Agroecological TRANSITIONS Programme

Principles for socially inclusive digital tools for smallholder farmers: A guide

Version 2

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TRANSITIONS

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Agroecology; Social inclusion; digital resources; smallholder farmers.

Introduction

The digitization of food systems is well underway. The digital ecosystem and its actors have increasing influence over how food is produced, what food people buy, and the flow of information among farmers, supply chain actors, and consumers. Efforts to transform food systems towards sustainability, including climate change resilience and mitigation, similarly rely on digital resources and offer the opportunity to scale up best practices rapidly at low cost.

Yet the top-down and often public good or corporate-driven nature of digital tools can be at odds with the ethos of farmers' self-determination and empowerment, especially for smallholder farmers in low- and middle-income countries (LMICs). Smallholder farmers do not have the resources, technology, or influence to develop digital resources that reflect their priorities.

This guide seeks to address concerns with the current digitalization of food systems (Shelton et al., 2022), including:

- Many digital tools designed for food systems are irrelevant to smallholder farmers' situations or have inaccessible content by use of paid subscriptions or not using local languages.
- Marginalized groups are often the last to benefit from new technology and at the greatest risk of privacy and data rights violations.
- Few tools include progressive sustainability practices such as low-emission agriculture, climate change adaptation or agroecology, or robust scientific evidence behind technical advice and performance assessment.

The guide lays out principles to instruct development and implementation of socially inclusive digital tools with smallholder farmers. The principles are intended to increase social and livelihood benefits of digital tools for diverse and underrepresented groups of farmers. The co-creation of farm practices with farmers is framed as an element of social inclusion that ensures relevance to farmers' livelihoods and development of robust technical solutions.

Our six principles aim to support digital developers and managers using digital tools with farmers. For **tool developers** – entities responsible for producing a tool – the guide can be used in design, implementation, evaluation, and improvement. In the case of **tool managers**, the guide can be used in all stages of application and modification of the tool, including selection, adaptation, use, evaluation, and improvement. Tool managers are commonly technical advisors, extension agents, or farmer support organizations, who are using a tool to improve farmers' well-being and practices through improved agricultural technical options, performance assessment, or access to finance and markets. The guide can also help **funders**, **farmers' organizations** or **nongovernmental organizations** (NGOs) hold developers or tool managers accountable to social inclusion principles.

A core tenet of this guide is that social inclusion should support farmers' agency, not just their participation, or identification of their needs. We refer to agency as farmers' ability to identify their goals, express their perspectives, make informed decisions, and act as empowered equal partners with tool developers throughout the process of tool design, implementation, and improvement.

We define digital tools as an application, online resource (not a platform), or other software available on a digital device such as a cell phone, smartphone, computer, or tablet—including tools based on text, audio, and visual components. We use the World Bank (2013) definition of social inclusion as "the process of improving … the ability, opportunity, and dignity of those disadvantaged on the basis of their identity." We use the term farmer to mean a person whose livelihood depends on the cultivation of crops or the tending of livestock. Farmers may include landless farmers and farm laborers. We defined co-creation of farming practices as the collaborative development of practices among

farmers, researchers, technical advisors, and other stakeholders. We differentiate co-creation from the co-design of tools, which is the process of developing digital tools in collaboration with appropriate stakeholders, including farmers.

We focus on farmers as the intended beneficiary of digital tools, but multiple players in the food system or digital ecosystem often serve as intermediaries who use digital tools or facilitate farmers' input to or use of the tool. Intermediaries may include technical advisors, NGOs, researchers, or companies. Achieving social inclusion requires understanding the needs of intermediaries in addition to farmers and supporting their collaboration. These actors are often the primary users of tools that aim to benefit farmers or improve farming practices. The principles in this guide also apply to intermediary users; however, we intentionally focus on farmers here as the group most in need of agency and inclusion in the application of digital tools.

This set of six principles is the result of a review of existing frameworks for digital projects, the learnings from a global review of digital tools (Dittmer et al., 2022), and interviews with digital tool and social inclusion experts. The principles can guide the design and implementation of digital tools to better include diverse, underrepresented farmers.

Principles for digital tool use and co-creation of best practices with farmers

Principle 1	**Engage diverse farmers**
1.1	Understand the full range of farmer diversity and who is left out
1.2	Ensure usability of tools to benefit diverse farmers
1.3	Enable diverse farmers to influence tools
Principle 2	**Enhance access**
2.1	Invest in farmers' digital literacy and skills
2.2	Provide open access to tools, data and innovation
2.3	Use business models that facilitate affordable farmer access
2.4	Build on existing community social networks
Principle 3	**Co-create digitally enabled farming practices with the farmer**
3.1	Use context-relevant tools
3.2	Facilitate information flows among farmers, and between farmers and advisors
3.3	Support collaborative solutions with farmers
3.4	Use resources efficiently, including farmers' time
3.5	Use participatory evaluation methods
3.6	Co-validate data
Principle 4	**Use technology appropriately**
4.1	Use digital tools only if they add value
4.2	Prioritize simple solutions depending on the context
4.3	Incorporate supportive resources, tools, and technology
4.4	Support farmers through human intermediaries
4.5	Design and allow for flexibility to accommodate multiple users

Principle 5	Use farmers' data responsibly
5.1	Use data privacy, security, and safety measures that meet diverse farmers' needs
5.2	Ensure informed and ongoing farmer consent
5.3	Share data analysis and learning with diverse farmers
5.4	Capture disaggregated data for diverse farmers
5.5	Identify excluded users
Principle 6	**Develop tools responsibly**
6.1	Build on existing solutions
6.2	Support farmer agency
6.3	Manage secondary negative impacts
6.4	Establish transparent and accountable governance structures

Using this guide

Tool developers and managers are encouraged to use this guide to support social inclusion for the benefit of diverse and underrepresented smallholder farmers.

