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Cross-Country Analysis on Integrating Farmer's Knowledge into Extension Approaches for Accelerated Agroecological Transition

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AFAAS

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global forum for rural advisory services
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PREFACE

GIZ would like to thank the Country Fora teams in Benin, Ethiopia, Kenya and Madagascar, AFAAS, and the GFRAS Global Secretariat for their support and dedication throughout the project. Their collaboration was crucial in achieving the project's goals. We also acknowledge the contributions of the numerous individuals and organisations involved in this project. Your efforts were essential in completing this report.

EXECUTIVE SUMMARY

This report examines agricultural extension approaches that integrate farmers' knowledge to accelerate agroecological transitions in Benin, Ethiopia, Kenya, and Madagascar. It assesses how advisory services support sustainable farming, foster knowledge-sharing, and ensure long-term farmer engagement.

The study compares different extension models, including Farmer Field Schools (FFS), Farmer-to-Farmer (F2F) exchanges, e-Extension, and Innovation Platforms. It finds that peer-to-peer learning is particularly effective in promoting agroecological practices. The report also highlights the financial and social incentives that encourage farmers to participate, ranging from market access and input support to social recognition and networking opportunities.

Financial sustainability remains a challenge, with declining public investment leading to increased reliance on externally funded projects. While e-Extension offers cost-effective outreach, participatory models like FFS and F2F require greater investment. The report emphasises the need for diverse financing strategies, combining support from governments, NGOs, and the private sector.

The findings stress the importance of tailoring extension services to local contexts, strengthening multi-stakeholder collaboration, and embedding agroecological principles into existing advisory systems. Successful community-driven models, such as Benin's social debt system and Madagascar's *Paysan Relais*, offer valuable lessons for scaling up farmer-led agroecology.

Ultimately, the report underscores the need for sustainable, farmer-centred advisory services. Increased investment, stronger partnerships, and knowledge-sharing networks are crucial for fostering resilient and inclusive agricultural systems. These insights provide practical guidance for policymakers, extension practitioners, and development partners supporting agroecological transitions.

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INTRODUCTION

Agroecology is recognised as a holistic and transformative approach to agriculture that offers a pathway to achieving sustainable food systems by integrating ecological principles into agricultural practices, emphasising biodiversity, resource conservation, and resilient farming systems. Unlike conventional methods, agroecology prioritises not only productivity but also environmental health, social equity, and economic viability (GIZ, 2024). This holistic approach to food system transformation addresses the pressing challenges of climate change, resource depletion, and food insecurity by creating systems that are adaptable, inclusive, and environmentally sound (FAO, 2024). This includes an explicit focus on social and economic dimensions of food systems. Agroecology places a strong focus on the rights of women, youth and indigenous peoples, as well as on land rights (McKay, et al 2024).

Agroecology is not a new invention. It can be identified in scientific literature since the 1920s, and has found expression in family farmers' practices, in grass-roots social movements for sustainability and the public policies of various countries around the world (FAO, 2018). According to FAO (2018), what makes Agroecology distinct is that it is based on bottom-up and territorial processes, helping to deliver contextualised solutions to local problems. Agroecological innovations are based on the co-creation of knowledge, combining science with the traditional, practical and local knowledge of producers. Agroecology is globally defined by the High Level Panel of Experts on Food Security and Nutrition (HLPE) which operates with 13 principles (Figure 1 in chapter 1.3).

While all these are relevant and positive for farmers, they are challenging existing power structures. Local governments and authorities might be positive towards agroecological practices, but at the same time can oppose or obstruct its social dimensions.

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THE ROLE OF EXTENSION APPROACHES IN AGROECOLOGICAL TRANSITION

Agricultural extension approaches are vital to the success of agroecology, serving as the bridge between research, knowledge, and on-the-ground practices. Traditional extension models are often top-down and focused on maximising yields through high-input methods. They are not geared towards being innovative or adaptive but on transfer of technology (Gliessman, 2022). To accelerate agroecological transition, extension approaches should emphasise participatory, inclusive, and responsive methods that are sensitive to local knowledge and needs, environmental conditions, and social context. Examples for such extension models include Farmer Field Schools, Farmer-to-Farmer exchanges, and innovation platforms, as they foster a collaborative learning environment where farmers, extensionists, and researchers work together to co-create sustainable solutions.

At the intersection of agroecology and advisory services, extension systems can drive a transition towards more sustainable agri-food systems by promoting techniques such as integrated pest management, soil conservation, crop diversification, and the production and use of local inputs (Gliessman, 2022). For example, participatory approaches encourage farmers to share their experiences, test new practices, and innovate based on their observations and local knowledge. This bottom-up dynamic not only strengthens the relevance and effectiveness of agroecological practices but also empowers farmers to become active agents of change within their communities.

This overview explores how embedding agroecological principles in agricultural extension approaches enhances long-term farmer engagement, encouraging continuous learning and a transition towards sustainable agri-food systems.

THE ROLE OF AFAAS AND GFRAS IN SUPPORTING THIS TRANSITION

For agroecology to thrive and be sustainable, it is essential to develop systems that align with its core principles, acknowledging that the transition involves stakeholders across the agri-food spectrum, including smallholders, advisors, policymakers and community leaders.

The Global Forum for Rural Advisory Services (GFRAS) community consists of 18 regional and sub-regional networks, including the African Forum for Agricultural Advisory Services (AFAAS). These regional networks collaborate closely with the national agriculture extension and advisory service platforms (Country Fora) actively exploring ways to support this agroecological transition by making these principles more accessible and practical for advisors and smallholders.

The “Agroecological Transition, Responsive Extension Approaches (ATREA)” project, a joint initiative led by AFAAS, is a strategic response that seeks to deepen understanding of effective, responsive extension practices that promote agroecology within selected countries: Benin, Kenya, Ethiopia, and Madagascar. By investigating the drivers and approaches that successfully engage farmers in these regions, ATREA aimed to distil best practices that can support the adoption of agroecological methods adapted to the local contexts. The ATREA project employed surveys, interviews, focus group discussions, and document reviews methodologies in the identification and documentation of sustainable, inclusive and responsive extension approaches for Agroecological Transition among target countries of Kenya, Benin, Madagascar and Ethiopia. Specifically, the project aims to: i) keep farmers engaged in extension approaches such as Farmer Field Schools (FFS), Farmer Business Schools (FBS), Farmer to Farmer (F2F) [objective 1] and, ii) to integrate farmers further into exchanges with researchers and extensionists [objective 2]. so that farmers stay motivated in sharing their experiences, hence, contribute to an agroecological transition of agri-food systems from bottom-up.

Results reported by AFAAS across these countries have confirmed that agroecology strengthens agricultural productivity, sustainability, and resilience. The adoption of agroecological practices has demonstrated benefits such as organic farming, sustainable land management, improved food security, higher incomes, and reduced reliance on external inputs. The key extension approaches used to promote agroecology across these countries include Farmer Field Schools (FFS), Farmer-to-Farmer Extension, Participatory Research and Extension, Information and Communication Technologies (ICTs), and Policy Advocacy and Institutional Support. These approaches, among others, provide farmers with comprehensive and customised guidance, supporting the adoption and expansion of sustainable and environmentally friendly agricultural practices nationwide. In Annex 1 is a list of the knowledge products produced under the ATREA project.

THE COLLABORATION BETWEEN AFAAS, GIZ, AND GFRAS

The ATREA Project was implemented through a collaboration between AFAAS and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. This collaboration was facilitated by GFRAS Global Secretariat, bringing together resources and expertise to advance agroecological extension practices in Africa. ATREA was funded by the Federal Ministry for Economic Cooperation and Development (BMZ), co-funded by the European Union (EU), and supported by GIZ. The project was spearheaded by AFAAS, the main extension network for the African continent, mandated by the African Union to represent and support advisory services within the African continent.

ATREA intends to transform agricultural systems through integrating farmers' knowledge further into extension approaches and by aligning them with agroecological principles. The study focused on identifying sustainable, inclusive, and responsive extension approaches to support the agroecological transition.

