POLICY BRIEF

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Socially Inclusive Digital Tools for Agriculture

A Way Forward

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KEY MESSAGES

- Socially inclusive digital tools are necessary to support diverse smallholder farmers' access to digital services such as technical advice and access to markets. Improving smallholders' access to digital resources and providing tool functions and features that enhance social inclusion are both necessary.

- Tool features that enable two-way communication, multiple channels of communication, co-creation of practices, and farmers' demonstration plots support more inclusive technical advisory services.

- Performance assessment tools can support smallholder inclusion by assuring that farmers retain ownership of personal and assessment data, that data are stored privately and securely within each user account and that farmer data are not being used for the profit of the tool developer or implementor.

- Mobile learning applications, gamification, SMS-alerts, and chatbots within digital tools make learning about agricultural insurance accessible to smallholders and improve adoption.

- Digital tools that promote the aggregation of smallholder products or serve as an e-commerce platform allow smallholders to fairly engage in formal markets.

- Principles for inclusion can help guide digital tool design and use.

Smallholders and digital inclusion

Increasing numbers of digital tools are available for agriculture that could benefit diverse smallholder farmers in low- and middle-income countries (LMICs) by providing services such as technical advice or access to markets and finance. Yet while digital tools have the potential to reach millions of smallholder farmers, most smallholders still lack access to appropriate or relevant digital services. In addition, many digital tools for agriculture have not been designed or used in ways that support the broad inclusion of traditionally underrepresented groups such as smallholder farmers.

The purpose of this brief is to identify (1) exemplary tool features and (2) principles for more socially inclusive digital tools. The goal is to improve the inclusiveness of digital tool to benefit smallholder farmers, including the diverse subgroups among them. Inclusive digital tools can be understood within the context of social and digital inclusion, which are often discussed as distinct topics.

Social inclusion can be defined as: "the process of improving the terms on which individuals and groups take part in society—improving the ability, opportunity, and dignity of those disadvantaged on the basis of their identity" (World Bank, 2013).

Digital inclusion is defined as "the ability of individuals and groups to access and use information and communication technologies. Digital inclusion encompasses not only access to the internet but also the availability of hardware and software; relevant content and services; and training for the digital literacy skills required for effective use of information and communication technologies" (Becker et al., 2012).

From these definitions, digital inclusion can be viewed as a component of social inclusion. While social inclusion points to who might be left out in digital development, digital inclusion focuses on improving access and reducing barriers to digital resources. Five barriers commonly limit digital inclusion (Deganis et al., 2021):

TRANSITIONS

1. **Access**: the lack of information and communication technology (ICT) infrastructure (i.e., all the devices, networks, protocols, and procedures that are employed in the telecoms or information technology fields), especially in rural areas.

2. **Affordability**: excessive cost of internet connections and ICT devices (e.g., computer, smartphone, tablet).

3. **Skills**: lack of digital and literacy skills.

4. **Awareness**: limited awareness of the benefits of the internet and ICTs.

5. **Relevance**: lack of incentive to go online based on irrelevant or inaccessible content (e.g., content not in local languages).

Smallholder farmers in LMICs often face all of these barriers, resulting in a digital divide that only exacerbates existing social inequity. Smallholder farmers are already a marginalized and disadvantaged group by virtue of being rural, poor, and often having limited formal education or literacy. Multiple layers of exclusion also need attention. Barriers may be even higher for smallholders who are women, individuals with disabilities, indigenous, landless, low caste or have a minority identity. Improved digital development should consider and address these inequities.

Below we identify exemplary tool functions and features, as well as principles for more inclusive digital tools for diverse smallholder farmers.

A Way Forward

To be relevant to farm users generally, digital tools should have the following core features:

- Create value for farmers so they have a reason to adopt the tool.
- Provide contextually relevant advice or solutions that are tailored to their unique context.
- Allow for direct farmer feedback, including farmer experience exchange and tool improvement recommendations.
- Support learning and incentives for adoption in ways appropriate to smallholders' capacities and interests.
- Provide some level of "boots on the ground" (i.e., physical, in-person support).