Each principle includes a description and examples of activities to work towards the principle. The activities required by a project depend on the stage of digital tool development and the type of project. A project might aim to design a new digital tool, select among existing tools, or adapt an already-in-use tool. To use this guide for a particular project, activities appropriate to the digital tool in use or under development should be identified for each sub-principle. The resulting set of activities can then be managed during project implementation.

The principles should be interpreted according to local contexts and applied as guidelines rather than strict rules. In this way, the principles are alive and adaptable. This guide is also a living document. The principles will be amended as they are tested in use. Feedback or comments to the authors are welcome. Contact information may be found in the citation section of this document.

Changes from Version 1

Five new sub-principles were introduced, and six existing sub-principles were revised based on lessons from the Agroecological TRANSITIONS' Inclusive Digital Tools (ATDT) project, established in 2021. The practical application of the principles in different local contexts highlighted areas where additional principles were necessary or existing principles could be refined to better support social inclusion.

For **livestock systems in Pará, Brazil**, key lessons included engaging youth as entry points to social networks, the need for technical advisors to curate digital knowledge generated by farmers, and managing trade-offs between inclusiveness and business viability due to tool owners' business models that involved selling farmers' information (Costa Jr. et al., 2022). Principles related to building on existing community social networks (**Principle 2.4**), using participatory evaluation methods (**Principle 3.5**) and using co-validation to select acceptable agroecological practices (**Principle 3.6**) were introduced to reflect these lessons. **Principle 2.3** was refined to highlight the importance of business models that are both affordable for farmers and designed for long-term success.

For **rice systems in the Mekong River Delta of Vietnam**, to address the longevity of the digital tool after the project period, additional principles were introduced for the design of digital tools for flexibility to ensure long-term success amongst diverse users (**Principle 4.5**) and to note the importance of transparent and accountable governance structures once the tool is implemented by additional partners (**Principle 6.4**).

Trends in digital tool development such as principles for artificial intelligence (AI) (e.g., OECD, 2024) and feedback from tool developers, project managers, and diverse smallholder farmers during participatory group discussions also informed the updated principles. For example, the principle related to co-validation of data (**Principle 3.6**) also reflects the need for farmers, advisors or scientists to validate automated information generated by AI. **Principle 3.3** was revised to emphasize the importance of incorporating traditional and indigenous knowledge of local farmers into the evaluation and promotion of farming practices within the digital tool.

Links to existing social inclusion frameworks

Each principle and sub-principle in this guide include a discussion of how the principle is situated relative to established social inclusion frameworks. We conducted an exploratory literature review to better understand existing principles, standards, frameworks, and guidance related to the inclusive use or development of digital tools, or more broadly, inclusive digital development. We reviewed 33 reports, articles, and grey literature to characterize the state of understanding digital inclusion. The resources ranged from broad guidance intended to help integrate best practices into technology-enabled development programs (e.g., *Principles for Digital Development*) to specific frameworks to advance the digital inclusion of underrepresented groups, such as persons with disabilities (e.g., *Principles for Driving the Digital Inclusion of Persons with Disabilities*), indigenous peoples (e.g., *Promoting the Rights of Indigenous Peoples*), and women (e.g., *Bridging the Digital Gender Divide: Include, Upskill, Innovate*).

We also mapped the new principles against established principles using six existing and widely accepted standards or guidance that we identified in the review (see Table 1). The six resources were selected to cover a range of digital development themes related to social inclusion. These included their applicability to apply digital technologies to development programs, promoting digital inclusion of disenfranchised groups and accounting for intersectional user needs, providing standards for digital public goods, and assessing companies' current level of social inclusion. Three resources provide guidance to inclusive digital development and another three resources provide standards (i.e., the degrees of goodness for evaluative criteria) to inclusive digital development.

Table 1: Map of principles to existing social inclusion frameworks.
An X denotes where principles are generally aligned with existing frameworks.