Research within ATREA concentrated on four intervention zones aligned with the BMZ-funded and GIZ-implemented Global Programme "Soil Protection and Rehabilitation for Food Security" (ProSoil), which was co-funded by the EU under the joint action "ProSilience: Enhancing soils and agroecology for resilient agri-food systems in Sub-Saharan Africa". This work was also supported by AFAAS's Country Fora in Benin, Ethiopia, Kenya, and Madagascar, where findings have illuminated key factors for integrating agroecological principles in agricultural extension approaches. It resulted into 50 knowledge products (14 for Madagascar, 10 for Benin, 14 for Kenya, 10 for Ethiopia, a webinar experience sharing report and one global synthesis report).

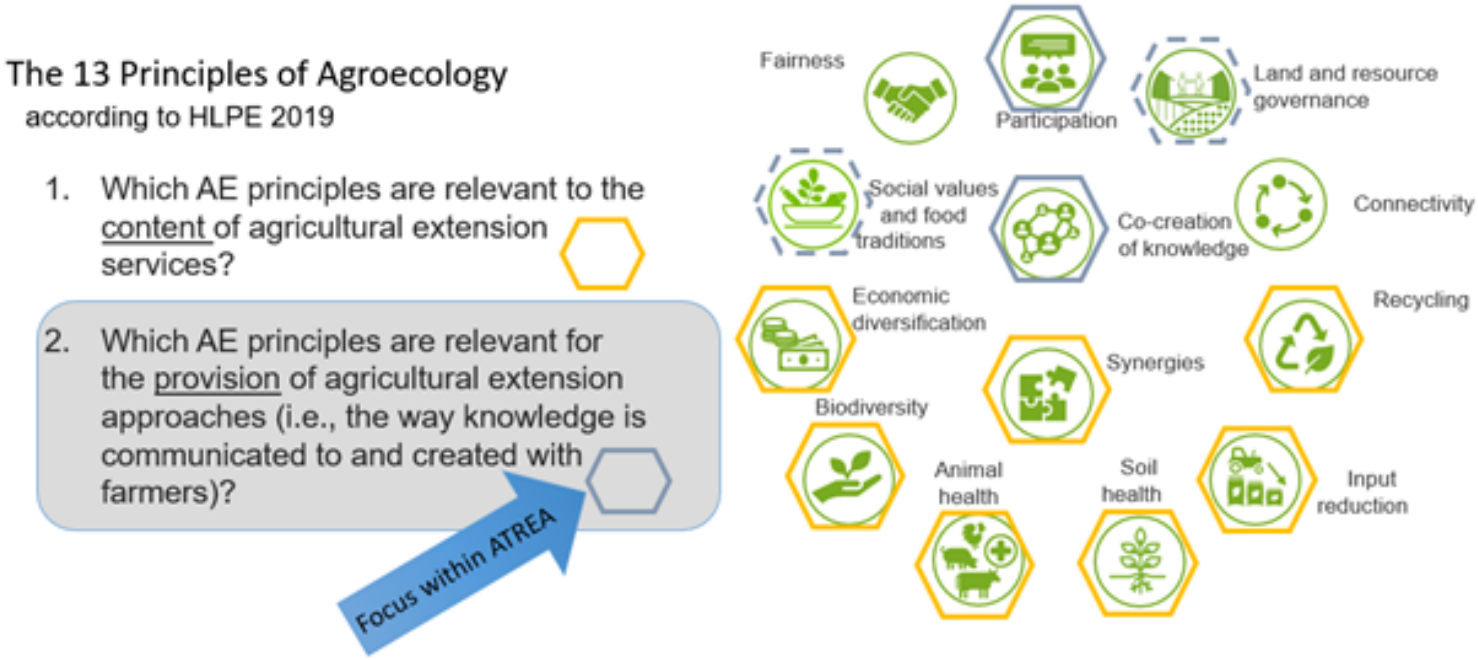


Figure 1: HLPE 13 principles for Agroecology with markings of the priority areas within the ATREA project looking at the role of agricultural extension agroecological transition towards sustainable agri-food systems.

GFRAS, as the global umbrella organisation of which AFAAS is a key member, has through its global secretariat contributed to this initiative by analysing these findings at a global and regional levels. From a global perspective, GFRAS monitors trends emerging from regional projects like ATREA and assesses how they inform best practices across other regions worldwide. By consolidating and summarising the project's insights, GFRAS Global Secretariat aims to identify broader patterns and practical approaches that could be beneficial in supporting agroecological transitions globally. This collaboration underscores the role of global networks in fostering shared knowledge and learning and supporting sustainable development goals through regionally adapted, responsive extension approaches.

CROSS-COUNTRY COMPARISON OF EXTENSION APPROACHES

PREVAILING EXTENSION APPROACHES PER COUNTRY

This section gives an overview of the prevalent extension approaches promoted in the context of ProSoil in each country (Table 1), paying special attention to the promotion of agroecological principles aimed at integrating farmers' knowledge, such as participation and co-creation. Based on this overview, best practices are identified to provide guidance for others interested in supporting the agroecological transition through extension services.

Farmer Field Schools (FFS)

A participatory education approach that brings together a group of small-scale food producers to solve production problems through sustainable agriculture. The FFS approach offers space for hands-on group learning, enhancing skills for observation and critical analysis and improved decision making by local communities.

Farmer Business Schools (FBS)

Drawing from the concept of FFS, FAO developed the Farm Business School (FBS). The FBS is focused on enhancing efficiency of productivity and on making "business choices" using a learning-by-doing approach and participatory methods.

Farmer to Farmer (F2F)

An approach to agricultural knowledge sharing, where experienced farmers train and mentor other farmers. It relies on peer-to-peer learning, local expertise, and practical demonstrations to spread sustainable farming techniques, improve productivity, and strengthen rural communities.

Relay Farmer Model

A peer-to-peer agricultural extension model where trained relay farmers serve as intermediaries between extension agents and local farmers. They demonstrate best practices, share knowledge, and provide guidance, ensuring localised dissemination of innovations, and boosting farmer participation, scalability, and sustainability.

Tem Sesiabun Gorado (TSG)

A farmer-led knowledge transfer approach from Benin promoting sustainable land management (SLM). In Baatonum, Tem Sesiabun Gorado means "land restoration messenger." Communities elect and train a TSG to share SLM techniques, fostering social responsibility and widespread adoption.

Training and Visits (T&V) - Transfers of Technology (TOT)

A structured, top-down approach developed by the World Bank in the 1970s to improve agricultural knowledge transfer. It involves regular, scheduled training for extension agents, who then visit farmers in a hierarchical system to disseminate new technologies and best practices.

Farmer Training Centres (FTC)

A decentralised approach where farmers receive hands-on training at designated centres. These centres serve as hubs for demonstration, skill development, and technology transfer, helping farmers adopt improved agricultural practices. The model promotes experiential learning, continuous capacity building, and community engagement.

Multi Actor Agriculture Innovation Platforms (MAIP)

Multi-stakeholder rural forums (also known as Innovative Platforms) uniting farmers, researchers, policymakers, and the private sector to co-develop agricultural solutions. This participatory approach drives innovation, problem-solving, and technology adoption for sustainable farming.

Smallholder Empowerment Projects (SHEP)

A market-oriented extension approach from Kenya, supported by JICA, helping smallholder farmers shift to “grow to sell.” SHEP links farmers to markets, enhances business skills, and boosts productivity through farmer-led decision-making and capacity building for sustainable income.

