Agroecological TRANSITIONS Programme

Livestock practices, use of digital tools and co-design and flow of information

Brazil baseline assessment in the region of Novo Repartimento (Pará State, Brazil)

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Executive Summary

Aiming to evaluate the status of key agroecological and digital ecosystem aspects, this report presents a study on major livestock practices, the use of digital tools, and the flow of information that have been carried out among actors working in the region of Novo Repartimento, Anapú and Pacajá (Para-Brazil), whereby ATDT project plans to implement its year 2 activities (2023) in partnership with Solidaridad. This study was based on a previous assessment done by the Agroecological TRANSITIONS program's *Inclusive Digital Tools to Enable Climate-informed Agroecological Transitions (*ATDT) Brazil implementation partner (Solidaridad) on farmer's profile, the status of livestock practices adoption and use of digital tools of about 1,000 smallholders in the target region. A field activity was deployed to visit and interview a sample of Solidaridad's extension agents (n=13) and farmers supported by Solidaridad (n=15) working in the region. Findings reveal that:

Livestock practices

- Approximately 70% of those farmers have livestock activities (n = 636)
- Less than 5% have adopted practices considered "improved", such as pasture intensification based on rotational grazing and fertilization based on soil analysis.

Flow of information among actors

Extensionists

- Extension Solution (mobile app developed by Solidaridad to support the work of rural extension staff) and WhatsApp are the major digital tools used by extensionists. Each extensionist has a WhatsApp group with farmers so that a message that is sent to the group reaches 100 producers and the lead extensionist. Extensionists report communication with farmers even on weekends and evenings – which is used similarly to a hotline. Communication is mostly through audio and videos, given the literacy limitations of most farmers.

- Extensionists also have a WhatsApp group of their own to share impressions and solutions across groups they assist (e.g., visit notice, quick questions, and calls for specific questions).
- The technical-assistance approach targets increasing productivity. Extension Solution flags potential areas for farming performance improvement, and a holistic approach is then taken during interviews and field visits.
- Usually, extensionists receive regular trainings to ensure streamlined technical assistance and also rely on the knowledge of their peers to recommend practices and interventions to farmers. Weekly in-person meetings are used to discuss assistance to farmers and problem-solving. Extensionists also periodically participate in capacity-building events and workshops. Scientists, local universities and research institutions are also directly involved or consulted in the process of technical assistance to farmers.
- Connectivity in the region is still relatively poor for mobile phone calls due to limitations with hard infrastructure (e.g., internet towers). However, the vast majority of farmers have access to a stable on-farm internet connection through satellite bandwidth, which has permitted the use of smartphone apps, such as WhatsApp. Nonetheless, connectivity on roads (between farms) remains inadequate.

Farmers

- Practically all have a smartphone and use WhatsApp, which is by far the most used digital tool. This digital application is not only used for farming activities but for daily communication, especially using text messages, audio messages and videos. This is also the main communication channel with Solidaridad Extensionists. YouTube, Instagram and Kwai have also been cited by producers for advice on production practices.
- Farmers are also involved in a technical assistance model which is based on horizontal information sharing. The technical assistance agenda of our extension staff is defined based on producers´ needs and demands for information and our extension staff seek constant feedback on the needs of the farmers they support.
- Farmers clearly state their willingness to participate in:
    - capacity building and training on production practices,
    - the design of locally specific practices,

  - digital training for more advanced smartphone use and a search feature for useful and specific information on the web.
- Producers would like to exchange experiences on how other smallholder farmers deal with similar problems and design farming solutions in the other countries where the Agroecological TRANSITIONS program is working.

Keywords

Digital agriculture, agroecology, smallholders, beef cattle, Amazon.

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Contents

1 Introduction

Digital resources in agriculture are changing the way food is produced. Yet differences in digital participation among farmers risk exacerbating inequities, and top-down digital information can lack local relevance and disempower farmers.

The CGIAR's 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 program is composed of three interlinked projects: Metrics, Digital Tools, and Private Sector Incentives and Investment. This baseline relates to the Digital Tools Project (ATDT).

The ATDT project will support the use of digital resources and citizen science to empower farmers to co-create, adapt, and innovate in practices for climate-resilient and low-emission agroecological outcomes at large scales. The key components of ATDT are to map and understand the ecosystem of digital tools available to farmers and to engage with tool developers and users in the design of a roadmap for improving the co-creation of knowledge through best practice principles for inclusive digital tools. The project will engage with the livestock supply chain in Brazil and the rice supply chain in Vietnam.

ATDT targets at least 24,000 men and women smallholder farmers to engage with improved digital tools for management practices on at least 100,000 ha across all sites (Brazil and Vietnam) and supply chains (livestock and rice). In Brazil, the target is to engage 1,000 smallholder farmer families, responsible for managing approximately 80,000 ha of land across Pará state, in the use of co-designed digital tool(s).

According to Farias et al. (2018), Pará emerges as the state of the Legal Amazon with the most settlement projects in its territory. Consisting of 144 municipalities, 102 of these have settlement projects in their territories. According to a classification defined by the National Institute of Colonization and Agrarian Reform (INCRA), these municipalities are grouped into three Regional Superintendencies: SR no. 01 - Belém, which includes 45 municipalities; SR no. 27 - Marabá, composed of 37 municipalities, including Novo Repartimento; and SR no. 30- Santarém, which has 20 municipalities. The municipality of Novo Repartimento has 31 rural settlement projects, covering a total area of 376,767.90 hectares,

representing 24.5% of the total area of the municipality. Part of the Regional Superintendence no. 27, stands out as the municipality that with the 4th most settlements in its area, behind Marabá (78 settlements), Itupiranga (36 settlements) and Conceição do Araguaia (35 settlements).