Principles	Guidance			Standards		
	DIAL[1]	GMSA[2]	POLLICY[3]	DPGA[4]	WBA[5]	Tufts[6]
Principle 1	**X**	**X**	**X**			**X**
1.1	X	X	X			X
1.2	X	X	X		X	
1.3	X		X	X		X
Principle 2	**X**	**X**	**X**	**X**	**X**	**X**
2.1	X	X		X	X	
2.2	X		X	X	X	
2.3	X	X	X		X	X
2.4						
Principle 3	**X**	**X**	**X**			**X**
3.1	X	X	X			X
3.2						
3.3	X	X	X			X
3.4	X					
3.5	X					
3.6					X	
Principle 4	**X**	**X**				**X**
4.1	X					
4.2	X					
4.3						
4.4						
4.5	X	X	X		X	X
Principle 5	**X**	**X**		**X**	**X**	**X**
5.1	X	X	X	X	X	
5.2	X					
5.3	X				X	X
5.4		X				
5.5		X	X		X	
Principle 6	**X**	**X**	**X**			**X**
6.1	X	X				X
6.2	X					X
6.3	X		X	X	X	
6.4	X	X	X	X	X	X

[1] Digital Impact Alliance (DIAL) - Principles for Digital Development

[2] Global System for Mobile Communications Association (GSMA) – Principles for Driving the Digital Inclusion of Persons with Disabilities

[3] POLLICY – Inclusion, Not Just an Add-On

[4] Digital Public Goods Alliance (DPGA) – Digital Public Goods Standard

[5] World Benchmarking Alliance (WBA) – Digital Inclusion Benchmark

[6] Tufts University – Beyond Access: How Digital Technologies Power Inclusive Innovation in Smallholder Farming

Digital Impact Alliance's (DIAL) Principles for Digital Development are nine guidelines that are designed to help integrate best practices into technology-enabled programs and are intended to be updated and refined over time. They include guidance for every phase of the project life cycle and are part of an ongoing effort among development practitioners to share knowledge and support continuous learning. The Principles for Digital Development has been endorsed by over 300 organizations.

The Global System for Mobile Communications Association (GSMA) Assistive Tech program works with the mobile industry and key stakeholders to address the digital inclusion gap of persons with disabilities and identify innovation opportunities for making mobile technologies enablers of assistive technology. The principles set out a framework for action for the mobile industry, together with recommended activities, to help address the barriers that currently prevent persons with disabilities from accessing and using mobile-enabled products and services. These principles are easily generalizable to other digitally excluded groups.

POLLICY's guide uses three personas (i.e., a realistic representation of the patterns in the audience, users, or customers for reference) to reflect the lived experiences, needs, risks, and frustrations that a user might face based on intersecting identities such as race, gender, ability, sexuality, class, etc. The personas serve as a foundation on how to engage with the four frameworks (Accessibility-by-Design, Gender-by-Design, Privacy-by-Design, and Safety-by- Design) presented in the report as well as other considerations to create an inclusive design in technology policies, practices, and products.

The Digital Public Goods Standard, developed by Digital Public Goods Alliance (DPGA) is a set of specifications and guidelines designed to maximize consensus about whether a digital solution conforms to the definition of a digital public good: open-source software, open data, open standards, and open content that adhere to privacy and other applicable best practices, such as *do no harm by design*, and are of high relevance to attain the United Nations 2030 Sustainable Development Goals (SDGs). The Digital Public Goods Standard establishes the baseline requirements that must be met to earn recognition as a digital public good. This standard is designed to complement other relevant principles such as the Principles for Digital Development.

The Digital Inclusion Benchmark, developed by the World Benchmarking Alliance (WBA), tracks how companies are helping to advance a more inclusive digital economy and society. Company commitments, disclosure, and performance are evaluated under four measurement areas: improving access, enhancing skills, building trust to foster beneficial use, and innovating openly, sustainably, and ethically. The benchmark scope will increase to 200 companies by 2023 to include all digital companies that are part of the SDG2000 (i.e., the World Benchmark Alliance's list of the 2,000 most influential companies for the SDGs).

The Fletcher School at Tufts University and Digital Planet use the Inclusive Innovation Model and the Nine A's Framework to assess and visualize select companies strengths and weaknesses for each of the business model components and their contributions to inclusion. The Nine A's Framework consists of advantage, affordability, accessibility, appropriateness, additivity, adaptability, amplifiability, authority, and adjacency.

This review showed that existing frameworks cover aspects of access well, but there has been limited guidance on the co-creation of farming practices. Sufficient evidence exists for principles related to social inclusion. DIAL, GSMA, and Tufts generally provided the most comprehensive frameworks for both social inclusion and general co-creation principles. Principles related to engaging diverse users, enhancing access and affordability, and using data responsibly (Principles 1, 2, and 5) were well captured. Our review revealed a gap in principles related to the appropriate use of technology (Principle 4), specifically the importance of human intermediaries, and thus is an area needed for further exploration.

Principle 1: Engage diverse farmers

This principle specifies the inclusion and engagement of diverse farmers. It is relevant to tool developers and tool managers. Engaging with users is a critical and well-established principle for designing inclusive digital products. DIAL broadly presented this as "design with people." Resources with specific topics, such as USAIDS' Promoting the Rights of Indigenous Peoples, highlight the need to "engage indigenous peoples." This principle adds the need for explicit attention to diverse farmers.

Subprinciples	Example activities
1.1 Understand the full range of farmer diversity and who is left out	
Identify the types of diversity among farmers in the target population (e.g., gender, age, class, land tenure, language, ethnicity, ability, sexuality, etc.) and define subgroups relevant to the local context. Assess how well existing digital products, including connectivity, hardware and software products, reach farmer subgroups and the obstacles they experience in using or not using them. The definition of a target group and the levels of diversity identified will depend on a project's objectives and scope and what is manageable based on project resources. To overcome biases that may limit diversity, projects should critically evaluate their decisions and seek external input from social inclusion specialists. Existing frameworks establish that digital design should be sensitive to the needs of the end-user by incorporating modalities the user is familiar with or can easily learn. DIAL advises to "ensure that the design is sensitive to and considers the needs of the traditionally underserved." GSMA and POLLICY advise to "deliver inclusive products and services that meet the diverse requirements of persons with disabilities" and "content should be perceivable: Information and user interface components must be presentable to users in ways they can perceive," respectively.	▪ Survey or interview target users to understand unique perspectives, identities, and life experiences. ▪ Ask target farmers about their current digital and analog communication formats and platforms. ▪ Assess connectivity capacity in the target region. Understand what sub-groups are not reached by this connectivity. ▪ Create user personas to design and test tools.
1.2 Ensure usability of tools to benefit diverse farmers	
Ensure tools meet the specific needs related to each farmer subgroup. Digital tool user needs must also be addressed when the user is not the farmer. Needs may relate to language, literacy, privacy, connectivity, or farmers' practices, for example. Include diverse farmers in stakeholder meetings, pilot the tool with diverse users and prioritize their feedback. Throughout implementation, track to make sure that uptake is appropriate among subgroups. Investigate project assumptions and work to identify unintentionally excluded farmers. Use an appropriate balance of digital and in-person channels of engagement. This principle is related to the GSMA principle to "deliver inclusive products and services that meet the diverse requirements of persons with disabilities." DIAL and POLLICY say to "ensure that the design is sensitive to and considers the needs of the traditionally underserved" and "consider that your users are diverse and embrace design choices that appreciate the full range of human diversity," respectively.	▪ Include underrepresented farmers in design workshops, focus groups and testing. Make sure farmers are appropriately compensated for their time. ▪ At each step of design, make a note of how the current design could exclude individuals, and which individuals or groups those might be. ▪ During implementation, include focused outreach to traditionally underserved populations to improve digital literacy and understanding of the benefits of uptake.
1.3 Enable diverse farmers to influence tools	
Avoid a top-down approach where developers decide what farmers need before seeking input. Start with collaborative question-asking and develop problem statements. Acknowledge the value of partnering with diverse farmers and the value they provide. Together with farmers, design a meaningful action plan for tool design, implementation, use, or improvement. Establishing collaboration between digital developers and users is recognized in the resources reviewed. POLLICY states to "acknowledge that your users are experts over their lived experiences, and that partnering with them enriches their experiences on platforms." Establishing partnerships was mentioned in six of the resources reviewed.	▪ Organize workshops for developers and farmers to work on prototype resources. ▪ Include feedback mechanisms in tool and assign developer(s) to be responsible for evaluating and incorporating farmer and user recommendations. ▪ Schedule in-depth feedback in project design.

Principle 2: Enhance access

Digital access, affordability and skills, including digital literacy, are the foundation of any digital social inclusion effort. These are well covered in existing frameworks and usually expressed as individual principles. The principle is relevant to both tool developers and tool managers. Twelve resources mentioned access and five mentioned affordability and skills.

Subprinciples	Example activities
2.1 Invest in farmers' digital literacy and skills	
Investigate what level of digital literacy target farmers have. Plan to close any gap between the current level of literacy and the needed literacy for the project. It may be better to invest in literacy for actors other than farmers, especially when farmers are not the primary users of the digital tool. For example, invest to improve capacity by training extension or field staff in new technologies such as tablets or smartphones. Make sure that intermediary staff is prepared to teach any necessary actions for downstream usage. This subprinciple is most relevant to tool managers. In the reviewed resources, improving skills ranged from "improv[ing] all levels of digital skills" (WBA) to urging investment in education, literacy, and digital skills (UN Department of Economic and Social Affairs). Lack of digital skills is listed as a major barrier to user uptake.	▪ Design tools that account for required learning. ▪ Schedule workshops to teach farmers with low digital literacy how to interact with the tool and related technology. ▪ Disseminate needed hardware and coach individuals on how to use it. ▪ Deliver voice or text message instructions on how to take advantage of features of the tool and related hardware, software, or content.
2.2 Provide open access to tools, data, and innovation	
Provide open access rights and proactively share tools, data, and innovations with people and organizations that can make use of and improve them. Promote collaboration among development communities to conserve limited resources and avoid duplication of work. This subprinciple is most relevant to tool developers. DIAL states "use open standards, open data, open source, and open innovation." DPGA also advised on the use of approved open licenses for digital public goods.	▪ Post data to public databases. ▪ Use open-source technology. ▪ Make proprietary technology available for free or marginal cost.
2.3 Use affordable and sustainable business models	
Develop and implement business models that are both affordable for farmers and designed for long-term success. Prioritize the understanding of potential trade-off between access and quality, including whether increased cost is associated with increased functionality and vice versa. Offer free or affordable access to tools and transparency about trade-offs in value among cost options. Business models should reflect affordability for actors along the value chain. Be clear about who will absorb the cost, what compels them to absorb that cost, and how long the farmer will have to bear the cost. Be aware of any tools that require payment from the farmer or other community members. Make available zero or low-cost options. In existing frameworks (e.g., UN Department of Economic and Social Affairs), affordability was related to the cost of internet coverage and the digital tool. It was also addressed as the key barrier to closing the digital divide. Free or low prices were listed as ways to increase demand for a tool.	▪ Include a no-cost tool when exploring possible tool options. ▪ Connect with technology providers to discuss whether tools with fees can be made available at lower or no cost. ▪ Use tools already familiar to farmers if appropriate (such as WhatsApp).
2.4 Build on existing community social networks	
Leverage communities' existing social networks to enhance access to resources, facilitate knowledge sharing, and provide mutual support. This can involve strengthening farmer cooperatives, online forums, and local meetups where farmers can exchange ideas, share experiences, and receive support from their peers. This principle was generated from participatory workshops with farmers, not the reviewed literature.	▪ Develop and maintain an online platform or forum where farmers can discuss agricultural practices, share resources, and support each other. ▪ Coordinate regular local meetups or workshops for farmers. ▪ Provide technical support and training to existing farmer cooperatives.