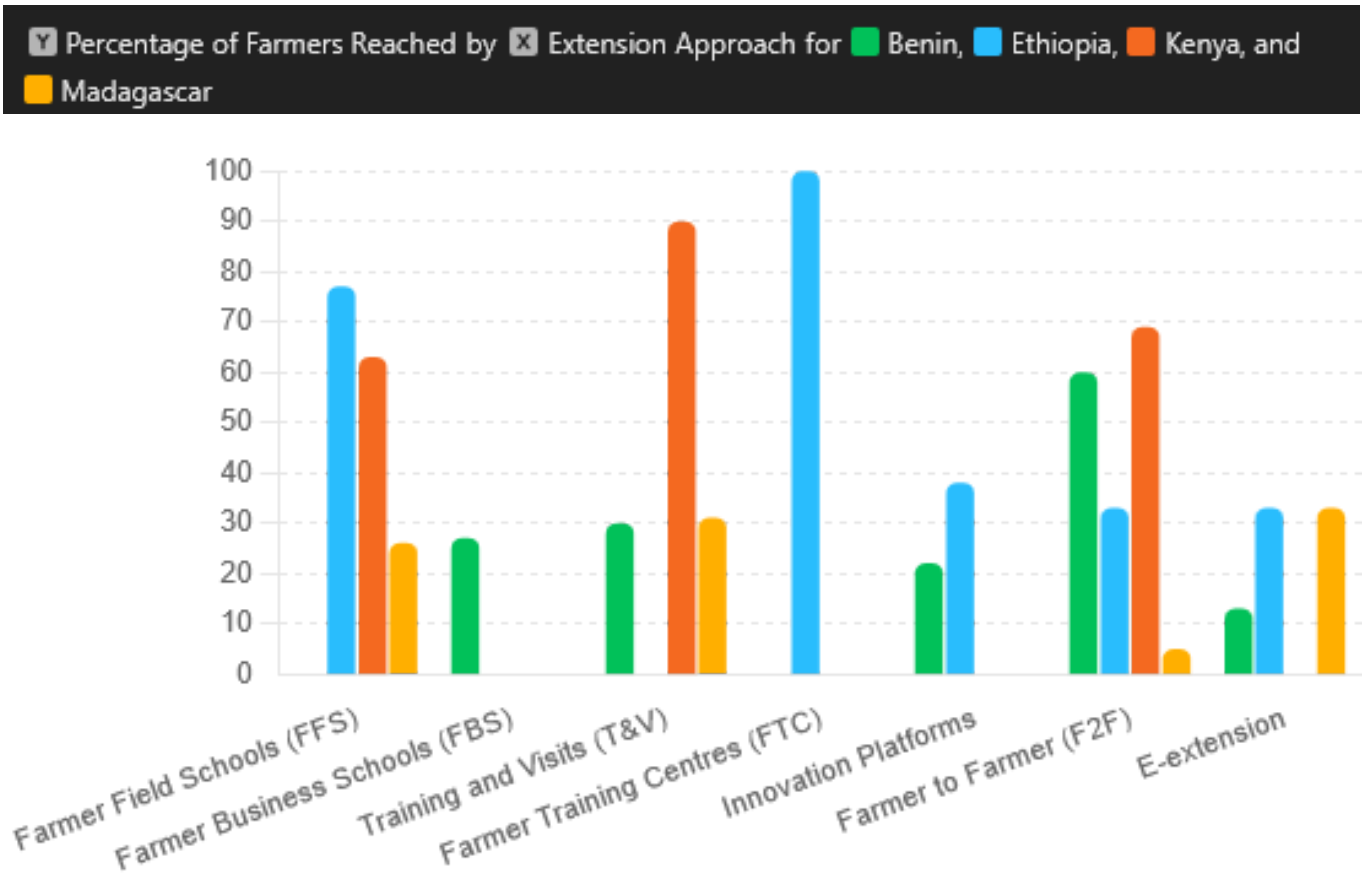
E-extension

A tech-driven extension model using mobile apps, SMS, social media, and AI to provide real-time farming advice. It improves accessibility, efficiency, and scalability, offering market updates, weather forecasts, and expert guidance for better productivity.

It is important to note that, while certain approaches had been recommended by ProSoil, AFAAS adopted a broader approach that extends beyond the specific extension methods promoted and co-developed by ProSoil. Rather than focusing solely on these approaches, AFAAS, through Country Fora applied a wider lens to explore diverse, inclusive, and context-specific extension strategies that support agroecological transitions. This approach ensures that multiple knowledge pathways, stakeholder needs, and local conditions are considered, fostering more adaptable and sustainable agricultural advisory services. The following observations were made:

Table 1: Extension approaches investigated in the context of ATREA. Percentage of farmers responding that they had been engaged by advisors using the listed extension approach.				
COUNTRY	BENIN	ETHIOPIA	KENYA	MADAGASCAR
Farmer Field Schools (FFS)	----	77%	63%	26%
Farmer Business Schools (FBS)	27%	----	----	----
Training and Visits (T&V)	30%	----	90%	31%
Farmer Training Centres (FTC)	----	100%	----	----
Innovative Platforms	22%	38%	----	----
Farmer to Farmer (F2F) - called Relay Approach in Benin and Madagascar	60%	33%	69%	5%
E-extension	13%	----	----	33%

Table 2: Chart to support visualisation of adoption of extension approaches per country



As can be seen from Table 1, the approaches used in the four countries vary and range from hands-on Training and Visits (T&V), through Farmer Field Schools (FFS), Farmer Business Schools (FBS), Farmer to Farmer (F2F, including Lead Farmer, Model Farmer and Relay Farmer approaches), to e-extension services, which use digital tools (e.g., videos, mass media such as radio broadcasts, SMS (short message service), e-extension applications, or telephone helplines). These digital services aim at complementing and enhancing traditional extension approaches (Fabregas, 2023; GFRAS, 2023).

In Benin, the ProSoil Country Package (CP) focused on improving existing extension services, which operate under the auspices of seven Territorial Agencies for Agricultural Development (ATDA) established under the Ministry of Agriculture, Livestock and Fisheries (MAEP). Farmers can visit the ATDA's communal unit in their area of residence to request agricultural advice and information.

Among the agricultural extension approaches used in Benin to reach farmers (Table 1), the CP focused its efforts on supporting the following three approaches: Farmer Business Schools (FBS)+ incorporating soil protection elements, informal F2F called the Relay Farmer Approach. Additionally, the Tem Sesiabun Gorado (TSG) (land restoration messenger) model, supported the scaling of ProSoil in Benin. This model incorporated the principle of "social debt," which underpinned its success (Annex 2). According to the interviews conducted by the 'Forum Béninois du Conseil Agricole' (FoBeCA) in Benin (368 interviewees, including farmers, extension workers, input dealers, researchers, community leaders, government officers) the F2F extension approach reached the highest proportion of the farmers (60%). The study was conducted in 10 villages in two departments, Alibori and Borgou; out of the ProSoil CPs' total intervention area, which consisted of 90 villages in four departments.

Feedback from farmers was that the F2F approach fostered peer learning and knowledge sharing among farmers, thereby enabling them to exchange experiences and best practices in agroecology. Second most farmers (30%) were reached through T&V, closely followed by FBS (27%) and Innovation Platforms (22%), while only 13% was reached using mobile based e-extension. The ATREA study also showed that the highest number of farmers (24%) had gained access to knowledge sharing and interaction through the F2F approach as compared to other extension approaches (T&V 13%, e-extension 14%, FBS 4%).

The ProSoil CP supported the F2F approach already practised in the country through capacity development, the accreditation of its service providers with the ATDAs, and the promotion of scientific knowledge through Researcher-to-Farmer extension systems, an approach that requires a delicate balance to not disregard local and indigenous expertise. Further, the ProSoil CP Benin also supported the operation of FBS and e-extension, offering training and skills development in entrepreneurship as well as sustainable farming practices, especially agriculture and livestock integration and integrated soil fertility management. The focus of these approaches was on knowledge dissemination, rather than co-creation.

In Ethiopia, a wide range of different extension approaches are used by public actors to reach farmers (Table 1). The ATREA study covered an area comprising of nine districts within four regions: Oromia, Sidama, Central, and Southern. 332 participants were interviewed by Country Fora and the Agricultural Development Partners Linkage Advisory Councils (ADPLACs), including: extension officers, input dealers, government officials, marketers, community leaders, and researchers. The study showed that the Farmer Training Centres (FTC) approach reached 100% of interviewees, Farmer Field Schools (FFS) reached 77% of interviewees, while Innovative Platforms and the F2F approach reached 38% and 33% of interviewees, respectively. These three extension approaches were consistently rated as priorities among farmers, extension officers, and other local stakeholders. For researchers and government officers, besides FFS and FTC, Innovative Platforms were considered more relevant than F2F.

