Research Progress Brief

partnership for economic policy pep

October 2025

Information Dissemination and Adoption of Low-Carbon Agricultural Technologies

By Aisha Nanyiti, Edward Bbaale, Florence Lwiza Nsereko, Gyaviira Ssewankambo, Martine Visser, Marc Jeuland, Amin Karimu

Key messages

- Uganda's agricultural sector contributes the most to its emissions. Low-carbon agricultural technologies are hence indispensable to Uganda's energy transition. Uganda is among the top 20 energy-deficient countries, with 26 million people not having access to electricity as of 2019. The urban electricity access rate was 71% and that of rural areas was 32% by 2019 (GIZ, 2022). There are reports of some areas experiencing more than 5 hours of power blackouts or relying on generators for more than 50% of the time (GBE, 2021).
- Low-carbon renewable energy sources offer environmentally friendly alternatives; however, uptake of these technologies is low. Lack of information, affordability, and financing mechanisms are often cited as key barriers to adoption. This study assesses the impact of the dissemination of information on the adoption of low-carbon agricultural technology. The information included a description of the benefits from use of such technology, and on available government financing through partner MSMEs to potential users.
- The target population for the study is smallholder farmers, who comprise a greater proportion of women. the majority of the women in Uganda derive their livelihood from agriculture, and women constitute 76% of the agricultural labour in Uganda (FAO, 2022; Ochieng, 2024). Women suffer from limited access to information via mainstream media (Ochieng, 2004), but are, however, active in farmer groups. The study uses farmer groups as the dissemination medium and promotes an effective communication channel for farmers and women in particular.

Anticipated Policy and Practice Relevance

The evidence, if positive, can help inform and orient government interventions that aim to support the transition to low-carbon ag-tech solutions in the sector. The findings may help address critical gaps identified in the approaches proposed by Uganda's Ministry of Energy and Mineral Development (MEMD) through the Energy Policy regarding the appropriateness of the information dissemination mechanisms and the effectiveness, targeting, and sequencing of the policy incentive structures.

The study seeks to evaluate the impact of information treatments that focus on benefits and availability only, versus those that combine with information on available rebates or financing mechanisms. This comparison is expected to offer insights into options for enhancing the effectiveness of agricultural technology financing programmes. T he s tudy also explores the socioeconomic profiles of adopters, with a focus on women and youth, in order to document the appropriate financing models for reaching these groups.

In addition to the country's global and regional commitments to climate goals – such as through the Africa Climate Summit 2023, the UN Forum on Climate Change, and the Climate Smart Agriculture initiative (Africa Heads of State, 2023; CIAT/BFS/USAID, 2017; UNCC, 2023) -, Uganda's interest in promoting the use of renewable energy is evident in many of its national policies including the Energy Policy 2023 and the Electricity Access Scale-up Project (EASP), and the Vision 2040 and the National Development Plans (NDP) among others. Potential users of the study findings include MEMD, partner MSMEs, and agricultural extension departments of the local governments.

Co-creation and Stakeholder Engagement

The intervention was designed through a participatory process that brought together farmers, MSMEs, government agencies, and local authorities to ensure both contextual relevance and policy alignment.

Early diagnostic interviews with ag-tech suppliers and smallholder farmers highlighted two central barriers: limited awareness of low-carbon Ag-techs and financing mechanisms. These insights informed the choice of community-level medium as the primary dissemination channel and the decision to test whether combining benefit information with financing details could enhance adoption.

Partner MSMEs played a critical role in shaping the intervention by providing model machines and staff for field demonstrations, helping ensure that the technologies promoted were both credible and practical.

Following initial discussions with the Ministry of Energy and Mineral Development (MEMD), the team was advised to engage with the Uganda Energy Credit Capitalization Company (UECCC) to explore potential collaboration under the Energy Access Scale-up Project (EASP). These discussions resulted in the active involvement of UECCC and its implementing partners in both the design and implementation of the intervention, establishing a direct link between the study and ongoing national subsidy programs. This engagement was particularly important in refining the financing dimension, by incorporating elements of the EASP's Results-Based Financing (RBF) model into the intervention design.