Principle 3: Co-create digitally enabled farming practices with the farmer

The co-creation of farming practices among farmers, technical advisors and researchers is a principle for bringing together diverse knowledge and perspectives to produce relevant and sustainable farming practices. This principle primarily supports the use of tools with farmers and is most relevant to tool managers. This is not common in existing frameworks but builds on DIAL's advice to "design with people" and POLLICY's principles on collaboration and localization.

Subprinciples	Example activities
3.1 Use context-relevant tools	
Understand and be sensitive to the context of different farmer subgroups, including local crop and livestock systems, environmental conditions, climate and weather, household conditions, cultural and language setting, and the interests and goals of a target farmer population. Build or choose tools with these priorities in mind and return often to the target population to validate appropriateness. The principle of using context- and solution-appropriate tools was well established in the resources reviewed. Existing principles ranged from "develop context-appropriate tools informed by users' priorities and needs" (DIAL) to "consider that users from different parts of the world feel valued when products mirror their realities and are culturally adaptive" (POLLICY).	▪ Interview target users to learn language and literacy capacity. ▪ Organize co-creation workshops to develop both the tool and its content. ▪ Ask farmer subgroups to evaluate tools based on appropriateness for context. ▪ Develop offline tools where connectivity or infrastructure is lacking.
3.2 Facilitate information flows among farmers, and between farmers and advisors	
Facilitate opportunities for communication among farmers in a peer group and between advisors and farmers throughout the design, use, and improvement of a tool. Ensure information flows in two directions. Build and use tools with established, robust communication channels with which farmers and advisors are familiar. Co-creation may involve several types of communication, such as providing data analysis for citizen science, jointly creating solutions, or iterative learning. IFOAM Organic Europe has translated the 10 Elements of Agroecology (FAO) into principles for ICT4AE (ICT for Agroecology) and advises "creating tools that combine top-down (scientist-to-farmer) with bottom-up (farmer-to-scientist) and peer-to-peer (farmer-to-farmer) modes of communication, aimed at the co-creation of situated agroecological knowledge."	▪ Include two-way communication in the tool between the farmer and the advisor. ▪ Create peer groups, for example, in WhatsApp, through an application. ▪ Include video recordings from peers in tool.
3.3 Support collaborative solutions with farmers	
Partner with diverse farmer subgroups and include them throughout the design, updates, and implementation of farming practices assessed or promoted in the tool. Integrate the traditional and indigenous knowledge of local farmers into the assessment process. Build farming practices in collaboration with these communities and iterate based on their feedback and direction. Enable farmers to experiment with alternative farming practices. The principle of establishing partnerships and collaborative solutions was well established in the resources reviewed. Effective Development for Co-operation explicitly advised to "promote inclusive, bottom-up, and innovative partnerships and raise awareness of engagement opportunities" and "make partnerships more accessible." As a broader outlook, POLLICY advised to "acknowledge that your users are experts over their lived experiences, and that partnering with them enriches their experiences on platforms."	▪ Facilitate workshops that include developers, users, and farmers at every step of development. ▪ Build in feedback mechanisms.

3.4 Use resources efficiently, including farmers' time

Time, money, and effort should be evaluated for the benefit gained. Be respectful of the time farmers allocate for co-creation processes. Inform farmers of the costs and value of new practices.

The reviewed resources lacked mention of using resources efficiently in terms of farmers' time, money, and effort. DIAL's principle of "reuse and improve" is most closely aligned with this principle. However, it is mainly related to adapting and enhancing existing products, resources, and approaches. In any case, adapting and enhancing existing products would translate into saving time, money, and effort downstream.

- Calculate how much time will be lost for individuals participating in co-creation sessions.
- Compensate individuals for participating in co-creation sessions.
- Schedule co-creation work with other existing programming or value add for participants.

3.5 Use participatory evaluation methods

Actively involve farmers in the evaluation process of farming practices. Utilize participatory research methods, such as on-farm trials, participatory workshops, or farmer-led evaluations, to jointly assess the impact and effectiveness of different agricultural practices.

No existing principles from the reviewed resources mention the use of participatory evaluation methods for evaluating outcomes of interventions. DIAL's principle of "design with people" emphasizes the importance of involving end-users in the design and evaluation process through participatory methods to ensure that innovations are relevant, effective, and continuously improved based on feedback.

- Set up on-farm trials where farmers can test different agricultural practices.
- Hold participatory workshops where farmers can discuss their experiences with various farming practices.

3.6 Co-validate data

Engage in collaborative efforts to curate and validate data or information among farmers, researchers, and advisors to ensure that information is accurate, relevant, and credible. Validate automated (e.g., AI) data with farmer or scientific expert knowledge to enhance the reliability and overall quality of the information produced. Where parties disagree, support negotiation or find a means for pluralistic solutions.

The principle of co-validating data or information was well established in the resources related to AI systems, which should consistently perform as intended, minimize accidental and unexpected hazards, and remain secure against tampering or compromise. For example, Google's AI principle of "be accountable to people" states, "We will design AI systems that provide appropriate opportunities for feedback, relevant explanations, and appeal. Our AI technologies will be subject to appropriate human direction and control."

- Organize regular workshops where farmers, researchers, and advisors collaboratively review and validate data.
- Implement a feedback mechanism within the digital tool that allows farmers and advisors to provide real-time input on data accuracy and relevance.

Principle 4: Use technology appropriately

Using technology appropriately is a means of using resources wisely and acknowledging that digital solutions alone may not always be the best solution. The principle is relevant to both tool developers and managers. It is not common in existing frameworks but was highly relevant during expert interviews. It builds on DIAL's advice to "develop context-appropriate tools informed by users' priorities and needs, considering the ecosystem and accepting that digital tools will not always be the best fit." GMSA recommends to "develop and/or release products and services that appeal to persons with disabilities" and "enhance existing products or services to appeal to persons with disabilities" with the notion to provide content, products, and services that are relevant to the target population.

Subprinciples	Example activities
4.1 Use digital tools only if they add value	
Digital tools may not always be necessary or the best course of action. Evaluate non-digital alternatives before moving forward with digital tools. Also, evaluate tradeoffs between digital solutions and existing in-person processes. Investigate the unintended consequences of adding a digital tool to existing processes. This subprinciple is most relevant to tool managers. DIAL advised to "develop context-appropriate tools informed by users' priorities and needs, considering the ecosystem and accepting that digital tools will not always be the best fit" within the "design with the user" principle.	▪ Evaluate the benefits and the costs of changing an interaction from in-person to digital. ▪ Evaluate non-digital options such as radio or poster campaigns.
4.2 Prioritize simple solutions depending on the context	
Simple solutions are likely to be more cost-effective and sustainable. The appropriate level of simplicity of a digital tool will vary depending on the purpose of the digital tool and enabling conditions for its use, including digital infrastructure, and digital and language literacy. Find solutions that consider these contexts and provide the simplest solution possible to meet project goals. Use existing technology or tools with which farmers are already familiar. This subprinciple is most relevant to tool developers. The UN Department of Economic and Social Affairs reflected this principle with "digital solutions, including those for low-skilled and low-literate users, are most effective when content is simple, clear, and culturally relevant." This was an important point during expert interviews.	▪ Use SMS, IVR or WhatsApp. ▪ Design USSD (Unstructured Supplementary Service Data) menus instead of applications. ▪ Use video or audio devices with local language information.
4.3 Incorporate supportive resources, tools, and technology	
When implementing new digital technologies, incorporate complementary technologies and resources familiar to farmers. Formats such as IVR, SMS, or radio can support primary digital tool implementation within the broader project scope. Poster campaigns or paper and pen options can run in parallel with digital tool implementation. This subprinciple is most relevant for tool managers. One resource (*Why Women Aren't Using Your Ag App*) advised using text-free user interfaces, community radio, IVR, and non-mobile phone solutions to better reach and engage female users.	▪ Use SMS, IVR or WhatsApp in addition to primary digital tool. ▪ Design USSD menus instead of applications. ▪ Use video or audio devices with local language information. ▪ Supplement with radio and poster campaigns.
4.4 Support farmers through human intermediaries	
Incorporate trusted human intermediaries, such as extension agents or trainers, to support famers' access to digital tools and their benefits. Intermediaries may help farmers by providing local equipment, inputting data, coaching on how to use the results, reporting results, or asking for feedback. Identify needs for including a role for interaction with other people, whether in person or otherwise, for successful digital tool implementation. This subprinciple is most relevant for tool managers. This principle has not been established in the reviewed literature, though it was an important and repeated comment made in expert interviews.	▪ Interview farmers about whom they trust for information. ▪ Work with existing organizations to develop and implement technology. ▪ In-person trainings.