Within the ProSilience component of ProSoil, the CP facilitated the establishment of 983 model farms to serve as venues for Farmer Field Schools (FFS). Additionally, the program collaborated with development agents in Farmers' Training Centers (FTCs) to train them using participatory approaches. The CP also introduced the concept of "Integrated Soil Fertility Management (ISFM) Ambassadors," selecting exemplary model farmers at the Woreda or Kebele level. These ambassadors played a critical role in teaching ISFM principles, with a particular focus on reaching socially vulnerable groups, such as women. Overall, the CP emphasised strengthening and improving group-based extension services, which provided spaces for knowledge co-creation and collaborative learning.

This focus was well-founded, as 88% of interviewed farmers reported receiving extension information from other farmers—slightly more than those who received it directly from extension agents (80%). Furthermore, over three-quarters (77%) of farmers engaged in discussions with community members about the application of agroecological practices, compared to just over half (52%) who discussed such topics with extensionists. These findings underscore the importance of farmer-to-farmer knowledge sharing, facilitated by participatory extension approaches. FFS, in particular, proved effective by allowing farmers to learn collaboratively on model farms and share knowledge within their groups.

In Kenya, a diverse range of extension approaches was employed in the study region, which encompassed 129 villages across Bungoma, Kakamega, and Siaya counties—areas targeted by the ProSoil CP. The availability of multiple extension services enabled the strategic use of each approaches' strengths to promote agroecology (AE) and achieve broader adoption of sustainable practices. However, this required careful alignment of each extension approach with the practices it was best suited to promote, based on the inherent design and objectives of those approaches.

According to interviews conducted by the 'Forum for Agricultural Advisory Services – Kenya' (KeFAAS) with 301 stakeholders, including farmers, extension officers, input dealers, government officials, marketers, and community leaders, the most prevalent extension approach in Kenya was the Training and Visit (T&V) model. This approach was utilised by 75% of extension agents and reached 90% of farmers. Its dominance stemmed from its long-standing history in Kenya's extension system, initially introduced when the system was well-staffed, and extension workers had resources to provide individualised advice directly on farmers' fields.

In the current resource-constrained environment, however, Kenyan extension services have become heavily reliant on donor funding. This has led to frequent reorganisations, with service delivery increasingly dominated by NGOs, including commodity-based, community-based, and faith-based organisations. Despite these challenges, T&V remains valuable for providing personalised AE extension services, which can enhance farmer participation, adoption, and scaling. Moreover, T&V can be complemented by other approaches that allow for broader outreach, accelerating the uptake of AE practices among larger farmer populations.

One notable alternative approach promoted by The Japan International Cooperation Agency (JICA) in Kenya is the Smallholder Horticulture Empowerment and Promotion (SHEP) approach. Initially designed to address the market needs of horticulture farmers, SHEP has since expanded to include other crops and broader market access support. This approach stands out for fostering intrinsic farmer motivation and independence while facilitating market-led production. SHEP's focus on market access aligns well with agroecological principles, as it allows farmers to adopt AE practices with confidence, knowing they have ready markets for their products. This also creates opportunities for farmers to secure premium prices for agroecologically produced food. By combining market-oriented support with AE education, SHEP helps sustain and scale the adoption of agroecology, building a strong foundation for long-term transformation.

In Madagascar, the study was conducted by the Country Fora 'Forum du Conseil Agricole' (FCA). They found that e-extension (33%) and T&V (31%) were the most widespread extension approaches among the 366 interviewees (farmers, extension agents, researchers, policymakers, input dealers, and marketers) in the study area (seven districts in Boeny and Androy regions). The latter involves direct training sessions led by NGO technicians or by farmer leaders, while the former utilises platforms such as community video screenings and radio. FFS (26%) and F2F (5%) are also valued but require further reinforcement to reach more farmers effectively. The ProSoil CP supported a semi-formal F2F approach, using Relay Farmer ("Paysan Relais") to complement the existing mechanisms of NGOs and ensure the continuity of knowledge transfer.

13 COMPARISON OF EXTENSION APPROACHES AND BEST PRACTICES

The **Farmer-to-Farmer (F2F)** approach was the only method implemented across all four countries studied. It proved especially well-suited for incorporating agroecological principles such as participation and the co-creation of knowledge. By valuing peer-to-peer learning and leveraging trusted local voices, the approach emphasised the role of local institutions, as farmer-trainers were more accountable to their communities. These trainers were selected by the very communities they later trained, chosen for their cultural knowledge, language skills, experience with agroecological (AE) farming, and ability to share information effectively. This positioned them as credible mediators, bridging scientific and indigenous knowledge within extension services.

Through collaborative learning and knowledge exchange, farmers gained insights into innovative agroecological practices tailored to their specific contexts. The F2F approach fostered continuous adaptation and improvement while also promoting social cohesion. However, researchers and practitioners observed that long-term motivation among farmer-trainers often declined, leading to reduced participation or abandonment of the knowledge transfer process. To address this, continuous support for farmer-trainers from extension agents is crucial. Participatory monitoring can help trainers manage complex situations, such as customising technologies to suit local needs. Furthermore, the inclusion of women as farmer-trainers is vital to ensure gender equality and responsiveness within the approach.

Two other widely used approaches were **Farmer Field Schools (FFS)** and the **Training and Visit (T&V)** model. In Ethiopia, the Farmer Training Centers (FTC) model, which is a variation of T&V, was particularly prominent. T&V had the highest degree of participation, as nearly all respondents in Ethiopia and Kenya reported its use, compared to less than one-third in Benin and Madagascar. Regarding FFS, its absence in Benin was attributed to the use of a variation called Farmer Business Schools (FBS), demonstrating that FFS and its variants are also preferred approaches for promoting agroecology and facilitating shared knowledge generation.

Determining which extension approach was most effective in promoting agroecology was beyond the scope of this study. However, in Benin and Madagascar, the Relay Farmer approaches—based on the F2F model—addressed some of the challenges identified, such as long-term trainer motivation. Additionally, the Tem Sesiabun Gorado (TSG) model, developed by Töpfer Müller Gaßner (TMG) Research, supported the scaling of ProSoil in Benin. This model incorporated the principle of “social debt,” which underpinned its success. Key principles for its effective implementation included:

Community ownership through open exchange: ensuring a shared understanding of the challenges related to community knowledge dissemination fosters collective ownership of the process.

Long-term motivation through realistic expectations and clear responsibilities: Setting achievable expectations and clarifying roles and responsibilities among stakeholders sustains motivation and encourages trainers to fulfil their obligations within the social debt framework.

Strengthened accountability via the principle of social debt: Farmers' commitment to the principle of social debt stimulated their accountability and sense of social responsibility in disseminating knowledge.

These approaches highlighted the importance of tailoring extension services to local contexts, ensuring inclusivity, and fostering sustainable knowledge-sharing systems to promote agroecological practices effectively.

The **“Paysan Relais” approach** used by the ProSoil CP in **Madagascar** was aimed at complementing the existing mechanisms of NGOs to ensure the continuity of knowledge transfer (Annex 3). Paysan Relais (PR) were linked to farmer associations (5 of which were created with support from ProSoil). This allowed them to apply for funding through the Agricultural Development Fund (Fonds de Développement Agricole, FDA) under better conditions than individual farmers. Another piece in the puzzle for improving access to agricultural inputs and extension services are the so-called "convenient stores for producers" (DMM). DMMs are accredited by the Ministry of Agriculture and Animal Husbandry (MinAE) and are envisaged to be managed by private sector or civil society service providers offering a range of inputs to farmers via a voucher system. This way, farmers receive agricultural inputs subsidised by the FDA as well as technical assistance, thus complementing the public extension system. However, as the DMM model is based on an initiative by the MinAE, only few operational DMMs exist, and infrastructure (roads, phone coverage) remains poor. The ProSoil CP also cooperated closely with the GIZ programme “Adaptation of Agricultural Value Chains to Climate Change (PrAda I and II)”, which focusses on setting up an agricultural extension pool in cooperation with the Madagascar Chamber of Agriculture. The pool is designed to integrate the PR and allow them to exist independently from project activities.

Comparing the two Relays Farmer approaches from Benin and Madagascar, the strength of Benin's TSG model lies i) in the ownership that is created at local or community level, and ii) the concept of "social debt" which takes advantage of intrinsic incentives. By framing knowledge-sharing as a way to "repay" the community, social debt can inspire a more sustainable, interdependent system of agriculture that relies on collective knowledge, rather than external interventions. These incentives go beyond financial or material rewards and instead tap into social and personal values that align with community-based knowledge sharing. This can foster a self-sustaining cycle of motivation based on social connection, mutual support, community resilience, and personal growth. This makes the model particularly sustainable in rural and resource-limited settings, where social bonds and shared goals are highly valued. Madagascar's approach has also proven to be very effective. The approach is now embedded in a national reference system, which enables the skills of farmers to be standardised and certified, thereby facilitating access to financing and income. Within the Global Programme ProSoil, the approach has been highlighted by ProSoil for being particularly successful (further information in French available here).

Regarding the use of **E-extension** (Annex 4) within ProSoil, the preferred tools are videos produced with farmers (testimonials or technical guides) and radio broadcasts. This choice is justified because these two tools are the most accessible in rural areas. Both are commonly offline tools and directly address issues of literacy in rural settings. As for radio, it is the most widely used mass media tool in rural areas and is more accessible to rural households. Although e-extension services might at first glance seem averse to enabling knowledge co-creation and participation, this is not necessarily the case. Experience from **Madagascar** has shown that the design of such services can actively strengthen the participation of farmers by involving them in the development, creation, and dissemination of videos. Furthermore, knowledge co-creation can be supported by offering farmers a range of technological options to experiment with. Thus, farmers can grasp the main principles of agroecology but also adapt their implementation to local conditions and create synergies with the indigenous knowledges they hold. Consequently, farmers can take a participative role in co-creating these extension services while sharing and further developing their own knowledge. As videos are produced based on the needs of farmers, relevant issues are addressed thus avoiding a top-down approach while ensuring better representativeness and ownership. When paired with hands-on extension approaches like T&V, e-extension can become a valuable tool for creating and disseminating information on AE approaches to a wider audience.

INCENTIVES FOR FARMERS TO PARTICIPATE AND SHARE KNOWLEDGE

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Farmers' interest in and willingness to participate in extension activities and knowledge-sharing initiatives are often influenced by their perceived benefits from such engagements. It is important to recognise that the time farmers dedicate to these activities comes at a cost, as it could have been spent working on their farms or pursuing off-farm business opportunities. Incentives for participation are not one-size-fits-all and are shaped by individual factors such as age, gender, income level, and social position within the community. Understanding these motivations is a critical prerequisite for designing effective and inclusive extension programs.

The experiences from the ATREA project across Benin, Ethiopia, Kenya, and Madagascar provide valuable insights into incentive strategies that enhanced farmer participation in agroecological transition programs. Below is a comparative analysis of the most impactful incentives in each country:

Benin

Farmers in Benin preferred ***farm inputs, credit/loans, and market access,*** with peer exchange opportunities (such as sponsored visits and training certificates) also being highly valued. Recognition and social networking also encouraged active participation, with awards promoting a sense of achievement and commitment to the program.

Ethiopia

Key incentives here include ***meals during meetings*** (ranked as top priority), ***social networking, subsidies, and training certifications***. These incentives reflect a practical approach, focusing on immediate needs like food, social connections, but also knowledge validation, which fostered higher engagement and a supportive community atmosphere. However, financial subsidies and trial input samples were also valued, as they reduce barriers to experimentation with new practices.

Kenya

Farmers were motivated by ***access to farm inputs, market access, and professional development opportunities*** (like becoming input dealers). Additionally, socially engaging incentives such as sponsored visits and community networking also played significant roles, signalling similarities to the conclusions reached in Ethiopia. Kenya's focus on economic and social incentives made the extension approaches more attractive, fostering knowledge sharing and professional growth.

Madagascar

Here, incentives were geared toward ***hands-on learning*** and ***community involvement***. Farmers responded well to access to ***farm inputs***, training sessions, and sponsored visits. The use of ***farms as demonstration sites*** helped them gain first-hand experience with agroecological practices, providing an effective bottom-up learning approach.

KEY TAKEAWAYS ON INCENTIVES

Tangible Incentives

Across all four countries, the provision of farm inputs, market access, and subsidies consistently emerged as primary motivators. These incentives directly address economic needs, making them foundational for best-practice models.

Social and Peer Exchange Opportunities

Sponsored visits and exchange programs encouraged farmers to share knowledge and support each other. These initiatives strengthened community bonds and enhanced the dissemination of agroecological practices.

Training and Recognition

Certifications and awards for participation provided farmers with validation and affirmed their expertise within their communities. While these low-cost incentives added value, they were rarely sufficient as stand-alone motivators for sustained knowledge-sharing engagement.

In summary, a combination of economic support, practical resources, peer networking, and training recognition stood out as a best-practice model to ensure sustained farmer engagement in agroecological extension programs across diverse contexts.

When further analysing the incentive systems across Benin, Ethiopia, Kenya, and Madagascar within the ATREA project, it became clear that each country has unique motivators grounded in local needs and challenges, a factor that underscores the importance of contextual awareness in designing effective agricultural extension programs. For instance, Ethiopian farmers place high value on social and community-oriented incentives, like shared meals and networking, which not only support the immediate needs of farmers but also strengthen collective knowledge and a sense of inclusion. Similarly, Kenyan farmers' interest in market access and professional development through roles like input dealers or seed multipliers reflects a drive for economic empowerment that aligns with Kenya's larger agricultural market structure. In Benin, practical inputs and financial support are key due to a reliance on direct resource support, while in Madagascar, hands-on learning through trial sites allows farmers to adapt agroecological practices within their specific environmental constraints. Thus, effective incentive systems must incorporate local priorities to foster farmer buy-in and long-term engagement. It is always recommended that the incentive package is developed in close collaboration with the farmers, taking into account that there might be gender and age differences.

Sustainability is crucial when adopting any incentive-based system, especially where financial incentives play a central role. Financial support—such as subsidies, credit access, or cash allowances—has proven effective across all countries, but reliance on these can create dependency if other supporting mechanisms are not in place by the project's end. The local advisory service providing organisation seldom has the financial means to continue such incentive-based systems. So, while incentive-based extension enhances the ability of the project to produce result in the short-term, it often decreases the efficiency of extension in the long-term, as farmers post project, become less interested in engaging in knowledge exchange.

Long-term negative spin-off can be reduced by promoting farmer-to-farmer exchanges, using local champions or community-led groups, and establishing partnerships with local market actors can help maintain engagement without ongoing financial input. Therefore, while financial incentives provide short-term engagement boosts, sustainable systems should weave in enduring resources that build farmer resilience and continue to support agroecological practices beyond the project lifespan.

The fact that farmers need financial incentives adds to the cost of extension services. This is most likely inevitable as long as farmers fall in the low-income category. It would be interesting to analyse and discover the point in farm commercialisation that would change the perception of incentives from predominantly tangible ones (inputs, meals, credits, subsidies) to be mainly intangible (knowledge, network, market access).

COST COMPARISON AND FINANCING OF EXTENSION APPROACHES

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Having examined the inherent additional costs of incentive-based extension systems for smallholder farmers, this section delves into the financial implications of various approaches designed to promote shared learning. While cost comparisons across different methods are valuable, they provide limited insight into the actual impact of extension efforts. The economic impact of agricultural extension remains an under-explored area, yet it is critical for informed decision-making. For governments, farmers' organisations, and private sector actors to justify increased investment in agricultural extension and advisory services, a comprehensive understanding of the cost-benefit dynamics of these systems would be essential.

Below is a listing of the registered cost in the four countries involved in the Global Programme ProSoil. The data collected through ATREA attempted to establish a comparative overview of the costs only, yet the variability across regions and contexts makes direct comparisons complex. For instance, similar extension approaches, such as Farmer Field Schools or e-extension, may incur different costs in different countries due to local resource availability, varying facilitator rates, and operational costs. Additionally, even within a single country, costs can fluctuate widely based on geographic, economic, and infrastructural factors.