Novo Repartimento was founded in 1991. With the formation of the Tucuruí reservoir, part of the Pucuruí reserve where the indigenous people lived was flooded; the remaining forested area was cut by the construction of the Trans Amazonian bypass (BR-230). In 1981, land located near the eastern border of the old Parakanã reserve was used to relocate expropriated peasants who were mostly settlers evicted from the margins of the original Trans Amazonian highway. They were migrants from all over the country, who moved to the Amazon in the 1970s, driven by federal government incentives and promises of land and subsidies for agriculture and housing (Acselrad & Silva, 2011 - in Farias et al., 2018).

The first settlement project was Tuerê, located near the municipality of Pacajá, described by INCRA as one of the largest settlements in Latin America, with more than 102,000 hectares and the largest number of families settled. According to INCRA, this settlement contains about 2,100 land lots and approximately 20,000 inhabitants. Even with a gradual reduction in deforestation rates since 2009, the calculation of all areas affected by deforestation has shown that, by 2013, the municipality of Novo Repartimento had lost about 48% of its forest cover (Farias et al., 2018).

In this context, Solidaridad has been working in the region for over 10 years focusing on developing an environmental governance model in the Amazon that keeps forests standing and restores landscapes hand-in-hand with a low-carbon production model adapted to agriculture families. Solidaridad is an international non-profit organization with more than 50 years of experience in the development of inclusive and sustainable value chains. In Pará, Solidaridad started its work in Novo Repartimento and recently expanded its scope of intervention in the neighboring municipalities of Anapú and Pacajá.

Solidaridad developed Extension Solution, a customizable mobile application developed via a participatory approach with diverse technical staff, allowing real-time monitoring of field activities to increase the efficiency of technical assistance strategies. It is available for both iOS and Android devices and is integrated with WhatsApp, a trusted and commonly used digital resource in the area and beyond. The version of Extension Solution currently used in Pará to support smallholder farmers has been developed based on an in-depth study of the carbon balance of several production models in the region

and incorporates low-carbon practices, and itprovides performance assessment and technical guidance on key agroecological and low-carbon practices contributing to climate change mitigation.

Extension Solution currently addresses three of the seven climate change resilience and one of the three mitigation indicators. It also addresses nine of the twelve agroecological indicators, making it agroecologically complete. (See Appendix for the full list of indicators used to assess Extension Solution.) Farmer information exchange (e.g., community forums, peer videos, etc.) and linking farmers to carbon markets are expected to be incorporated into the tool in the future.

With the objective to evaluate the baseline of key agroecological and digital ecosystem dimensions, this report presents a study on major livestock practices, use of digital tools and flow of information that have been carried out among actors working in the region of Novo Repartimento, Anapú and Pacajá (Pará-Brazil), whereby ATDT project plans to implement its year 2 (2023) activities in partnership with Solidaridad.

2 Methods

This baseline assessment is based on two elements:

- An analysis of the survey done by Solidaridad in 2021-2022 of 1,020 farmers across three municipalities (Novo Repartimento, Anapú and Pacajá). Data is periodically collected by extensionists on farmers' land use and farming activities using Extension Solution. This set of data forms the basis for the land planning and technical assistance provided by Solidaridad's team of experts (i.e., project managers and coordinators, agronomists, extensionists, and digital experts). The survey was used for describing farmer's characterization and major farming and livestock practices.
- Focus groups were held in November 2022 to understand which digital tools are used by extensionists and farmers and for what purposes and how information is co-designed and circulate among actors. The guiding questions and the co-creation model used in these interviews are presented in the appendix. Three groups of actors consulted were:
    - Solidaridad's extensionists (n=10);

- Farmers assisted long-term by Solidaridad's extension program (n=5; all men; age 19-48) located in the municipality of Novo Repartimento;
- Farmers that had recently joined Solidaridad's extension program (n=9; 5 men and 4 women; age >30) located in the municipality of Pacajá.

3 Results

3.1 Solidaridad survey: producer demographics

There are 1,020 producers registered under Solidaridad's technical assistance program in the region of Novo Repartimento (Pará State, Brazil). Of these, only 15% are women. More than half of registered producers reside in Novo Repartimento, followed by Pacajá and Anapú (Figure 1). Three quarters of producers' families include up to four people (76%), and only 4% of families include between six and nine members (Figure 2c). The average age of producers is 46 years old (ranging from 19 to 83, Figure 2d). The average farm area is approximately 60 ha, though the largest farm consists of 350 ha (Figure 2e).

