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

GFSS Supplemental Technical Guide
Towards Digitally Enabled Global Agriculture and Food Systems

This is one of 18 technical guidance documents for implementing the U.S. Government's Global Food Security Strategy. The entire set of documents can be found at www.feedthefuture.gov and www.agrilinks.org.

Introduction

Global agricultural development is increasingly shaped by the unprecedented growth of the digital economy. As noted in the U.S. Government's Global Food Security Strategy (GFSS), digital technologies have demonstrated the potential to redefine economic growth models, empower poor people with new communications tools, and facilitate more productive interactions and financial transactions across agricultural market systems and value chains. This guide highlights key concepts, evidence, and principles of good practice to leverage the full potential of digital tools in market system and value chain programming.

Terminology and Context

Agricultural development is in a period of intense data-driven transition, and models for realizing the full benefit of this transformation are emerging and evolving. Advancements in earth science, computational power, geospatial analysis, and data communications systems over the last 30 years have made it possible to monitor crops and assess yields from space,[1] better predict and manage economic or climatic shocks,[2] [3] and improve the precision and profitability of agricultural production. There is growing consensus that the precise management of production factors made possible by digital technologies will be critical for achieving the sustainable, adaptive global intensification of agricultural production the world requires,[4] yet even in industrialized countries the path to full market adoption remains unclear.[5] [6] For example, investment in agriculture technologies in the U.S. reached $4.6 billion in 2015[7] (including both public and private sector investments), yet of 22 key economic sectors,[8] agriculture ranks last in its levels of digitization.

Both developed and developing economies have much to contribute. As the data related to global food and agriculture systems grow, so do opportunities to gain new insights and turn them into action, linking value chain actors across agriculture and food systems. For example, crop breeding programs can increasingly leverage large, real-world datasets,[9] in addition to controlled field trials, to accelerate development of locally-adapted crop varieties[10] and build ongoing feedback with farmers. Localized data detailing on- and off-farm productivity and natural resource management are increasingly used to improve the timeliness and site-specificity of agronomic advice[11] and revolutionize new financial services to help farmers save,[12] access credit,[13] or manage risk. Global coordination has led to efforts like the Agricultural Market Information Systems (AMIS), a G20 initiative aimed at improving global data and market transparency as well as coordination of policy action in response to market uncertainty by disclosing regular, reliable, accurate, timely, and comparable data.

Developing economies are now part of this global transformation in large part as a result of the mobile revolution: explosive growth in mobile phone sectors worldwide has made telephony nearly ubiquitous, driving dramatic expansion in internet access and decreased transaction costs. Unique mobile subscribership (one person, one number) increased by 75 percent and smartphone adoption increased by 800 percent from 2010 to 2015 in the areas where Feed the Future works.[14] The world has seen a 400 percent increase in deployment of mobile money services in the same timeframe.

Despite these substantial advances, constraints do persist. This is particularly true in remote environments with low bandwidth and/or unreliable network connectivity and where communities face challenges due to digital illiteracy, lack of locally relevant content, unaffordable mobile and broadband services, and in some cases gender gaps around mobile phone ownership and use. Because these constraints might have implications on program design, **market research should be performed at the outset**. USAID's Mobile Access Diagnostic Tool[15] provides an online platform for measuring the strength of a mobile ecosystem at national and regional levels.

The power of digital technologies comes from how they can be integrated to address challenges across agriculture and food systems, at multiple scales, to:

Improve feedback between market actors. There is a growing body of rich evidence[16] demonstrating that digital channels such as Interactive Voice Response, low-cost video, digital payments, and text messaging campaigns enable true *interactivity* between smallholder farmers and other value chain actors, and this can support adoption of improved farming practices and creation of new commercial connections. Quicker feedback also enables more rapid decision-making and response.

Strengthen farmer and system resiliency. The expansion of mobile money has dramatically lowered transaction costs and, by providing the ability to store funds and access remittances quickly, has, in some contexts, directly improved smallholder farmers' resistance to economic shocks[17] and enabled new pathways out of poverty.[18] Once they are established, mobile money networks enable innovations in digital delivery of the full array of financial services including savings, insurance, and credit for smallholders[19] and the array of other market actors. In turn, this can contribute to greater household resilience, with digital technologies and approaches helping to connect farmers and agricultural entrepreneurs with additional income-generating activities and business opportunities both on and off their farms, as well as helping women farmers, in particular, to gain access to and control over their incomes.