It is widely recognised that e-extension is more cost-effective way of information exchange than face-to-face interventions, and that methodologies such as Farmer Field Schools (FFS) excel at enhancing farmers' knowledge, understanding and behavioural change. However, there is little data available on the long-term impact or return on investment (ROI) of these and other extension approaches.

Benin

The Farmer-to-Farmer approach in Benin costs $2,500 per session. The Soil Vehicle (Video) and Radio Broadcasting approaches are more affordable, with costs of $500 and $170, respectively, making them accessible tools for awareness-raising and initial training on agroecological principles.

Ethiopia

Extension costs are notably high, with the Farmer Field School (FFS) approach costing around $8,700, making it one of the costliest methods. Similarly, approaches like Farmer-to-Farmer (F2F) and SHEP also require substantial funding, with costs around $8,400 and $6,400 respectively. Comparatively, Plant Clinics and Innovation Platforms are more cost-effective, at $1,900 and $2,150, respectively, due to their more targeted approach, limited focus and lower reliance on extensive materials and facilities.

Kenya

Kenya's extension approach costs show a wide range, with SHEP as the most expensive at $40,000 per complete training cycle, reflecting intensive training resources and personnel. The Innovation Platform approach also has a high cost of $10,300. Meanwhile, e-extension remains the most affordable at $3,000 per session, leveraging digital communication to reach farmers more efficiently.

Madagascar

Costs here are generally lower, with the Farmer Field School at $2,300 and Training and Visit at $300. Again, FFS stands out as being 10 times as expensive. A relevant question to investigate is if they are 10 times as effective. Plant Clinics and e-extension are notably economical, costing $180 and $610, respectively. Nevertheless, Plant Clinics only cover a small part of extension contents which may also explain the relatively lower costs. These lower costs reflect resource amortisation strategies, where reusable materials and shared sessions reduce the per-session expenses.

MAIN OBSERVATIONS

COST EFFICIENCY

e-extension and digital approaches, such as radio and mobile video screenings, stand out as cost-effective methods for delivering agricultural information, as can be seen from the examples in Kenya and Benin. When measured as cost per farmer reached, these approaches allow broader reach at a fraction of the cost of hands-on training, making them scalable options for widespread education. The impact of e-extension still needs to be further investigated.

VARIATION BY APPROACH

Intensive, participatory methods like Farmer Field Schools and Farmer-to-Farmer models are generally more expensive across all countries, as they require facilitators, training materials, and often higher operational costs. However, they are valuable for building deep, practical knowledge and community engagement, which are essential for sustaining agroecological transitions.

FUNDING MECHANISMS

Across countries, funding models typically combine resources from farmers, government, NGOs, and sometimes private sector contributions. This mix highlights the need for diverse and sustainable funding sources, especially for high-cost approaches that might be challenging to maintain without consistent support. One challenge that we see across Africa is that there is limited capacity, and especially in the poorer countries the extension that is actually happening is increasingly project-based and externally financed.

SCALABILITY

Countries with lower-cost approaches, like Madagascar's e-extension and plant clinics, demonstrate how cost-sharing and resource optimisation (e.g., reusable materials) can make extension services more sustainable. This model could be replicated in other regions to increase accessibility without compromising quality. However, we are still missing the full picture as we do not know the relationship between cost and impact of the different approaches.

A general remark on cost analysis in extension approaches highlights a significant gap in scientifically sound, comparative data within and across countries (Djuraeva, et al 2023). Detailed cost data per extension approach is often sparse, and cross-country comparisons remain challenging due to inconsistencies in implementation and data collection methods. While the ATREA project provides valuable insights into costs per farmer and per session, these figures represent rare instances of systematically gathered information, underscoring the importance of further research to build a robust evidence base.

Efforts to make extension sessions more inclusive, incorporating a balanced representation of gender and age groups, often elevate costs. Providing inclusive sessions often requires targeted outreach, tailored materials, and additional logistical support, such as childcare services or special accommodations, to ensure all demographic groups can participate meaningfully. Thus, while inclusivity enhances the effectiveness and reach of extension programmes, it may increase the overall budget, reinforcing the need for flexible and context-responsive funding mechanisms.

RECOMMENDATIONS FOR SCALING OF EXTENSION APPROACHES

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Based on the findings from the ATREA project, as well as GFRAS global experience within the sector, several recommendations can be made that can enhance the scaling of agroecological sensitive extension approaches effectively:

Tailor Approaches to Local Contexts

Successful scaling requires adapting extension approaches to the specific socio-cultural, environmental, and economic conditions of each region. For instance, methods like Farmer-to-Farmer (F2F) are highly effective in Benin, where peer learning is culturally significant, while e-extension has proven efficient in reaching farmers in Madagascar due to its reach and cost-effectiveness. Understanding local needs and leveraging cultural practices helps to ensure that extension services remain relevant and resonate with farmers.

Promote Multi-Stakeholder Collaboration

Effective scaling of agroecological practices depends on collaboration between farmers, extension agents, researchers, NGOs, and governmental bodies. ProSoils' success in using participatory extension methods to facilitate dialogue and information exchange, particularly through innovation platforms and farmer training centres, highlights the need for sustained engagement. Encouraging partnerships that share resources, and expertise ensures that farmers continue to receive support after initial project funding ends. In encouraging partnerships, it is important to pay attention to the incentives that motivate different people and different stakeholder groups to engage. Partnerships only work if everyone feels that they gain from them.

Focus on Low-Cost, High-Impact Methods

Approaches like e-extension, which uses radio and video for disseminating knowledge, are not only low-cost but also capable of reaching large numbers of farmers. This is particularly useful for raising awareness and providing general training on agroecological principles. These methods should be scaled as an initial engagement tool, with more intensive approaches like Farmer Field Schools (FFS) or Training and Visits used to deepen understanding and implementation.

Integrate Agroecological Principles into Existing Extension Systems

Embedding agroecological practices into standard extension services, such as Farmer Advisory Services or Training and Visits, can promote consistency and ensure that agroecological knowledge is regularly refreshed and reinforced. This integration can make the transition smoother and reduce costs associated with creating entirely new systems. While integrating in existing systems acknowledging the need for a more dialogue-oriented approach to foster co-creation of knowledge is important. Integrating agroecology into the existing system entails both AE technologies and adaption of approaches so the facilitate co-creation of knowledge, as well as addressing the socio-economic aspects of AE.

SCALING SUCCESS STORIES DERIVED FROM PROSOIL EXPERIENCE

Several extension approaches have already been scaled successfully within ProSoil, providing valuable lessons for other regions within the countries and other countries within the region:

FARMER TO FARMER (F2F) APPROACH

Widely adopted in Benin and Kenya, this method is effective in scaling due to its peer-led structure, which allows farmers to share knowledge directly within their communities. This approach's success lies in its ability to build trust and ownership. It facilitates hands-on learning, making it a model for regions looking to strengthen community networks.

E-EXTENSION IN MADAGASCAR

This approach uses radio broadcasts and community video screenings to reach remote farmers. Its low cost and broad reach make it an attractive option for countries with dispersed rural populations. Scaling e-extension could be particularly useful in areas with limited physical infrastructure, as it minimises logistical costs while maximising reach. Again, acknowledging that it is not a stand-alone approach but a supplement to physical extension approaches such as the successfully introduced F2F approach Paysan Relais (see also Annex 3).

FARMER TRAINER CENTRES (FTC) IN ETHIOPIA

These centres have proven effective in providing ongoing training and support. By becoming local hubs of knowledge, FTCs have helped to maintain consistent communication between extension agents and farmers, ensuring that agroecological practices are reinforced over time. This model could be adapted to other countries looking to establish regional centres for sustained knowledge dissemination.

The real challenge lies in scaling success beyond the project limitations (ProSoil in this example), both in time and in geographical coverage. As mentioned earlier, the ability to mobilise resources locally is limited and is a real constrain in any scaling effort. Unfortunately, some of the most effective face-to-face learning models such as FFS and FBS, as illustrated in this paper, also tend to be the most expensive.