Tools often overlook these core features for smallholders. Unequal power relations and a disconnect from farmers' needs and input are two common critiques of digital tools for smallholders. Digital tools designed for and with smallholders, under the set of core features listed above, can promote equitable capacity building, co-creation and co-design of tools and practices, cooperative learning, mentorship, and sharing of resources, knowledge, and practices (Shelton et al., 2022).

Digital tool features that support smallholder inclusion for specific functions are discussed below. We examine four functions of digital tools in agricultural development: technical advisory services, farm performance assessment, insurance and risk management, and access to markets and finance. We conclude with principles that may help guide developers in producing digital tools that better benefit diverse smallholders.

As much attention has been given to barriers related to access, affordability, and skills (DIAL, 2017), we focus here on *relevance.* Relevant digital tools for smallholders are tools with functions or features that serve smallholders' farmers' needs, current situations, and agroecological contexts. Functions describe a tool's purpose or the service provided, and features are the channels through which a user can engage with the tool (e.g., text or audio messages, call centers, and community videos).

Technical advisory services

Many technical advisory services provide generalized recommendations that lack the contextual specificity of location, value chain, or social conditions required to make the service valuable for individual farmers. This is exacerbated in rural areas where connectivity may be insufficient, or when farmers incur costs to send or receive messages, which prevents farmer input. Unless explicitly designed for smallholders and their subgroups, digital advice is more likely to be generalized in ways that reflect the circumstances of larger, wealthier, and majority groups of farmers.

The first approach to improve the relevance of technical advice is therefore to explicitly design and implement tools for smallholders and the diversity of groups in them. This includes identifying smallholders' technical needs,

facilitating user-centered design, building smallholders' digital capacities, and examining the need for human intermediaries to support information flows.

Second, is to give smallholders input and influence over the content of tools improves tools' relevance. Short messaging service- (SMS) based advisories and alerts, and interactive voice response (IVR) services that can run on low-end devices (i.e., devices with basic communication features) and do not incur costs offer an opportunity for improving the relevance of advice to local conditions and farmers' co-creation of practices. Co-creation of farming practices is defined here as the collaborative development of farm practices among farmers, researchers, technical advisors, and others (Dittmer & Burns et al. 2022).

Technical advisory messages can be delivered through a wide variety of channels. Incorporating one or more communication features to deliver content increases the likely usability of the tool. For example, using SMS in addition to call centers or face-to-face exchange via extension agents allows farmers to choose communication features according to their specific needs and may lead to an increase in farmer satisfaction and trust in the service. Allowing for direct farmer feedback and two-way-communication ensure information flows between farmers and advisors.

More inclusive technical advisory services may also be achieved by involving a user-centered design approach to tailor advisory content for delivery to farmers and to understand the requirements and abilities of the target farmer groups. The user-centered design approach is grounded in continuous and structured interactions with smallholders, ultimately putting their experiences at the center of the service or product design. Establishing user personas, or example users whose intersectional characteristics and goals represent the needs of a larger group, as part of the user-centered design approach, may help address one of the most important questions: "Who are we designing for?"

Demonstration plots have traditionally been used by agricultural organizations and associated extension agents to introduce smallholders to farming innovations. As a trusted source of innovation, demonstration plots can be used to facilitate the adoption of digital technical advisory services. ClimMob is an example of a digital tool leading this effort. The free and open-source software uses citizen science to design on-farm trials that serve as demonstration plots based on participants' innovation interests and collect and analyze data and communicate results via extensive automatic reports, which famers can now use this empirical evidence to independently improve their cultivation practices.

Performance assessment

Digital tools for on-farm performance assessment can support smallholders to access credit, certification, or payments for ecosystem services. They can also support improved farm management. Examples of assessment include checklists of best practices or comprehensive assessment of climate change or sustainability indicators.

Many performance assessment tools collect and generate large amounts of data. Smallholder farmers are often unaware of their rights to intellectual property or the risks of sharing it. They are also disadvantaged in negotiating for these rights. More inclusive performance assessment tools can support smallholder inclusion by assuring that farmers retain ownership of their personal and assessment data, that data is held privately and securely within each user account, and that farmer data is not being used for the unfair profit of the tool developer or implementor (Shelton et al., 2022). While there is potential for data-driven insights from multiple assessments and contexts, this must be accompanied by a responsible and robust data ethics framework, the complete and ongoing consent from individual users, anonymous profiling, and allow for the user to opt-out of data sharing at any time.