Policymakers from the Ministry of Energy and Mineral Development (MEMD) and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) were involved throughout co-creation meetings and workshops, to foster early buy-in and align the project with sectoral strategies such as the Energy Policy 2023. Local governments also contributed by legitimizing the community engagement process and supporting mobilization at the parish and sub-county levels.

Intervention Design

The project tests two complementary approaches to closing the information gap that constrains adoption of low-carbon agricultural technologies.

The first intervention u ses farmer groups as a direct engagement channel. Farmers were invited to workshop-style demonstrations where information was provided either on the benefits of low-carbon machinery alone, or on benefits combined w ith d etails of government financing schemes. Randomization at the sub-county level ensures that observed differences in adoption can be attributed to the information treatment. By working through farmer groups, the design leverages existing structures in which women are strongly represented, supporting gender inclusiveness.

The second intervention evaluates the role of mass media, specifically radio advertising, in diffusing similar messages. Here, the design compares districts exposed to advertisements on benefits, access and financing information with districts that are not exposed to the advertisements. This approach captures the potential of wide-scale dissemination through established communication medium in Uganda.

Both interventions are anchored in the project's theory of change (see Figure 1). The theory holds that smallholder farmers often lack adequate knowledge of low-carbon technologies and financing mechanisms. Providing information on benefits, access, and available financing is expected to increase awareness, shift attitudes, and strengthen willingness to adopt. By systematically comparing benefit and access-only versus benefit, access and financing information, and by testing targeted (workshop) versus broad (radio) delivery modes, the study generates evidence on which communication strategies are most effective in shifting adoption behavior.

This design also reflects strong stakeholder input. MSME partners provided demonstration machines and staff for the workshops, while the Uganda Energy Credit Capitalisation Company (UECCC) ensured that the financing component accurately reflected the Results-Based Financing (RBF) mechanism under the Electricity Access Scale-up Project (EASP). Embedding these inputs in the design helps align the intervention with ongoing government programs and ensures policy relevance.

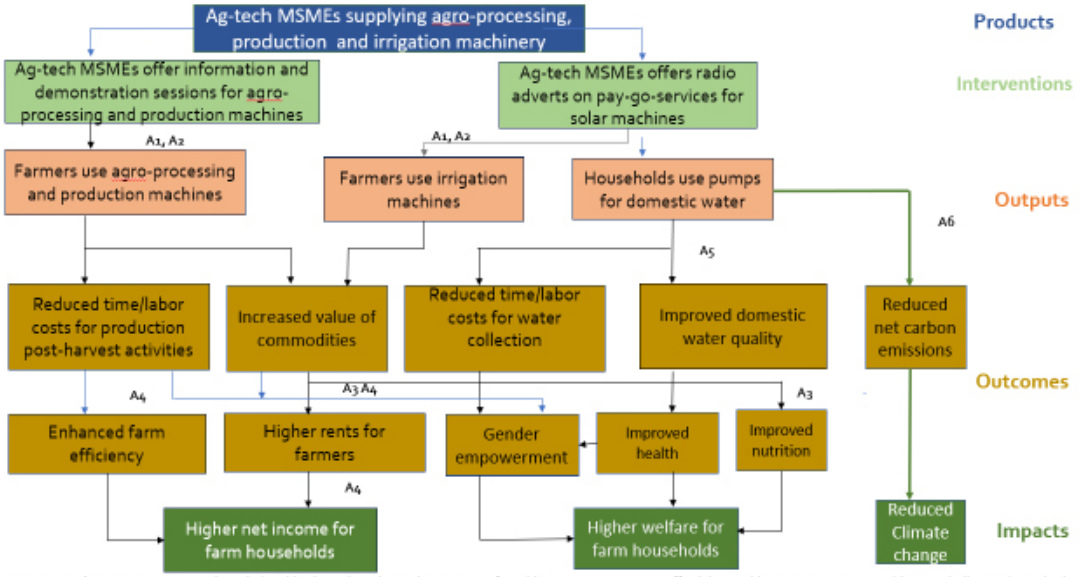

Figure 1: Theory of Change.