CONCLUSION AND RECOMMENDATIONS FOR FUTURE INTEGRATION

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This study provided valuable insights into the variety of extension methods used to facilitate the agroecological transition towards sustainable agri-food systems, focusing on approaches employed by ProSoil across four African countries. At the same time, it highlighted the inherent challenges of conducting cross-country comparisons due to economic, institutional, and cultural differences.

A persistent issue identified was the long-standing decline in national investment in agricultural extension and advisory services, particularly in Africa. Over the decades, this sector has evolved into a pluralistic landscape involving numerous actors, including farmer organisations, governments, NGOs, community-based organisations (CBOs), private sector stakeholders, and the donor community. However, this plurality often results in fragmentation and a lack of coordination. In many areas, extension activities increasingly occur in a "project mode," which poses challenges for ensuring long-term impact and sustainability. Overall, the funding for extension services remains limited, and the public sector's role continues to diminish.

While the study does not look at costs and benefits of the different extension approaches, it is generally recognised that knowledge and labour-intensive extension approaches such as FFS and FBS have high implementing costs which significantly affects the potential for scaling up these efforts. Approaches based on F2F peer learning is generally perceived to strike a reasonable balance between cost and efficiency. Though this has not be sufficiently backed by research. Generally, updated literature on the cost benefit of different extension approaches is scarce. The findings of this project revealed that cost comparisons within and across countries are complicated by considerable variability in implementation contexts, such as differences in the average number of farmers per session, session frequency, and input costs. Additionally, efforts to make extension services more inclusive—by addressing gender and age balance among participants—often increase costs, requiring additional outreach, resources, and logistical support to ensure equitable access.

Some intermediate solutions proposed in this study include joint financing of extension services through contributions from governments, NGOs, private sector partners (such as input suppliers and retailers), and farmers themselves. Specific examples from the study include:

Benin

A combination of public funding, NGO support, and farmer contributions, emphasizing cost-sharing to promote sustainability.

Ethiopia

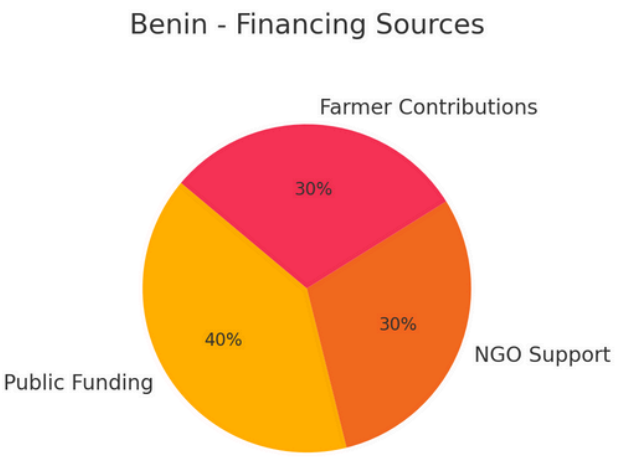
Farmers covered approximately 20% of costs, primarily through time and resource contributions, while the government, NGOs, and private sector shared the remaining burden.

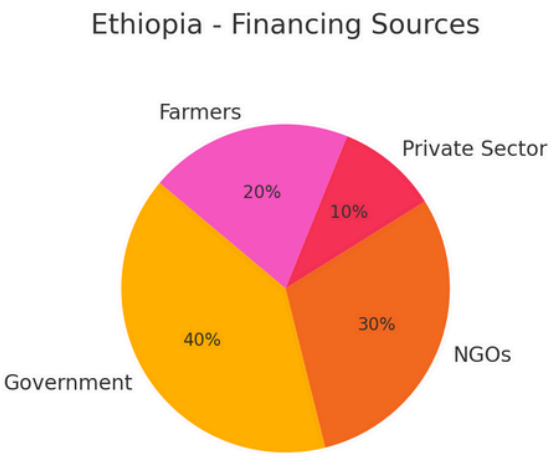
Kenya

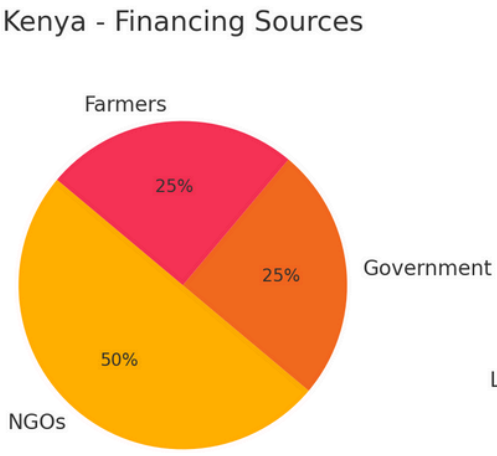
NGOs played a significant role, covering over 50% of the funding, complemented by contributions from farmers and the government.

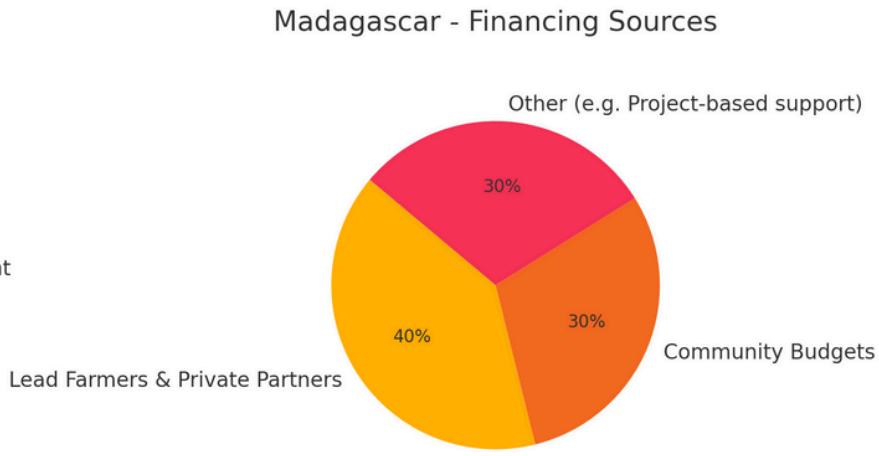
Madagascar

Lead farmers and private partners played key roles in funding training costs, while community budgets supported ongoing advisory services.









As a concluding remark, it is crucial to recognise that there are no quick fixes or short-term solutions to the challenges faced by agricultural extension services. The sector must improve its ability to document and demonstrate impact as a prerequisite for increased investment. Without enhanced and sustained investment in agricultural extension and advisory services, the transformative changes required to achieve agroecological food systems will remain unattainable.

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ANNEX 1. LIST OF KNOWLEDGE PRODUCTS FROM ATREA PROJECT

BENIN

1. Factsheet on “Extension Approaches Promoting Agroecological Practices in Benin”;
2. Factsheet on “Knowledge Co-Creation through Extension Approaches in Benin”;
3. Factsheet on “Responsiveness of Extension Approaches to Agroecological Principles in Benin”;
4. Factsheet on “Adoption and Scalability of Agroecological Extension Approaches in Benin”;
5. Factsheet on “Enhancing Collaboration between Researchers, Extensionists, and Farmers in Benin”;
6. Factsheet on “Costs and Financing of Extension Approaches in Benin”;
7. Factsheet on “Incentives and Engagement Strategies for Farmers in Extension Approaches in Benin”;
8. Good Practice Note on “Farmer-to-Farmer Extension for Agroecology in Benin”;
9. Policy Brief on “Responsive Extension Approaches for Agroecological Transition in Benin”;
10. Report on “Policy Dialogue on Strengthening the Partnership between Researchers, Extension Workers, and Farmers in Promoting Agroecology in Benin”.