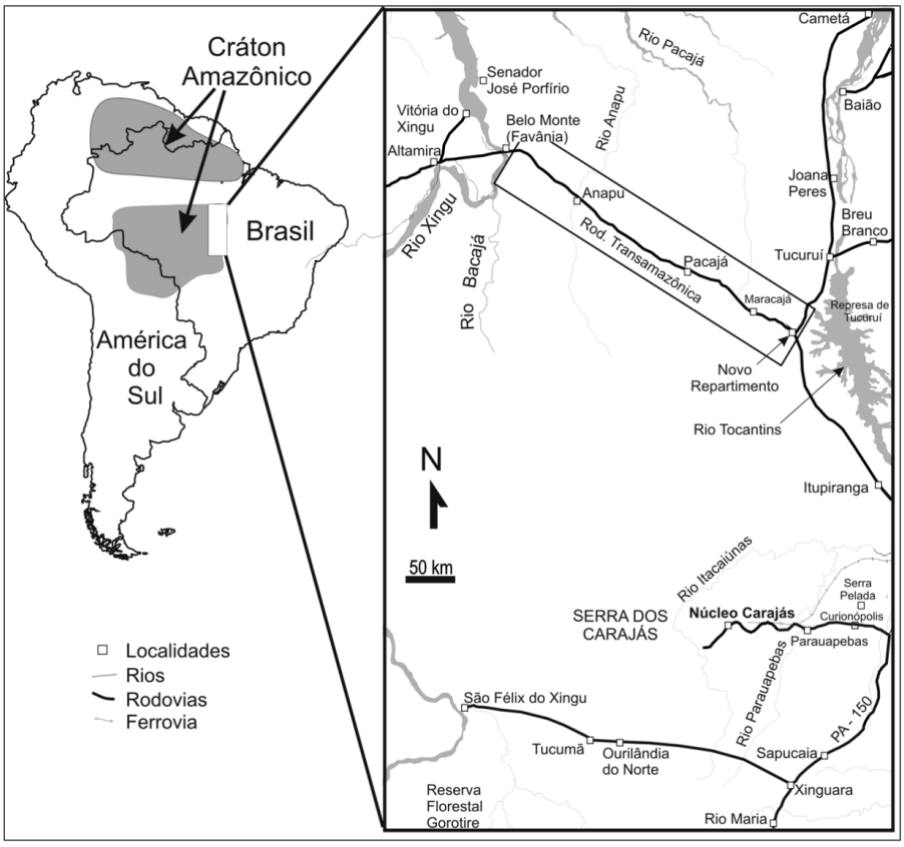


Figure 1. Location of the studied area along the Transamazônica highway between the municipalities of Novo Repartimento and Anapú.
(Source: Barros et al., 2017).