Most digital tools for performance assessment do not transparently provide information to users or ask for their consent about intellectual property rights. Implementation of tools may not have protocols that ensure smallholder farmers are aware of the rights and risks of sharing data. The Cool Farm Tool, a farm decision support tool, supports smallholder inclusion by explicitly stating data ownership rights and how farmer data will be used and stored. Farmers retain ownership of their assessment and personal data, which is stored privately in their account, but have the option to share assessment results with other users.

Insurance and risk management

In LMICs, smallholders often do not have access to risk management products, such as crop insurance, based on limited availability of insurance options for low-income farmers, the high cost of data collection and claims processing, or smallholders' lack of awareness or understanding about insurance. The use of digital tools to

provide agricultural insurance has the potential to improve smallholder uptake and reduce transaction costs (USAID, 2018).

Interventions to increase smallholders' access to agricultural insurance can begin at the smallholder, aggregator, service provider, or government level. For the case of smallholders, tools that promote learning about insurance to reduce cost and increase uptake may include mobile learning (m-learning) apps, gamification, SMS-alerts, and chatbots. For example, Viamo developed an interactive mobile audio game to educate smallholders in Madagascar on the concepts of microinsurance and climate change. Not only did half of the farmers express interest in being contacted once the new insurance was available, but farmers who played the audio game had listened to twice as many messages related to microinsurance relative to farmers who had not played the game.

Alternatively, crop insurance policies may be integrated directly with smart contracts (i.e., programs stored on a blockchain that run when predetermined conditions are met) and indexed to local weather. This would allow for policies to be automatically triggered once an extreme event occurs, thereby facilitating the fair, transparent, and timely payouts to smallholders. For example, Chanlink has launched a program to support the development of data-driven decentralized insurance products and accelerate adoption, which caters to smallholders and helps them cover losses after extreme events.

Access to markets and finance

Many smallholders lack access to formal markets and rely on middlemen for information and services, thus receiving less money for their products. Digital e-commerce platforms can improve smallholder access to markets by making market prices more transparent or supporting collective smallholder selling, thereby increasing smallholders' negotiating power and reducing their dependency on traders.

Price transparency allows smallholder farmers to find buyers and reduces their risk of post-harvest losses. Numerous success stories exist for the use of e-commerce platforms. For example, smallholders in Mozambique that use the e-commerce platform, IzyShop, reported monthly revenues five times greater than the country's average for smallholder farmers (Joiner and Okeleke, 2019).

Digital tools that promote the aggregation of smallholder products provide another inclusive way for smallholders to engage in formal markets. Mozar3, an agtech startup in Egypt, helps farmers sell their crops by working with institutional buyers. It signs contracts with smallholders via the Mozare3 Farmer App to purchase future products at the predicted market price for the buyer. Contracted smallholders then receive an electronic payment card to receive their money digitally.

Rapid digitalization in 2020 because of the COVID-19 crisis accelerated the shift towards digital finance. Digital tools such as mobile money and e-wallets have the potential to support smallholder financial inclusion and provide new market opportunities. M-Pesa is a well-known example of mobile banking that has reduced transaction costs in Kenya. The service was designed to allow users to securely send, receive, and store money on any mobile device. M-Pesa has lifted 194,000 households out of poverty, especially female-headed households (Suri and Jack, 2016). Global development communities can therefore consider mobile money services as a poverty alleviation tool in regions with limited bank access.

Taking these examples into account, we provide principles below to guide the development of social inclusion generally in digital tools for smallholders. We broaden the scope to consider all barriers to inclusion, from access to relevance.

Follow the Principles

Numerous standards, guidance, and frameworks exist to inform socially inclusive digital tool development and implementation. We provide below a set of principles that can guide developers in producing digital tools and tool managers to use digital tools in ways that better benefit diverse smallholders. The principles are based on a comprehensive review of the literature and expert consultations (Dittmer & Burns et al., 2022). Below we elaborate on the actions to support inclusion.