ETHIOPIA

11. Country Report on “Agroecology Transition Responsive Extension Approaches in Ethiopia”;
12. Factsheet on “Extension Approaches Promoting Agroecological Practices in Ethiopia”;
13. Factsheet on “Cost and Funds Requires to Promote Agroecology Practice through Extension Approaches in Ethiopia”;
14. Factsheet on “Enhancing Adoption and Scalability of Agroecology Practices through Extension Approaches in Ethiopia”;
15. Factsheet on “Funding Mechanism versus Cost per Farmer and Extension Officer per Extension Approach in Ethiopia”;
16. Factsheet on “Knowledge Co-Creation on Agroecology through Extension Approaches in Ethiopia”;
17. Factsheet on “Obstacles that Make the Implementation of Extension Approaches Deficient in Ethiopia”;
18. Factsheet on “Responsiveness of Extension Approaches to Agroecological Principles in Ethiopia”;
19. Policy Brief on “Innovative Responsive Extension Approaches for Agroecological Transition in Ethiopia”;
20. Country Dialogue Report on “Agroecology Transition Responsive Extension Approaches in Ethiopia”;
21. Farmer Training Centre in Ethiopia, Training Manual;
22. Good Practice Note on Farmer Training Center in Ethiopia;
23. Good Practice Note on Farmer Field Schools in Ethiopia;
24. Training Manual on Farmer Field Schools in Ethiopia;
25. Factsheet on “Incentive for Farmers Engagement in Extension Approaches in Ethiopia”.

BENIN

26. Country Report “Agroecological Transition Responsive Extension Approaches in Kenya”;
27. Policy Dialogue Report on “Dynamic and Inclusive Extension Approaches in Kenya”;
28. Factsheet on “Collaboration on Extension Service Delivery and its impact on Farmer Understanding and Uptake in Kenya”;
29. Factsheet on “Stakeholder collaborations driving engagement and commitment in agroecological practices in Kenya”;
30. Factsheet on “Constraints to the Adoption of Agroecology in Kenya”;
31. Factsheet on “Incentives to Sustain Agroecological Extension Approaches in Kenya”;
32. Factsheet on “Success Conditions Influencing Farmer Participation in, and Uptake and Adoption of Agroecology Practices in Kenya”;
33. Factsheet on “Costs for Different Extension Approaches in Kenya and the Mode of Financing”;
34. Factsheet on “Extension Approaches Promoting Agroecological Practices in Kenya”;
35. Factsheet on “Responsiveness of Extension Approaches to Agroecological Principles in Kenya”;
36. Policy Brief “Responsive Extension Approaches for Agroecology Transition in Kenya”;
37. Good Practice Note “Smallholder Horticulture Empowerment Project (SHEP) for Agroecology”;
38. Policy Brief “Enhancing Collaboration for Agroecological Transition in Kenya”;
39. Factsheet on “Initiatives through which the State can support Agroecology Adoption in Kenya”.

MADAGASCAR

40. Factsheet on “Enhancing Adoption and Scalability of Agroecological Extension Approaches in Madagascar”;
41. Factsheet on “Responsiveness of Extension Approaches to Agroecology Principles in Madagascar”;
42. Factsheet on “Co-Creation of Agroecology Knowledge by Extension Approaches in Madagascar”;
43. Factsheet on “Extension Approaches Cost and Financing Mechanism in Madagascar”;
44. Factsheet on “Extension Approaches Promoting Agroecology Practices in Madagascar”;
45. Factsheet on “Incentives and Engagement Strategies for Farmers in Extension Approaches in Madagascar”;
46. Factsheet on “Constraints for Farmers to Practice Agroecology in Madagascar”;
42. Factsheet on “Enhancing Collaboration between Researchers, Extensionists, and Farmers in Madagascar”;
47. Factsheet on “Roles of the State in the Agroecological Transition in Madagascar”;
48. Factsheet on “Impact of Collaboration on Extension Service Delivery and Farmer Understanding and Uptake”;
49. Policy Dialogue Report from Madagascar;
50. Good Practice Note “e-Extension for Agroecology”;
51. Training Manual “What is the training and visit extension approach?”
52. Policy Brief “Responsive Extension Approaches for Agroecological Transition in Madagascar”.

CROSS-COUNTRY

53. Synthesis of report “Agroecological Transition, Responsive Extension Approaches (ATREA) across Benin, Ethiopia, Kenya and Madagascar”
54. Experience Sharing Webinar Report “Agroecological Transition, Responsive Extension Approaches (ATREA)“

ANNEX 2. THE *TEM SESIABUN GORADO* (TSG) MODEL IN BENIN

The principle of "social debt" is the central pillar in the implementation of the TSG model. It is a mechanism for individual and collective accountability that serves as the basis for the sustainable transfer of knowledge and skills between farmers participating in a development project, and those in the broader community. In the TSG model, extension agents serve as facilitators. Their role is not only to support farmers to adapt the knowledge gained to address their specific needs, but also to continue to experiment on, and innovate agricultural practices. They also play a role in creating an enabling environment in which farmers can share the results of their experimentation with their peers.

- At the outset of the project, a group of "farmer-trainers" (TSGs) is selected, who will then be responsible for transferring their knowledge to all farmers in the village, without making distinctions based on sex, religion, or socio-cultural background.

- The selection is done through a participatory community process. By agreeing to participate in trainings and to receive various types of support from the project (free training, farm inputs, resources, and professional technical support, provided e.g. by programmes or state-based agricultural services), each farmer-trainer incurs a social debt towards his/her community, and towards the project.

- No financial or material compensation is required to refund this debt. Instead, the farmer- trainer commits to share the knowledge and skills acquired with five untrained farmers over a period of one or two agricultural seasons.

- This group becomes the first generation of "farmer-learners." Each of the five farmer-learners also undertakes to train five other farmers after a period of successful experimentation with the acquired good practices. This process can be continued with a minimum of coaching from field technicians.

- The knowledge-sharing cycle is continued until all farmers in the village are trained. It is accompanied by continual participatory assessments and validations of TSGs' work, including periodic exchanges between the technical advisor, or extension agent, the farmer-trainers, and their learners as well as discussion sessions in small groups.

- At the end of a knowledge- and skills-sharing cycle, a public meeting is convened to validate the results of implementing the TSG model, as well as the performance of the actors involved. This final step provides an opportunity for the community to evaluate, and publicly acknowledge the efforts made by the farmer-trainers, as well as all other actors involved in the knowledge- sharing process.

ANNEX 3. THE *PAYSAN RELAIS* MODEL IN MADAGASCAR

In this model, the first farmers who volunteered to test technical innovations got the opportunity to become Paysan Relais (PR). They were technically supported by agricultural extension agents of NGOs and received additional training and tailored advice from agricultural extension agents from the MinAE or from DMMs if needed. This enabled them to play a leader's role in farmer associations, helping them to improve farmers' access to knowledge, inputs, and funding.

- PRs applied the techniques identified as relevant on their own plots which then served as demonstration fields to train other farmers, using resources provided by the project (e.g., training kits, seed samples, bicycle).
- PRs also participated in periodic technique evaluation workshops.
- As incentives, they were offered benefits in kind (e.g., 10 kg of rice seed) as well as a monetary compensation for the additional working days (up to 5000 Ar/half day).
- In turn, PR were asked to accompany at least 40 farmers per agricultural season.
- Further information can be accessed in French here.

ANNEX 4. E-EXTENSION DEFINITIONS AND EXAMPLES

E-extension is defined as the use of digital tools such as e-extension applications, mass media, videos, telephone helplines, USSD, or SMS to enhance traditional extension approaches to enable change (New Extension Learning Kit (NELK) by GFRAS). With relatively low resources, it allows reaching more people. However, the use of new technologies in rural areas remains a challenge. Accessibility issues are still problematic:

- Firstly, access to decent networks is still an issue in remote areas.
- Additionally, technological accessibility due to the high cost of digital equipment and services is also a barrier to consider.
- Moreover, the lack of decent infrastructure in rural areas, limiting access to energy, is also noted.
- Finally, skill issues, both in technical manipulation and literacy, remain challenges to address. This last point is even more crucial for women and vulnerable individuals.

Further, it is important to note that e-extension itself is not a standalone approach acting in isolation. It does not replace extension workers and agricultural advisors in any way. Instead, it serves as a complementary tool to the interventions of extension actors.

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