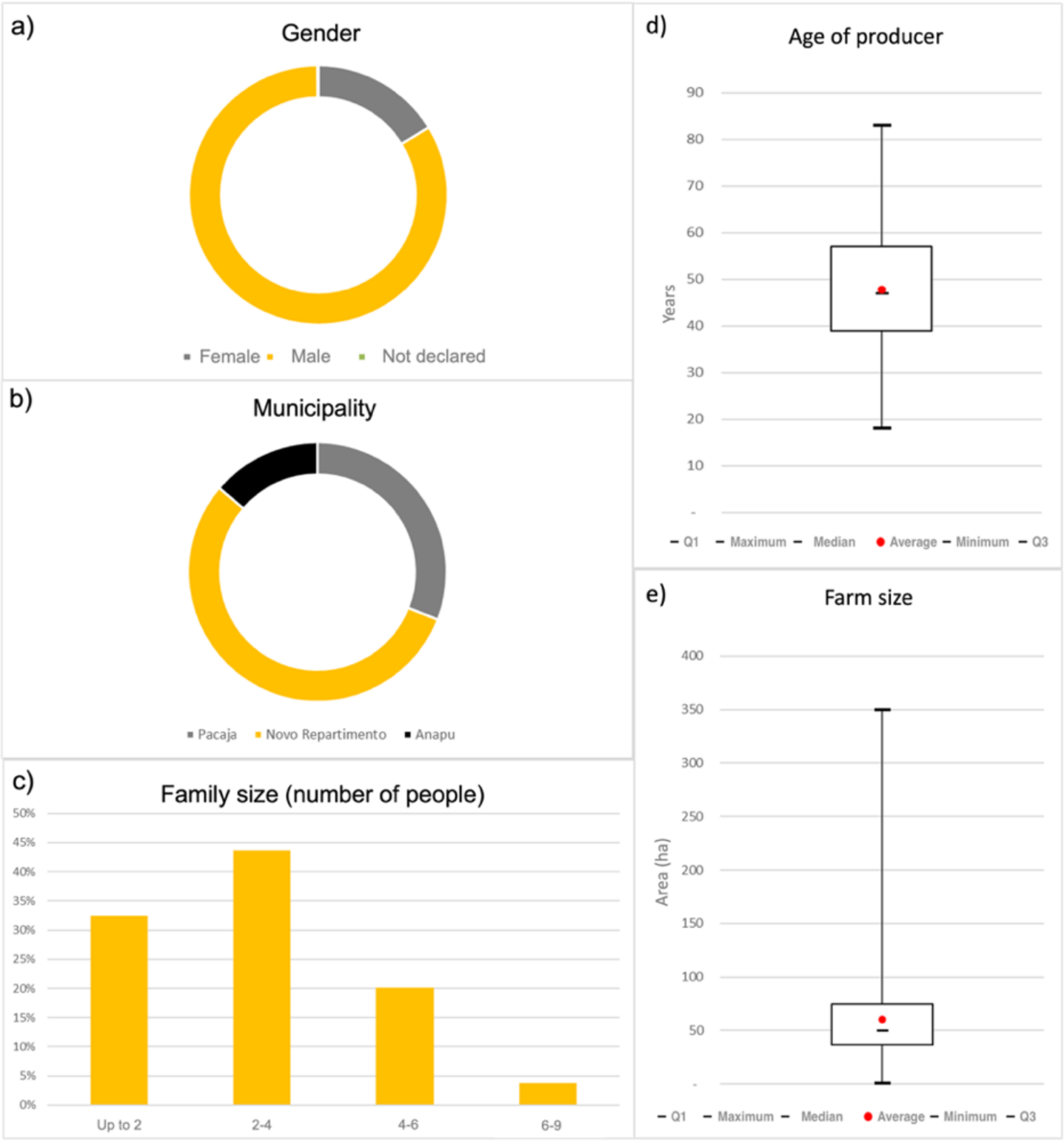


Figure 2. Demographics of currently enrolled producers under Solidaridad's technical assistance portfolio regarding (a) gender, (b) municipality, (c) family size, (d) producer age and (e) farm size.

3.2 Solidaridad survey results: practices and connectivity

3.2.1 Practices and traceability systems

Most producers have cocoa plantations (73.3% of 915 respondents) or properties with livestock activity (68.4% of 916 respondents). Of the latter, 83% own their own cattle and only 17% of producers lease pasture. Virtually all (99%) producers manage extensive or non-intensified production systems. This is supported by the evidence of limited application of fertilization (3% of producers), which is done based on agronomic recommendations and on soil analysis, or on recommendations from neighbors or friends. Recurrent soil analysis and subsequent correction is rare in these systems. Traceability systems (e.g., Grinders, Companies, Cooperatives, others) are uncommon for these producers (5.2%) and certified properties are even less common (2.0%), although most producers are interested in obtaining rural credit (83.3%) (Table 1).

3.2.2 Connectivity and digital tool use

Internet access outside of the property is common (92.3% of 915 respondents), though access is more limited on the property (54.3%). One-third of producers receive some type of technical assistance, however, only 2.3% currently use mobile applications (other than WhatsApp) for production activity monitoring or technical advice despite most producers owning a smartphone (86.3%) (Table 1).

Table 1. Producer farming and livelihood characteristics.

General information	Number of farms assessed	%
Properties with livestock activity	916	68.4%
Producers with cocoa plantation	915	73.3%
Producers who received some type of technical assistance	915	33.3%
Producers interested in obtaining rural credit	914	83.3%
Producers with bank account	915	82.2%
Producers who own smartphones	915	86.3%
Producers with internet access on the property	915	54.3%
Producers with internet access outside the property	915	92.3%
Producers using (any) applications to support productive activity	915	2.3%
Producers with certified properties	767	2.0%
Properties with some traceability system (Grinders, Companies, Cooperatives, others)	767	5.2%
Main findings related to livestock	**Number of farms**	**%***
Number of producers who have livestock activity on the plot	636	100%
Producers with extensive/non-intensified production system	630	99%
Producers who only lease pasture (and do not have their own herd)	106	17%

Producers who have their own cattle	529	83%
Producers who have not performed soil analysis in the last 3 years	613	96%
Producers who have not done soil correction in the last 3 years	627	99%
Producers who have not done any type of fertilization in the last 3 years	619	97%
Among those who fertilized, only 12 producers did so based on:		
General recommendations	1	8.3%
Agronomic recommendation/soil analysis	6	50%
Recommendation from neighbours/friends	5	41.7%

* Percent of farms with livestock (out of 636 total farms)

3.3 Communication and co-design of information

3.3.1 Focal group with extensionists

Digital tools in use: Extension Solution app and WhatsApp are the major digital tools used. Another app, *Field Area Measure Pro*, is also used but only to map farm area and boundaries (i.e., delimitation of farm polygons – total area and land use lots).

Technical assistance approach: Solidaridad's technical assistance is based on field visits and interviews and targets increasing productivity. It is facilitated by Extension Solution, which, upon activity data collection on farming activities, flags potential areas for farming performance improvement and generates an individualized action plan. A holistic approach is taken during interviews and field visits, meaning that technicians evaluate every value chain or production system in the farm (e.g., livestock, cocoa, horticulture, fish) before proposing a workplan for the farmers. With the information gathered in Extension Solution, extensionists then evaluate each farmers' context in order to design feasible farming interventions. Major aspects related to the producer's ability to implement the recommendation are:

- Current production practice
- Financial conditions
- Availability of farming inputs and services in the region
- Technical capacity
- Workforce composition
- Information on the credit profile

Over time, extensionists build a farmer's track record within Extension Solution (e.g., setting the farmer's baseline and defining priority areas of interventions). This allows them to track suggestions and

interventions during field visits enabling them to monitor progress. The face-to-face visit allows the collection of important complementary information.

Knowledge and capacity building of extensionists: Usually, extensionists rely on their own knowledge and on the knowledge of their peers to recommend practices and interventions to farmers. Weekly in-person meetings are used to discuss assistance to farmers and problem-solving. Extensionists also periodically participate in capacity-building events and workshops. They have a WhatsApp group to share impressions and problem-solving across families assisted by them (e.g., visit notice, quick questions, and calls for specific questions). Scientists, local universities (e.g., Federal University of Pará) and research institutions (e.g., CEPLAC - public research organization) are also directly involved or consulted in the process of technical assistance to farmers.