Digital technologies in agriculture may include:

- Remote sensing (such as from satellites or unmanned aerial vehicles);
- Proximal sensing such as for soil moisture, hand-held crop health sensors, or through networked weather stations;
- Mapping and geospatial analysis;
- Big-data analysis of production factors; and
- Telemetric farming technologies to improve the precision of mechanization or irrigation.

Projects or business models may leverage these as well as **information and communication technology (ICT) tools** including:

- The internet and mobile phones;
- Tablets or other electronic devices;
- Social media;
- Mobile money and digitally-enabled financial services; and
- Enhanced traditional media including radio and television

When mobile money networks are established to make humanitarian response payments, this critical infrastructure can serve as a bridge to resilience and long-term food security. USAID is already leading the way by working with the Department for International Development (DFID), the Gates Foundation, and the Federal Ministry for Economic Cooperation and Development (BMZ) to operationalize the Barcelona Principles for Digital Payments in Humanitarian Response, which lay the foundation for ensuring that aid is leveraged for long-term social, economic, and financial inclusion.

Digital financial services also generate data that can be used for rapid feedback, particularly when compared with data from the farm or other links in the value chain — improving transparency, trust, and coordination between actors at all levels of the food system.

Increase farming precision. Integrated data on production factors including hyper-localized weather, soils, inputs, and management are being used to improve the timeliness or site-specificity of agronomic advice, and there is growing evidence that this is effective for increasing productivity in developing agriculture sectors.[20] [21] For example, text message or interactive voice campaigns can remind farmers to conduct time sensitive tasks and achieve increased productivity with no change in the farmer's costs. This type of data and digital solution are also useful to pastoralists; for example, USAID/Ethiopia's REVIVE[22] program is providing pastoralists and county level government offices with digital access to regularly updated vegetative greenness maps for decision making on livestock movement for grazing.

Extend reach of advisory services. Existing extension services can include more farmers — including women farmers, who may not have the same level of access to agricultural or market information — and leverage greater interaction with them over digital channels, such as through locally produced low-cost video on improved agronomic practices.[23] Additional resources and tools on ICT-enabled extension are available on the MEAS website.[24]

Tighten connections across a food and agriculture system. Digital tools enable business models that are founded on improved coordination and unlocking value across a food system, such as easing on-demand mechanization,[25] transport,[26] and leasing, or enabling bundling of digital financial products with critical agricultural services at multiple points in the value chain to help farmers access the right inputs when they need them.[27] Digitally-enabled business models have lower transaction costs and higher potential for scale, and create new channels to reach vulnerable populations, including women and youth, who may not have the same networks or priority to access these services. Similarly, digital payments and tools can enable firms to purchase commodities directly from smallholder farmers who were previously too expensive to reach.

Leverage new data for system-wide analysis and decision making. Use of digital technologies generates data that may unlock more precise understanding of market systems when combined with data from other sectors or sources. For example, researchers have successfully established mobile phone usage patterns as proxies for changes in wealth[28] or food security[29] that could enable in-depth analysis and decision support, as well as more effective monitoring, evaluation, and learning in development programs. This includes both data collected from farmers, communities, and implementers on the ground — often over mobile phones and tablets using a variety of off-the-shelf, proven, and affordable collection tools — and the array of "big data" sources and processes such as geospatial imagery combined with machine learning.

Designing Interventions

Scalable, successful implementations of digital tools in agriculture and food systems will build on decades of U.S. Government experience in value chain programming while leveraging and contributing to the evidence base for digital interventions. High-level precepts for programming include:

Analyze and understand your market system and value chain challenges. Identify the key constraints or challenges in target value chains and market systems that can be addressed through the use of digital solutions, leveraging USG expertise and the specific technical guidance on market systems and value chain programming. The Guide to the Use of Digital Financial Services in Agriculture[30] and accompanying video case studies[31]provide one framework that can be used to diagnose and assess agriculture value chains to determine key areas where digital approaches can be leveraged.

Leverage the digital economy. USG programs have decades of experience with value chain methodologies, but a shorter history of leveraging the digital economy in specific country environments.

To design scalable digital interventions, program designers must consider how their program can benefit from and contribute to the digital economy in their country contexts including, as comprised by:

- Policy and enabling environment for mobile telephony, internet diffusion, value-added service providers, and digital financial services;
- Policies and/or stakeholders promoting open data for development;
- Presence of digital enterprises and startups, such as those engaged in end-to-end business process outsourcing or web and mobile application development;
- Number and position of market participants in each of these categories of service and number of products or services targeting the agriculture sector.