1. Engage diverse farmers

Digital tools are often developed without understanding the diversity among farmers. Before design or implementation of a digital technology begins, a firm understanding of the target group and diversity of farmers in that group are needed to support tool access and relevance. Barriers can be analyzed by gender, age, income or social class, size of farm, land tenure, landlessness, language, ethnicity, ability, sexuality, or other relevant categories.

Once the target groups and their barriers to engagement have been identified, the design process for the specific needs of traditionally underserved populations in the target farmer group can begin.

Farmers are experts of their own lived experiences. Including them in stakeholder meetings and prioritizing their feedback throughout the process is going to enrich their experience with the digital tool. The farmer should also have trust in and feel represented by the service — invoke common cultural context by incorporating voices that speak the same dialect or leverage local knowledge, for example. Services and related content need to be tailored to support the farmer, not the developer.

2. Enhance access

Going online can be confusing, difficult, and costly. Besides accessing physical devices, users must know how to navigate subscription fees, download software, create online accounts and more — all of which can make for a challenging experience.

Start by investigating what level of digital skills and literacy the target farmers have and then create a plan to either invest in trainings for farmers or create a service that is sensitive to their current level of literacy. In digitally illiterate or semiliterate areas, incorporating text-free interfaces, IVR or videos will help with uptake and retention. Confidence in using a digital service is as much of a requirement as connectivity.

Free digital services may be one way to enhance access and affordability, though free services should be assessed for potential trade-offs between cost and quality. Transparent business models that facilitate affordable farmer access are needed to understand who will absorb the cost of the tool. Providing open access to tools, data and innovation can enhance collaboration among development communities and lead to robust innovations.

3. Co-create digitally enabled farming practices with the farmer

Smallholder farmers' knowledge and needs are often not addressed in digital tools. Yet, the co-creation of farming practices among farmers, technical advisors, and researchers can bring together diverse knowledge and perspectives to produce relevant and sustainable farming practices.

Farmers' context, including local crop and livestock systems, environmental conditions, climate and weather, household conditions, cultural and language setting, and their interests and goals must be considered from the outset. Partnering with diverse farmers can help guide the relevant content and delivery method needed for the success of a digital tool and create opportunities to form collaborative solutions among multiple actors.

Farmers should be able to experiment with alternative practices rather than follow a prescriptive list. Incorporating two-way-communication features for farmers to discuss practices with advisors or peers and to provide feedback on what does and does not work is needed to facilitate information flow and avoid a top-down approach. Smallholders are ultimately in control of their own production decisions.

4. Use technology appropriately

Digital tools may not always be necessary or the best course of action. Digital tools should only be used when they add value to an existing in-person process.

When digital tools are deemed necessary, simple solutions should be prioritized based on the context. This also includes incorporating supportive features that target farmers are already familiar with. Examples of simple and familiar tool features may include SMS, video or audio messages in local languages, or integration of software such as WhatsApp or Facebook.

Farmers may need assistance using digital tools. Incorporating trusted human intermediaries, such as extension agents or trainers, can help farmers with inputting data or by providing coaching on how to use information generated by the tool. Involving human intermediaries outside of face-to-face processes, such as hotlines and coaching services linked to tools, provide further opportunities for farmers and experts to interact and design solutions best suited to farmers' needs.

5. Use farmers' data responsibly

Digital technologies generate and store large amounts of data. Yet smallholder data privacy is often not well established, thus creating an additional obstacle for them to engage with a digital tool.

Clear guidelines are needed that prioritize farmers' privacy, safety, and agency in issues related to data governance and ownership. Where farmers' data are being collected, they should remain as the primary beneficiary of any economic benefit from their data and be able to opt-out of a service or data sharing at any time.

Capturing disaggregated data will allow tool developers and implementors to better understand what types of farmers are being affected by digital tool solutions. This should also include data from regions where data points are typically lacking (e.g., Sub-Saharan Africa) to get relevant solutions to farmers in these regions. Disaggregated data can also be used to identify excluded target farmers and how to better reach them.

6. Develop tools responsibly

Duplication of resources waste time, money, and effort, ultimately benefitting no one.

Before designing or updating a tool, tool developers should have a clear understanding of the digital ecosystem and how a new or improved tool adds value to this ecosystem. In many cases, preexisting tools, resources, guidance, and approaches can be adapted or enhanced for a particular context.