The dirt road in the outskirts of Novo Repartimento (Pará, Brazil)

ICRAF-CIAT teams interviewing Solidaridad's extensionists in Novo Repartimento (Pará, Brazil)

Solidaridad headquarters in Novo Repartimento (Pará-Brazil), CIAT-ICRAF Team with Solidaridad's extensionists at its headquarters after the baseline interviewing

Technical assistance and WhatsApp: Field visits are carried out every two months, on average. The WhatsApp app has been intensively used to complement technical assistance and is currently the major communication channel from extensionists to farmers and for farmer-to-farmer interaction and knowledge exchange. Each extensionist assists 100 farmers and share a WhatsApp group with them so that a message that is sent to the group reaches 100 producers plus the lead extensionist. Given literacy limitations by many farmers, sending audio messages with recommendations has been more effective than texts. Extensionists also reported that conversations in WhatsApp groups sometimes go off topic, which demands curation and redirection to farming subjects.

Connectivity: Connectivity is relatively poor for mobile phone calls in the region, but the vast majority of farmers have a stable on-farm internet connection through satellite bandwidth. This permits the use of smartphones and apps, radically changing the status quo by introducing digital innovations such as WhatsApp. Nonetheless, connectivity on roads (between farms) remains inadequate. Extensionists report connectivity issues on roads, while in transit – given the limitations with hard infrastructure (e.g., internet towers).

Communications frequency: Overall, the use of digital tools has generally increased the number of farmers assisted and changed the pen-and-paper type of technical assistance that occurred every one or two months to daily technical support. Extensionists report communication with farmers even on weekends and evenings – which is used as a sort of hotline. Communications is mostly through audio messages and videos, given literacy limitations of most farmers.

3.3.2 Focus groups with farmers

3.3.2.1 Group 1 – Farmers long attended by Solidaridad

WhatsApp is the most used digital tool by farmers. All farmers have a smartphone and use WhatsApp, not only for farming activities but for daily communication. YouTube, Instagram and Kwai have also been cited by producers to consult about production practices, especially by younger farmers.

WhatsApp is the main channel of communication for daily consultation and following up on the technical assistance workplans with Solidaridad's extensionists. Twitter is used to follow cocoa and livestock experts, the major value-chains in the region. Kwai and TikTok are used for watching short videos on practices. YouTube is used for more detailed technical assistance and is the second most used digital channel by farmers.

Farmers have declared that information provided by digital channels often needs to be adapted for the implementation on their properties when the content was developed elsewhere or for a region not similar to the Amazon region where their farms are located.

In this context, farmers mentioned that these digital resources complement the technical assistance provided by Solidaridad. Farmers cited that the information obtained in YouTube, although relevant, is not reliable enough to help make the decision to change or adopt farming interventions or not.

For example, when farmers come across an issue or doubt about any farming practice or intervention, problem-solving is done by searching YouTube. This allows the farmers to cross-reference the information that is received from Solidaridad's extensionists via WhatsApp. YouTube video comments have been mentioned to provide hints on how to better adapt practices for their condition and context.

View of a typical pasture area in the region of Novo Repartimento (Pará, Brazil).

Livestock practices, use of digital tools and co-design and flow of information

ICRAF and CIAT staff visiting an improved pasture area in Novo Repartimento – Tuerê Settlement (Pará, Brazil).

Group of farmers interviewed by ICRAF-CIAT teams in Novo Repartimento – Tuerê Settlement (Pará, Brazil).

The majority of farmers have said that adopting practices could be facilitated if they participated in the co-design of solutions. Furthermore, given the amount of information available on the internet, farmers were wondering if a sorting or filtering feature could be developed. This way, farmer's web search could be more refined to identify farming practices, solutions, and innovations.

Finally, producers demonstrated an interest in understanding how smallholders in other countries manage their systems and how the Agroecological Transitions program could bring experiences from other locations to better understand how producers in different contexts manage similar problems. There is also an interest in capacity building and training for production, especially on more advanced use of smartphones and channels for selecting location-specific farming information. Producers noted that too much information is available that is not relevant to their systems, thus wasting their time.

3.3.2.2 Group 2 - Farmers recently attended by Solidaridad

This group of farmers reported similar types and use of digital tools as group 1: WhatsApp is the most used digital tool for daily and speedy communication, and YouTube as a digital platform to better understand and search for farming practices. WhatsApp is also the main channel of communication with Solidaridad's extensionists.

Farmers' cooperative where the ATDT-Brazil interview was held with farmers in Pacajá (Pará, Brazil).

Group of farmers interviewed by ICRAF-CIAT teams in Pacajá (Pará, Brazil).

The difference relies on the fact that these farmers do not use Instagram, Kwai, or TikTok, and their use of YouTube is more superficial without interaction or consultation of comments. This may be due to the fact that this group was more represented by older farmers that consider these functions or newest app as something to be used by young farmers. This reflects that younger people are more likely to use a wider variety of digital tools compared to the previous generation.

Digital resources complement the technical assistance provided by Solidaridad, but farmers trust in the extensionists' opinions first and foremost. In addition, farmers have said that adoption of practices could

be facilitated if they participated in the co-design of solutions, especially if this process is supervised by extensionists.

Similar to the first group of farmers, there is also an interest in capacity building and training for production, especially on more advanced used of the smartphone and filtering web information for more locally specific and assertive solutions for farming interventions and practices.