4.5 Design and allow for flexibility

To ensure long-term success, design and test tools for flexibility to accommodate diverse user needs and scenarios, thereby maintaining their relevance and effectiveness. Prioritize a proactive approach to enhance functionality and user satisfaction, creating resilient and adaptable solutions. Ensure tool administration is similarly flexible.

The reviewed resources underscore the importance of flexibility in design by promoting continuous improvement, inclusivity, diversity, openness, and adaptability. By using evidence to inform iterative updates (DIAL), ensuring accessibility (GSMA), embracing diversity (POLLICY), practicing open innovation (WBA), and being adaptable (Tufts), organizations can create robust, user-centered solutions that remain effective and relevant in dynamic contexts.

- Incorporate modular design features that allow users to customize the tool according to their specific farming practices and local conditions.
- Establish a system for ongoing monitoring and updates based on user feedback and technological advancements.

Principle 5: Use farmers' data responsibly

This principle acknowledges farmers' intellectual property rights and the role of data in supporting social inclusion. It is relevant to both tool developers and managers. Responsible use of data was well captured in the reviewed resources. It is most closely aligned with the DIAL principle "be data driven" and the tenet of "collect and use data responsibly according to international norms and standards." This principle expands on this guidance and addresses diverse farmers' needs and data security directly.

Subprinciples	Example activities
5.1 Use data privacy, security and safety measures that meet diverse farmers' needs	
Identify how the digital tool or the use of the tool could have negative consequences for diverse farmer subgroups and proactively work to mitigate those. Follow leading data safety, intellectual property rights, and privacy measures, such as the EU General Data Protection Regulation (GDPR). Privacy and security are often addressed together in existing frameworks. Safety is generally separated. This principle was adopted from DIAL's principle: "address privacy and security." It is aligned with DPGA's data privacy and security requirement "digital public goods that collect, store and distribute personally identifiable data, must demonstrate how they ensure the privacy, security and integrity of this data in addition to the steps taken to prevent adverse impacts resulting from its collection, storage and distribution."	▪ Adopt existing standards such as GDPR. ▪ Make a list of ways that safety of individuals could be affected by using the tool. ▪ Keep a clear record of who can view what data and at what time.
5.2 Ensure informed and ongoing farmer consent	
Proactively seek farmers' free and informed consent for any data collection. Make sure farmers are the primary beneficiary of any economic benefit from their data. Maintain farmers' agency to retrieve data later and opt-out of data collection at any time. Also, allow farmers to opt out of participation completely. This subprinciple is mostly relevant to tool managers. DIAL's principle of "address privacy and security" advised obtaining informed consent prior to data collection to ensure that users understand why their data are being collected.	▪ Use video informed consent to ensure transparency for farmers. ▪ Use local language in informed consent materials opt-in materials.
5.3 Share data analysis and learning with diverse farmers	
Proactively make results and learnings accessible to diverse farmer subgroups in the target group. Sharing results should include successes alongside failures or obstacles and ideas for replicating or mitigating those. This subprinciple is mostly relevant to tool managers, but tool developers can design tools to make these functions available. Measuring and sharing results was a well-represented principle among the reviewed resources. One resource (Effective Development for Co-creation) explicitly recommended measuring and disseminating results as individual principles. A key message from Food Systems Summit 2021 was to "share data, evidence, and knowledge as we iterate to come to the best solutions."	▪ Send SMS text messages or voice calls to farmers with the results and learnings. ▪ Post results on public web pages.
5.4 Capture disaggregated data for diverse farmers	
Gather data on diverse farmer subgroups to better understand their needs and develop digital tools and enabling conditions for them. Take care that when this information is collected, it is appropriately protected so it cannot be taken advantage of. Prioritize the safety and security of these groups. When tradeoffs are required between disaggregated data and privacy issues, prioritize privacy (Principle 5.1). This subprinciple mostly applies to tool managers, but tool developers can design tools to make this function available. Two resources (IEAG and OECD) explicitly mentioned collecting disaggregated data while one resource (UKAID) mentioned lack of disaggregated data as an evidence gap. IEAG had a "data disaggregation" principle, and OECD had a specific principle to "collect gender-disaggregated data to inform digital policy." GSMA did not have a specific principle relating to disaggregated data, though it mentioned: "disability-disaggregated data is collected and analyzed to understand the mobile disability gap." This principle was of high importance during expert interviews.	▪ Include disaggregated data questions in surveys of target farmer groups. ▪ Include disaggregated data questions on first login for digital tool users (whether they are farmers or not).

5.5 Identify excluded users

Identify individuals or subgroups who are in the target group but continue to be excluded from tool use. Investigate why subgroups are unable to access or engage with the tool. Take steps to manage and mitigate these exclusions. This subprinciple applies primarily to tool managers but may be used by tool developers in the evaluation of tools.

None of the reviewed resources advised identifying excluded users. GSMA and POLLICY had similar action points such as "the barriers and requirements of persons with disabilities in accessing and using mobile-enabled products and services are understood" and "consider that different users perceive and encounter different barriers and constraints when using technology," respectively.

