA Intelligence

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APPENDIX 3: CHANGE IN 3G + 4G MARKET PENETRATION SINCE 2010

The table below shows the change in 3G + 4G market penetration between Q1 2010 and Q2 2017 in Feed the Future and affiliate countries. Total change ranges from 1.49 percentage points in Niger to 79.51 percentage points in Cambodia. On average, 3G + 4G market penetration increased by 27.96 percentage points in these countries.

3G + 4G MARKET PENETRATION

COUNTRY	ABSOLUTE CHANGE IN MARKET PENETRATION (PERCENTAGE POINTS)
Bangladesh	20.54
Cambodia	79.51
Ethiopia	34.64
Ghana	62.08
Guatemala	39.91
Haiti	15.76
Honduras	43.4
Kenya	17.39
Liberia	9.8
Malawi	10.99
Mali	18.7
Mozambique	28.63
Nepal	28.98
Niger	1.49
Nigeria	27.7
Rwanda	34.68
Senegal	22.12
Tajikistan	25.41
Tanzania	27.87
Uganda	18
Zambia	19.49
AVERAGE	27.96

Source: GSMA Intelligence

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APPENDIX 4: CHANGE IN POPULATION SINCE 2010

The table below shows the change in population between Q1 2010 and Q2 2017 in Feed the Future and affiliate countries. In total, the population increased 18.46%, or 134,821,323, in these countries. This is significantly less than the increases seen in total subscribers (239,713,576, or 127.82%) or mobile connections (421,950,952, or 152.10%).

POPULATION

COUNTRY	ABSOLUTE CHANGE IN POPULATION	PERCENT CHANGE IN POPULATION
Bangladesh	13,638,676	9.02
Cambodia	1,767,596	12.35
Ethiopia	17,348,016	19.94
Ghana	4,490,131	18.58
Guatemala	2,351,793	16.05
Haiti	1,020,323	10.24
Honduras	830,996	11.12
Kenya	8,403,196	20.97
Liberia	806,570	20.56
Malawi	3,639,047	24.82
Mali	3,640,860	24.19
Mozambique	5,384,867	22.29
Nepal	2,381,938	8.89
Niger	5,426,566	33.63
Nigeria	33,465,593	21.13
Rwanda	1,933,186	18.90
Senegal	3,191,276	24.81
Tajikistan	1,318,103	17.48
Tanzania	11,585,607	25.58
Uganda	8,774,094	26.69
Zambia	3,422,889	24.78
TOTAL	134,821,323	18.46

Source: GSMA Intelligence

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APPENDIX 5: AGRICULTURE AS % OF GDP, 2015

The table below shows the value added of the agricultural sector in Feed the Future and affiliate countries' GDPs, which averaged 25.30%. The lowest percent value added was 5.25% in Zambia, and the highest was 40.97% in Mali.

AGRICULTURE IN THE ECONOMY

COUNTRY	AGRICULTURE, VALUE ADDED (% OF GDP)
Bangladesh	15.51
Cambodia	28.63
Ethiopia	39.23
Ghana	20.99
Guatemala	10.76
Haiti	No Data
Honduras	13.59
Kenya	33.30
Liberia	34.37
Malawi	29.71
Mali	40.97
Mozambique	25.20
Nepal	33.00
Niger	No Data
Nigeria	20.86
Rwanda	30.17
Senegal	17.49
Tajikistan	24.95
Tanzania	31.08
Uganda	25.61
Zambia	5.25
AVERAGE	25.30

Source: World Bank

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