Baseline Insights

Baseline Characteristics- () Represent for the second intervention sample

Table 1, Figure 2 and Figure 3, presents some summary statistics at baseline.

Table 1: Socio-economic characteristics

Variable	Intervention 1		Intervention 2	
	Mean	SD	Mean	SD
Male respondents	0.53	0.50	0.58	0.49
Male household head	0.81	0.39	0.83	0.38
Age of household head	44.96	13.00	49.85	13.37
Crop-producing household head	0.81	0.39	0.87	0.33
Livestock-producing household head	0.01	0.11	0.02	0.15
Estimated income of the household head per month	190,127	354,254	235,576	872,904
Household uses rainfed and supplementary irrigation for crops grown on a particular parcel	0.02	0.15	0.04	0.19
Household has spray irrigation	0.008	0.09	0.01	0.10
Household has drip irrigation system	0.002	0.05	0.001	0.04
Household has feed mixer	0.0006	0.02	0.0007	0.03
Household has a petrol/diesel maize sheller	0.004	0.06	0.002	0.05
Household has access to agricultural machinery via a farmer's group	0.03	0.16	0.07	0.26
Household has access to agricultural machinery via neighbours	0.03	0.17	0.03	0.18
Household access maize sheller from village neighbourhoods	0.71	0.45	0.54	0.49
Respondent belongs to a women-only group (farmers' group)	0.12	0.32	0.21	0.41
Respondent is aware of the Electricity Access Scale-up Project	0.001	0.03	0.006	0.08
Amount the respondent would pay for a solar water pump	1,217,000	217,000	1,239,000	2,121,000
Amount the respondent would pay for a solar maize sheller	782,500	754,200	733,000	759,000

The baseline findings highlight several structural barriers and opportunities that shape the adoption of low-carbon agricultural technologies. First, farming remains overwhelmingly rain-fed, with fewer than 8% of households using any form of irrigation. This dependence on rainfall underscores both the vulnerability of smallholder farmers to climate variability and the potential value of agricultural technologies such as solar irrigation pumps. Yet, the near absence of mechanization—less than 2% of households owning any agricultural machinery—reveals the limited penetration of modern farming tools. Despite this, demand for mechanization is evident. Farmers consistently expressed interest in maize shellers, millers, tractors, and irrigation pumps. However, access is typically through diesel-powered shellers operated by local service providers. These options are costly, prone to delays, and often deliver poor-quality outcomes, such as oil spills on the shelled grain. This reliance on inefficient and polluting machinery points to a clear market opportunity for affordable, low-carbon alternatives. Gender dynamics further sharpen this opportunity. Women dominate agricultural labor and actively participate in farmer groups, yet they face greater barriers to accessing information. The baseline confirms that radio and television remain the main sources of agricultural advice, with little preference for them compared to face-to-face engagement. This validates the project's strategy of using farmer groups as an information channel and highlights the importance of testing whether financing information, alongside benefit and access messaging, is especially effective for women and youth. The baseline results also expose a major policy–practice disconnect. Awareness of government initiatives such as the Electricity Access Scale-up Project is almost nonexistent. Without effective communication and tailored dissemination, subsidy schemes and financing mechanisms risk bypassing their intended beneficiaries. This insight underscores the importance of evaluating how different modes of information provision can close the awareness gap and enable equitable access to low-carbon ag-tech.