3.4 Overall alignment with agroecological principles

Solidaridad's current livestock practices aligned with agroecological principles laid out below, based on the FAO's 10 Elements of Agroecology (Table 2). Five of the principles are significantly aligned with Solidaridad practices, four are fairly aligned, and only three that are addressed minimally, indirectly or not at all.

Table 2. Overall alignment of Solidaridad's current livestock practices with agroecological principles (Based on the FAO's - 10 Elements of Agroecology)

Agroecological Principles	Main related practices and level of implementation (color)		
Level of implementation	Significant	Fair	Low
System transformation or practice	Through technical assistance, support farmers to improve agronomic practices associated with forest conservation		
Diversification (economic, product, or biodiversity)	Support diversification, especially with cocoa agroforestry, and market access		
Efficiency/ Input reduction	Use of fertilizers based on soil analysis and implementation of rotational grazing		
Exposure to toxic agrochemicals, other negative human health impacts	Technical assistance covers the use of Personal Protective Equipment (PPE), but the use of agrochemicals in the region is still low, especially in livestock systems		
Animal health and welfare	Improved animal health, breeding and feeding		
Synergies (enhance positive ecological interactions)	Through technical assistance, support farmers to improve agronomic practices associated with forest conservation.		
Productivity and Income (and stability over time)	Increased productivity through implementation of improved practices		
Co-creation and sharing of knowledge, farmer relevant content	Constant interactions between extensionists and farmers		
Gender and youth	Constant interactions between extensionists and farmers		
Circular and solidarity economies/ Connectivity (inc. recycling)	Support cooperatives in the region, fair trade and market access		
Culture and food traditions, nutrition and human and social values	No specific practice has been implemented. However, food security has been supported with crop diversification.		
Responsible governance (inc. participation, fairness, land tenure)	Support producers with land regularization, working with municipalities, State and Federal gov't bodies, coops, etc.		

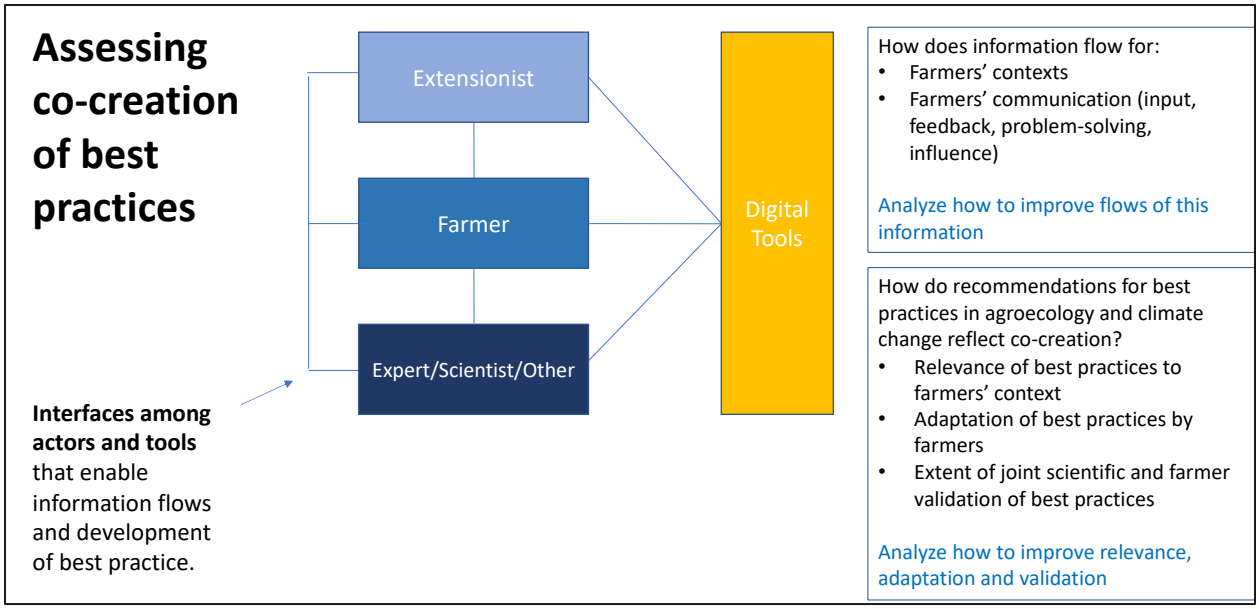
4 Next steps

This report presents a baseline study on major livestock practices, use of digital tools and co-design and flow of information among actors (extensionists and farmers) working in the region of Novo Repartimento, Anapú and Pacajá (Pará-Brazil). This information will support the implementation of the ATDT Year 2 project activities in Brazil, which will focus on:

Tool developers, extensionists and farmers co-create ways of adapting digital tools for inclusiveness and climate-informed agroecology at scale.	Carry out a co-creation process with producers, extensionists and digital tool developers (e.g. workshops, field days, etc.) to (i) discuss barriers and opportunities to implement agroecological practices, (ii) identify skills that producers and extensionists need to develop to adopt these practices and how digital tools could support, and (iii) identify improvements in digital tools to optimize the extensionist-producer-other actors information flow for practices adoption.
Digital tool improvements	Consolidate the improvements and innovations identified above into a road map to enhance digital tools, including the design of innovations to support extensionists and producers in the adoption of agroecological practices.
Support farmer's capacity building	Conduct digital training in agroecological practices for producers, extension workers and other actors involved (e.g., government agents, private sector) through field days and workshops.