Leverage public, private, and non-profit alliances. Agricultural intensification is enabled by active collaboration among public, private, and non-profit actors, including the research and academic communities. Similarly, multiple stakeholders will have incentive to help a new digital service succeed if it addresses a key challenge or constraint. Stakeholders include traditional value chain actors such as distributors, processors, or farmers' associations as well as digital actors such as mobile network operators, investors or funders, and information technology firms. Innovation processes such as challenges, prizes, alliances, or co-creation events will create opportunities to leverage the unique capabilities of an array of actors. The USG is often well-placed to convene this array of actors to improve the enabling environment and overall functioning of the market system. An example of this is the Data Driven Farming Prize,[32] which aims to source data driven solutions for smallholder farmers to be tested in Nepal.

Build on good digital development practice. Leverage the existing evidence and body of knowledge about good digital development practice. The Principles for Digital Development[33] include nine well-supported precepts for design, diffusion, and adoption of digital innovations. The Principles have been adopted by multiple funders and implementers.

Make gender inclusivity a design principle. Women comprise up to 50% of agricultural workers, yet they play different roles in agricultural production and the household (generally more informal roles), have different price sensitivities and purchasing priorities than men (reinvesting an estimated 90% of their income in their families), and access information through different, often informal channels.[34] They are less likely to have access to technology due to cultural barriers, lower literacy levels, and less disposable income, so addressing the needs of women in agriculture often requires a more tailored approach. Considering gender inclusion and equity at the outset of developing a digital intervention will ensure that the particular needs of women are adequately met.

Operational Best Practices

Data-driven development in agriculture is an emergent discipline that will be most effective when considered as an integral *and integrated* part of the program design, implementation, monitoring, and evaluation cycles. Some key practices will help unlock the full potential of digital solutions across the program cycle:

Default to "electronic first" data. The increased efficiency, quality, and cost-savings of digital data collection makes its adoption good business practice. Electronic data enables easier comparison of indicator data with non-traditional datasets (such as mobile network data), potentially providing new, cost-effective proxy measurements for changes in food security. As a result, USAID has developed publicly available guidance[35] on geo-referenced, electronic data collection and reporting that will help accelerate collection of good quality data.

Default to digital payments wherever possible. Electronic payments are good development practice. To support this, USAID has adopted procurement guidance[36] stating that all grantees or contract awardees must make electronic payments the default means of transaction wherever possible; this guidance is in accordance with the Digital Accountability and Transparency Act of 2014. Agreement and Contracting Officers have critical roles to play here.

Embrace open data wherever possible. The spirit of USG open data efforts[37] is to default toward sharing and openness — provided no sensitive information or personally-identifiable information is shared — in recognition that USG-funded data can be leveraged for the public good. Leveraging data from implementing partners, USG-funded researchers, open data repositories, and non-traditional sources such as mobile network data can inform strategy, support implementation, and enhance learning and adaptation. To realize the potential of open data, Agreement and Contracting Officers' Representatives have critical roles to play in requiring implementing partners to provide well-organized, machine-readable data as a deliverable.

Include digital capabilities in procurement requirements. Contractors and grantees need digital expertise to fulfill minimum USG reporting requirements, and there may be specific competencies or approaches that need to be identified in procurement documents (e.g. geospatial analysis for monitoring natural resource management) to ensure that contractors and awardees are leveraging proven digital tools and business models that embody and contribute to good digital development practice.

Conclusion

The *potential* of digital technologies for transforming agriculture has given way to the *reality* today, but the market alone may not bring that potential to fruition. The USG has a critical role to play in leveraging these tools to lift underserved populations out of poverty, fostering greater food security, resilience, and nutrition.

Additional Resources and Tools

For further assistance related to topics discussed in this Technical Guidance, please contact ftfguidance@usaid.gov.

General: There are many resources related to digital tools in agricultural development. Check www.agrilinks.org and www.e-agriculture.org for examples. *The E-Agriculture Strategy Guide*,[38] published by the Food and Agriculture Organization (FAO) and the International Telecommunication Union, is useful for countries that are developing national e-agriculture strategies.

Skills Building: TechChange[39] offers interactive online courses on agriculture and cross-sectoral topics.

Digital Financial Services: The Consultative Group to Assist the Poor (CGAP) conducts research and analysis on reaching smallholder farmers through digital financial services. A recent study[40] summarizes progress related to digitizing agriculture value chains.

Development programming: The USAID Global Development Lab's Center for Digital Development has produced numerous resources on incorporating digital development into programs, including digital inclusion, digital finance, geographic and data analytics, and development informatics.

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