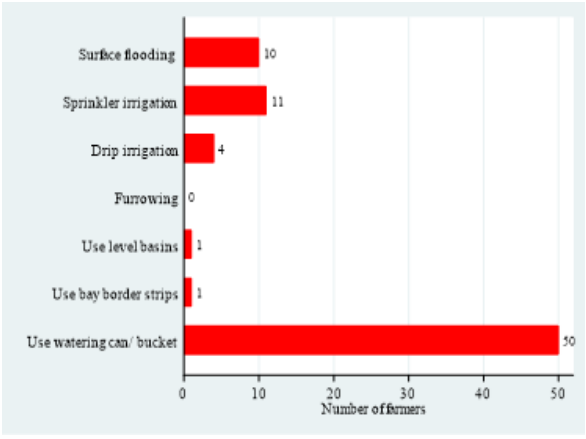

Figure 2: Baseline Irrigation Method used, Intervention 1 sample

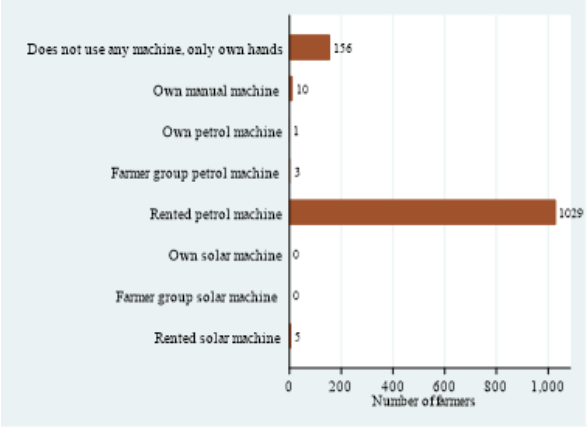

Figure 3: Baseline Maize shelling methods used, Intervention 2 sample

Green House farming

Planned Outcome Evaluation

The main outcome variable is the adoption of low-carbon ag-tech, and this will be captured by whether the farm household possesses or uses low-carbon ag-tech. With limited uptake, other outcome variables will include access to low-carbon ag-tech through their farmer group or peers, knowledge of low-carbon ag-tech, attitude to adoption of low-carbon ag-tech, and willingness to pay for low-carbon machinery they desire on their farm.

Sub-group analysis according to gender and age will be implemented.

Next Steps

Edline surveys started on 1st September 2025 and will be on till end of October. Edline data analysis and reporting will then follow shortly until January. We hope then to engage policy makers and MSMEs on the findings of the study between February and March and then conduct a larger dissemination workshop with all relevant stakeholders between April and May.

References

Food and Agricultural Organization. (2022). National gender profile of agriculture and rural livelihoods – Uganda. Country gender assessment series. Available at. content (fao.org). Accessed on 02/07/2024.

Ochieng. 2024. Rural Women and Information in Uganda. Food and Agricultural Organization (FAO). Available at. HIGH-LEVEL CONSULTATION ON RURAL WOMEN AND INFORMATION - PROCEEDINGS (fao.org). Accessed 19/06/2024.

GBE. (2021). GBE Launches Solar Design Advisory Support for SMEs in Uganda. available at. GBE launches solar design advisory support for SMEs in Uganda - Green People's Energy for Africa (gruene-buergerenergie.org) accessed on 27/10/2023.

GIZ (2022). Promoting Mini Grids for Rural Electrification in Uganda (Pro Mini Grids). Available at Promoting mini grids for rural electrification in Uganda (Pro Mini Grids) - giz.de. Accessed on 08/01/2024.

Solar energy water irrigation system

This document presents progress and preliminary analytical insights from the project Leveraging Renewable Energy MSMEs for Sustainable Agriculture in Sub-Saharan Africa and Southeast Asia (SSA and SEA). The authors acknowledge the valuable guidance of CEDCA Scientific Advisors — Marc Jeuland, Martine Visser, Amin Karimu, Brais Álvarez Pereira, Gallina Vysotskaya, Francesca Marchetta, and Jorge Dávalos — and extend special thanks to Bipasha Baruah (IDRC) for her continued support.

The project is part of a three-year initiative jointly implemented by the Partnership for Economic Policy (PEP) and the Environment for Development (EfD) network, with funding support from the International Development Research Centre (IDRC), Canada. *The views and opinions expressed in this publication are those of the authors and do not necessarily reflect those of PEP, EfD, or IDRC.*

IDRC · CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

EfD