Appendix

Co-creation model used in the baseline study



Guiding questions – Extensionists

1. Is Extension Solution the only DT you use to provide TA for farmers?
2. How do you collect information to provide TA through Extension Solution?
3. How do you provide TA based on Extension Solution outputs? (e.g., Phone, message, field visit)
4. Do DTs provide problem-solving on interventions?
5. How do you design interventions?
    1. Who are consulted in this process? Farmers, Scientists, Experts….
        1. How do they participate?
    2. Is farmers' context considered in this process?
    3. Do farmers adapt recommended practices? If yes, any barriers?
6. How much of the TA is delivered in-person and using a DT?
7. How has the use of DTs changed your relationship with farmers? (Pros e cons)

Guiding questions – Farmers

1. What are the digital tools you use for evaluating managing livestock practices in your farm?

2. How do you receive and send information?
3. How relevant is this information for the management of the practices?
4. Do you use the information you receive through WhatsApp? 1-Yes 2-No
5. If yes, do you need to adapt recommendations?
6. Any barriers?
7. Has your context been evaluated for the design of practices and recommendations?
8. Do you provide feedback to tool developer or content developer?
9. Have you been consulted in the DT design and improvement?
10. Have you been consulted in defining the DT content?

Extension Solution Baseline

Extension Solution allows real-time monitoring of field activities to increase the efficiency of technical assistance strategies while collecting data and information to generate business intelligence. Solidaridad is an international non-profit organization with more than 50 years of experience in developing inclusive and sustainable value chains. The network organization is made up of eight regional centers located in South America, Central America, North America, West Africa, Central and East Africa, South Africa, Europe and Asia.

The development of Extension Solution involved a participatory approach via technical staff from different countries and working in different contexts. This guarantees a user-friendly experience and intuitive functionalities that respond to a single objective: to facilitate the task of extension staff and reduce the time spent on administrative tasks. Extension Solution supports extension workers in their daily routines with:

- Easy data gathering online or offline
- Real-time monitoring of farmers' progress and collection of evidence
- Easy record-keeping of interactions through visit logs
- Access to insights on challenges faced by farmers
- Access to relevant support material
- Facilitated organization of work agenda

Available for Android and iOS devices, Extension Solution mobile app is free of charge and is currently available in English, Spanish and Portuguese. The app is integrated with WhatsApp and email, allowing for direct communication with farmers or to share a document, and it has been connected with Cool Farm Tool and Microsoft Power BI. All interactions related to a specific group of farmers can be accessed by any other extension worker supporting the same group of farmers through the app, thus allowing continuity of technical support to farmers.

When visiting a farmer for the first time, a user (typically an extension agent or rural technician) applies a questionnaire to understand their practices and creates a plan to help them improve. The questionnaire used by the agent can be tailored to any crop and region and benchmarked against any certification standard. During the questionnaire, there is always one single question on the screen to make it easier to read and answer. After the questionnaire is completed, the user can see the performance of the partner and a summary of the farmers best practices and where improvements can be made. Once a topic is completed, the app generates an individual work plan for the farmer (i.e., a list of tasks that must be completed to improve performance). Photos can also be used to document evidence for certification or verification purposes.

The current version of Extension Solution currently used in Pará to support smallholders provides performance assessment and technical guidance on key agroecological and low-carbon practices, contributing to climate change mitigation, as it was developed based on an in-depth study of the carbon balance of several production models in the region and incorporates low-carbon practices.

Performance assessment features include benchmark against any certification standard, reporting, and monitoring. The tool further provides a wide range of traceability features: (i) identification number or code provided for unique farm profiling, (ii) triangulation with other sources of data, (iii) solutions are available on a clearinghouse, platform, or linked to other digital tools, and (iv) record keeping, including GIS compatibility. Most notably, the tool uses a methodology of improvements based on four sustainability levels (entry level, bronze, silver, gold). The meaning of each level can be defined for each project.

Extension Solution addresses three of the seven climate change resilience features (see Appendix): (i) production diversification (e.g., multi-cropping/livestock/forestry), (ii) water conservation or use

efficiency, and (iii) access to pest and disease information and/or early warning. Farmer information exchange is expected to be incorporated into the tool in the future. The tool also provides climate change mitigation recommendations and there are plans to link farmers to carbon markets in the future.

Agroecological principles are well-captured within Extension Solution, with nine of the twelve agroecological principles being supported. These principles include: (i) system transformation or practice, (ii) diversification (economic, product, or biodiversity), (iii) efficiency or input reduction, (iv) exposure to toxic agrochemicals or other negative human health impacts, (v) animal health and welfare, (vi) synergies (i.e., enhance positive ecological interactions), (vii) productivity, income, and their stability over time, (viii) co-creation and sharing of knowledge or farmer relevant content, and (ix) gender and youth. The tool does not support circular and solidarity economies or culture and food traditions, nutrition and human and social values. Furthermore, Extension Solution supports responsible governance (e.g., participation, fairness, land tenure), as it is meant to support continuous improvement at farm level and addressing issues such as fairness or participation is not its value proposition. This does not mean that these topics are not addressed by the programme. Extension does address the topic of land tenure as it is a critical topic for business sustainability.