- Based on disaggregated data collection or user interviews, find individuals or groups not being reached – this can be pre-design, pre-implementation, mid-implementation, or all the above.
- Brainstorm with diverse farmers and other stakeholders on what groups may still be missing beyond what data shows.
- Send agents or make calls to the unreached individuals and work to prototype ways to increase access.

Principle 6: Develop tools responsibly

This principle promotes tools that make wise use of existing resources, support the socially inclusive engagement of farmers, and avoid negative impacts. It applies primarily to tool developers. Existing frameworks lack principles for responsible tool development. The mantra "nothing about us without us" from GSMA most closely reflected this principle in the recommendation to consult, involve, and listen to target users during different development iterations of a digital product or service.

Subprinciples	Example activities
6.1 Build on existing solutions	
Adapt and enhance existing products, resources, guidance, and approaches instead of creating new tools. Create new tools only when added value is significant. Find groups or individuals who have done similar work and learn from their experiences. Funders should be aware of and support existing solutions whenever possible. Identify opportunities to link and integrate digital solutions, for example from farm to policy levels. This principle was adopted from DIAL's "reuse and improve" principle, which advised to "identify the existing technology tools (local and global), data and frameworks being used by your target population, in your geography or in your sector."	▪ Meet with others who have done similar projects to learn challenges, opportunities, and areas to collaborate. ▪ Research existing solutions. ▪ Partner with organizations that already have work in progress complementary to planned projects.
6.2 Support farmer agency	
Include farmers as active agents and partners in the development of tools. Establish open communication channels for farmer input and create opportunities for farmers to share in decision-making. Provide frequent updates of the status of tool development. Be clear and honest with farmers about obstacles and challenges related to the collaborative aspects of tool development and implementation. Build mechanisms for feedback and actively incorporate them into planning. Avoid creating lock-in situations for farmers where they are unable to choose other technologies or providers as they like. The European Commission provided the principle "Communication and collaboration: To interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity. To participate in society through public and private digital services and participatory citizenship. To use digital tools and technologies for collaborative processes, and for co-construction and co-creation of resources and knowledge." This principle also builds on DIAL's “design with people” principle, which stated to "embrace an iterative process that allows for incorporating feedback and adapting your tool after the initial testing and launch."	▪ Schedule regular updates with all stakeholders. ▪ Encourage negative feedback and change course accordingly.
6.3 Manage secondary negative impacts	
Be aware of secondary negative impacts of the development and implementation of digital tools and their content, such as loss of important human interaction, excessive or irrelevant information, or accidental dis-/misinformation. Mitigate when necessary. DPGA, DIAL, and WBA directly addressed this principle. The "do no harm by design" indicator from DPGA is directly related to mitigating secondary negative impacts via data privacy and security, inappropriate and illegal content, and protection from harassment. Under DIAL's principle of "address privacy and security," a core tenet was to "understand that risks are highly contextualized, not just to countries, but also to communities, populations, and periods of time" and to "keep the best interests of end users and individuals whose data are collected at the forefront of your planning for upholding user privacy and ensuring data security and ethical implementation." WBA's framework for is "Use" broadly related to companies mitigating digital risks and harms.	▪ Do periodic SWOT (strengths, weaknesses, opportunities and threats) analysis during ideation, design and implementation of tools focused on their downstream effects. ▪ Be clear on what negative impacts would result in stopping or pausing implementation.

6.4 Establish transparent and accountable governance structures

Clearly define roles and responsibilities to provide farmers with an understanding of how decisions are made and who is responsible for them. Implement transparent governance practices to actively nurture trust among farmers and stakeholders. Enact accountability measures to maintain consistent prioritization of the farming community's best interests in all decisions, including updates to digital tools.

The reviewed resources emphasize the importance of transparent and accountable governance structures in various contexts. Open and transparent practices necessitate governance frameworks that clearly define roles, responsibilities, and ensure proactive communication and feedback mechanisms (DIAL). Incorporating disability inclusion within business strategies with clear targets and accountability structures ensures that governance frameworks are inclusive and equitable (GSMA). Transparency in algorithmic processes and ownership of digital assets promotes accountability and trust in digital platforms (POLLICY). Applying responsible data practices and exerting authority to influence positive changes across the value chain highlights the role of governance in maintaining ethical standards and leadership in stakeholder engagement (WBA and Tufts).

- Develop and publish a governance document that outlines the roles and responsibilities of all stakeholders involved in the digital tool.
- Publish regular accountability reports that outline decisions made, actions taken, and the rationale behind them.
- Create a set of accountability measures, such as periodic audits and performance reviews.

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USAID - The Gender Digital Divide Primer

WBA - Digital Inclusion Benchmark

Why Women Aren't Using Your Ag App

Agroecological TRANSITIONS Programme

The Program on Agroecological Transitions for Building Resilient, Inclusive, Agricultural and Food Systems (TRANSITIONS) aims to enable climate-informed agroecological transitions by farmers in low- and middle-income countries 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 to Enable Climate-informed Agroecological Transitions* (ATDT) aims to scale agroecological practices by enabling smallholder farmers to participate in co-design of digital tools and farming practices. The ATDT Project is implemented by the Alliance of Bioversity and CIAT.
Learn more about ATDT & find more outputs here

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