It is the responsibility of the tool developer and implementor to manage the negative impacts of digital tool use and their content. Such impacts include loss of important human interaction, excessive or irrelevant information, or misinformation. Feedback mechanisms can enable farmers to flag issues, which tool developers can then address in future updates.

Policy Needs

To enhance social inclusion for diverse smallholders in digital tools, attention to both digital inclusion and social inclusion policy is needed. For digital inclusion, governments can strengthen infrastructure development, human capital and farmer education on digital literacy and skills. For social inclusion, governments and the private sector can:

- Promote coordinated joint planning and decision-making with smallholders to consider the needs of different stakeholders and regions based on local contexts.
- Create tangible incentives for smallholders to access and use digital tools.
- Invest in programs that prioritize smallholders and underrepresented groups among them. Create targets for accountability.
- Identify scenarios for the improved well-being of smallholder farmers. Compare this against their current status and analyze the gap. Design digital tools to address the gap.

Conclusions

Digital tools are transforming agricultural production, but smallholders are often being left behind. To make digital tools more inclusive for smallholders, their needs must be heard, and their participation supported. Aside from closing the digital divide, embracing social inclusion in tool functions and features is critical. In this brief, we examined:

- Examples of four digital tool functions or services that provide development opportunities for smallholder farmers: technical advice, performance assessment, risk management, and access to markets or credit.
- Examples of tool features that can improve the relevance of services to smallholder farmers.
- Overarching principles to guide the development and implementation of socially inclusive digital tools.

Providing inclusive digital tools to diverse smallholder farmers is vital in addressing multiple Sustainable Development Goals. Digital tools are inclusive only when the delivered content or service reflects the users' needs and contexts. Digital agricultural development can be inclusive at the smallholder level. For digital tools to reach their full potential for improving the lives of millions of smallholder farmers, prioritizing smallholders and their agency in digital tools is essential.

Further reading

- Becker, S., C. Coward, M. Crandall, and R. Sears. 2012. Building Digital Communities: A framework for action. Institute of Museum and Library Services, University of Washington, International City/ County Management Association., Washington, DC.

- Deganis, I., P. Zohouri Haghian, and M. Tagashira. 2021. Leveraging digital technologies for social inclusion. United Nations Department of Economic and Social Affairs.

- Digital Impact Alliance (DIAL). 2017. Principles for Digital Development. https://digitalprinciples.org/principles/.

- Dittmer, K.M., S. Burns, S. Shelton, and E. Wollenberg. 2022. Principles for socially inclusive digital tools for smallholder farmers: A guide. Cali, Colombia: Alliance of Bioversity & CIAT.

- Joiner, J., and K. Okeleke. 2019. E-commerce in agriculture: new business models for smallholders' inclusion into the formal economy. GSMA.

- Shelton, S.W., C. Gehan, E. Wollenberg, C. Costa Jr, S. Burns, et al. 2022. Critiques of digital tools in agriculture: Challenges & opportunities for using digital tools to scale agroecology by smallholders. Agroecological TRANSITIONS: Inclusive Digital Tools to Enable Climate-informed Agroecological Transitions (ATDT), Cali, Colombia: Alliance of Bioversity & CIAT.

- Suri, T., and W. Jack. 2016. The long-run poverty and gender impacts of mobile money. Science 354(6317): 1288–1292. doi: 10.1126/science.aah5309.

- USAID. 2018. Using digital tools to expand access to agricultural insurance.

- World Bank. 2013. Inclusion Matters: The Foundation for Shared Prosperity—Overview. Washington, DC: World Bank.

The Agroecological Transitions for Building Resilient, Inclusive, Agricultural and Food Systems (TRANSITIONS) Program aims to enable agroecological transitions through the development and adoption of holistic metrics for food and agricultural systems performance, inclusive digital tools, and transparent private sector engagement.

The Inclusive Digital Tools (ATDT) project aims to support the use of digital resources and citizen science to empower farmers to co-create, adapt, and innovate practices for climate-resilient and low-emission agroecological outcomes at large scales. This brief was produced by the global team as part of the review of the agricultural global digital ecosystem.

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