Indicators used to assess Extension Solution

Field Category	Field
Basic Information	Name of tool
	Brief description of tool
	Website or other locating information
	Creator of tool
	Name of underlying technology
	Underlying technology creator
Categorization	Does this tool provide technical assistance on agroecology?
	Does this tool provide technical assistance on climate change?
	Does this tool provide performance assessment on agroecology?
	Does this tool provide performance assessment on climate change?
Performance Assessment Purpose	Does this tool support certification or labeling?
	Does this tool provide reports or monitoring?
	Does this tool support payments for ecosystem services or finance?
	What traceability functions are part of the tool?
	Identification number/code provided
	Triangulation with other forms of data

	Provenance (documentation of origin)
	Solutions available on a clearinghouse/platform or linked to other digital tools
	Record keeping (inc. GIS compatible)
	What other performance assessment functions are part of this tool?
Tech Specs	Does the solution require phone?
	Does the solution require smartphone/tablet?
	Does the solution require internet connection?
	Does the solution require computer?
	Does the solution use interactive voice response (IVR)?
	Does the tool use short message service (SMS)?
	Does the tool use video or (non-IVR) audio recordings?
	Does the tool use iconography?
	Can you engage in more than one way with the tool? (e.g., IVR and SMS)
	What hardware is required beyond phone, smartphone/tablet, or a computer?
	Does the tool allow for integration with other tools?
	Assuming that the user is familiar with the hardware, do they need to be trained to use this tool?
	Is the tool built on open-source software?
	What language(s) is/are the tool available in?
	What is the primary incentive for the user of this tool?
	How much does this tool cost?
	Is the cost transparent?
	Who pays the cost of the tool?
Social Inclusion & Co-creation	Is the technical assistance informed by citizen science?
	Who is contributing to the information provided by the technical assistance?
	Does this tool allow for direct farmer-driven content, aside from user information?
	Was a user design or participatory approach employed during tool development?
	Is this tool designed for any sub-group? (e.g., for women farmers)
	Does this tool have features or content that accommodate sub-groups?
	Who is the primary end user of this tool?
	Who is the primary beneficiary of this tool?
	Is the underlying technology proprietary?
	Is there two-way communication?
	Do farmers control their own information? (e.g., data privacy, IPR)
	In what ways could this tool be extractive of farmer participation or information?
	Is the tool a stand-alone solution or does it contain bundled services?
	Is the tool time efficient for the user?
	Does the tool ensure user security, especially amongst women?
Scaling	Was the tool developed for a specific project/program?
	Who is responsible for the improvement or maintenance of this tool?
	How local or generalizable is the tool?
Climate Change	*What climate change adaptation functions are part of the tool?*
	Access to weather information or early warning systems

Livestock practices, use of digital tools and co-design and flow of information

	Production diversification (e.g., multi-cropping/livestock/forestry)
	Crop insurance
	Water conservation/use efficiency
	Emergency relief
	Access to pest and disease information and/or early warning
	Farmer information exchange
	What climate change mitigation functions are part of the tool?
	Linking to carbon benefits / finance
	Making mitigation recommendations
Climate Change - GHG Estimates	Does this tool estimate net greenhouse gas emissions?
	Which sub-sectors are covered by this GHG analysis?
	Trees on farm (e.g., agroforestry)
	Land use change
	Livestock & pasture
	Soil & nutrient management
	Rice
	Food loss & waste
	Energy
	Burning
	What is the scale/boundaries of analysis of GHG emission estimates?
	Does the tool calculate a change in emissions based on comparison with a reference (compare two practices)?
	What tier emission factors (EFs) are used?
Agroecological Principles	*Which of the following agroecological principles are addressed by the implementation of this tool?*
	System transformation or practice
	Diversification (economic, product, or biodiversity)
	Efficiency/Input reduction
	Exposure to toxic agrochemicals, other negative human health impacts
	Animal health and welfare
	Synergies (enhance positive ecological interactions)
	Productivity and Income (and stability over time)
	Co-creation and sharing of knowledge, farmer relevant content
	Gender and youth
	Circular and solidarity economies/Connectivity (inc. recycling)
	Culture and food traditions, nutrition and human and social values
	Responsible governance (inc. participation, fairness, land tenure)
Preliminary Assessment	What are the strengths of this tool?
	What are the weaknesses of this tool?
	Identify any unique or special features that make this tool exemplary
	Other notes
	Sources

References

Acselrad, H., Silva, M.G. 2011. Rearticulações sociais da terra e do trabalho em áreas de grandes projetos hidrelétricos na Amazônia. In: ZHOURI, A. (Org.). As Tensões do Lugar. Belo Horizonte: Ed. UFMG.

Barros, C., Macambira, M.J.B., Santos, M., Silva, D., Palmeira L., Sousa, M. 2007. Estruturas sinmagmáticas e idade de zircão de granitos (evaporação de Pb) paleoproterozóicos da parte leste do domínio Bacajá, Província Maroni-Itacaiúnas. *Revista Brasileira de Geociências,* 37(2):293-304.

Farias, M., Beltrão, N., Santos, C., Cordeiro, Y. 2018. Impact of rural settlements on the deforestation of the Amazon. Universidade Federal do Ceará, *Revista de Geografia da UFC*, 17(5):1-17.

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. Learn more about ATDT here.

It is led by:

TRANSITIONS is financed by:

And managed by: