CIF CLIMATE INVESTMENT FUNDS

IMPACT EVALUATION EARLY EVIDENCE SERIES

IRRIGATION TO ENHANCE YIELDS AND CLIMATE-RESILIENCE BENEFICIARY TARGETING

The Climate Investment Fund's (CIF) Pilot Program for Climate Resilience (PPCR) is a program for developing countries and regions to build adaptation and resilience to the impacts of climate change. The program supports the Sustainable Land & Water Resources Management Project (SLWRMP) in Mozambique, implemented by the African Development Bank and focusing on addressing key welfare challenges faced by rural farming communities, including low and/or unequal incomes, food insecurity, and the effects of land degradation. The irrigation component of the project is achieving this by providing beneficiary communities with small-scale irrigation kits, contributing to an increase of farmers' incomes by expanding cultivation to the dry season (double cropping calendar); allowing for the cultivation of water-sensitive crops (diversification); and improving resilience to droughts.

The impact evaluation of the project, currently being conducted by the World Bank Group's Development Impact Evaluation Group (DIME), asks several questions that inform these objectives. Namely:

- What is the impact of irrigation infrastructure on water availability, crop choices, yields and variability of yield?
- Does group composition affect water user associations' abilities to maintain the irrigation infrastructure and increase yields?

The evaluation compares the performance of two models used to select beneficiaries: one in which small-holder farmers are prioritized to receive the kits (i.e. smaller plots and a greater number of households), vs. unconstrained, community-determined provision of access to irrigation, which tends to skew usage to larger landholders. It is often assumed that efficiency gains of irrigation are maximized via the scaling and expertise potential of larger landowners. Yet, the existence of this equity/efficiency trade-off remains an empirical question.

QUICK FACTS

DATE
May 2020

COUNTRY
Mozambique

PROJECT
Sustainable Land & Water Resources Management Program (SLWRMP)

CIF FUNDING
$15.75M for PPCR

MDB
African Development Bank

PRODUCT TYPE
Development Impact Evaluation (DIME)

ARGUMENTS FOR TARGETING SMALLHOLDERS

With the intent to address rural poverty in tandem with climate vulnerability, logic would hold that access to irrigation should target the poorest potential beneficiaries. Targeting smallholders for poverty-reducing irrigation access would be built around the assumptions that:

- Smallholders are more likely to be poor;
- Targeting smallholders = on average, a larger number of smaller plots irrigated = a greater number of households reached; and
- Diminishing marginal returns on capital = greater gains with a larger number of smaller plots.

ARGUMENTS FOR TARGETING LARGER LANDHOLDERS

Based on the intent to maximize returns on investments, one would seek to target those beneficiaries that would achieve the most gains in production. Large landholders are likely to

be more sophisticated in their use of agricultural technologies, and often hypothesized to be able to achieve higher returns from irrigation.

Moreover, focusing on a fewer number of users per kit would also stand to reduce the risk of collective action failure in the management of a public good.

METHODS OF TARGETING

To test the two models side by side, the project deployed two alternate means of selecting beneficiaries. The first, preferencing smallholders, was done via score-based targeting, using a proxy means test (PMT) to identify those with smaller land areas (<2ha). The second, which leveraged community knowledge on those best suited to maximize outcomes, asked community leaders to choose beneficiaries. The protocols were randomly allocated across communities and the baseline showed that using a simple score-based protocol was effective in ensuring the intended targeting. Figure 1 shows an example of the allocation of kits via the decentralized approach, while Figure 2 shows an allocation that used the smallholder-centric approach. Figure 3 summarizes these results: the average landholding of a farmer assigned via the decentralized approach is more than 0.8ha larger than the average landholding of a farmer assigned via the smallholder priority approach.

Figure 1.
DECENTRALIZED, COMMUNITY-DRIVEN ALLOCATION

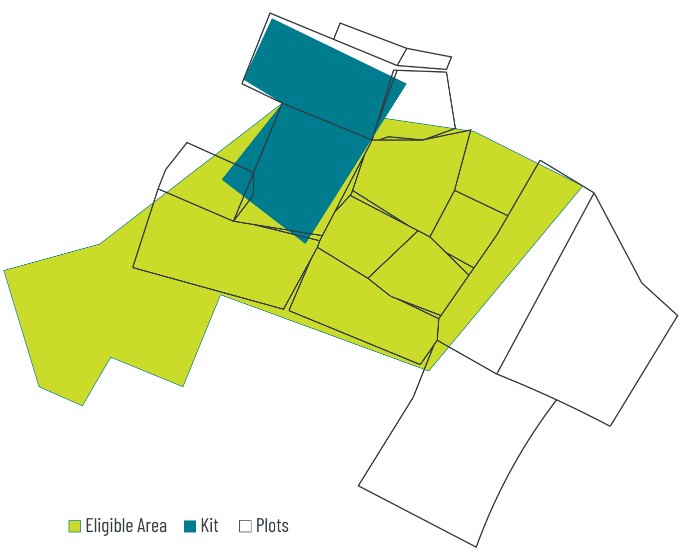


Figure 2.
SMALLHOLDER-PRIORITISING ALLOCATION

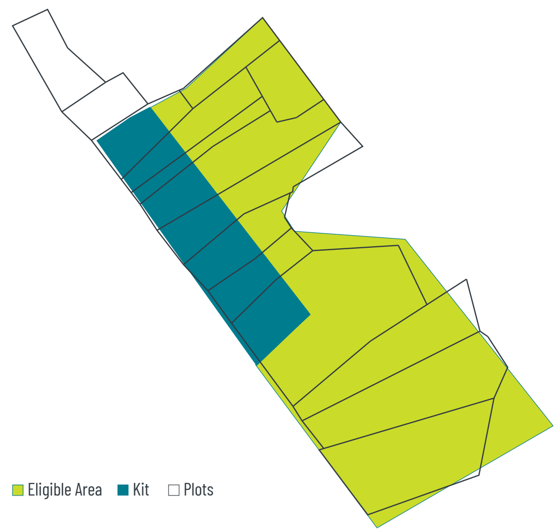
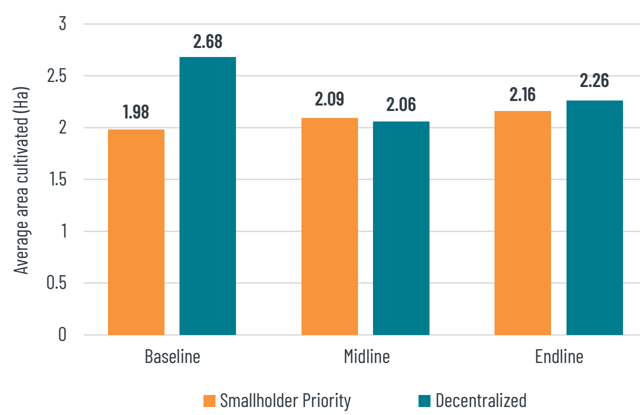


Figure 3.
AVERAGE LANDHOLDING OF SMALLHOLDER-PRIORITISING VS. DECENTRALISED ALLOCATION



Sample is restricted to households assigned to kit at baseline or using kit at mid-line or endline.

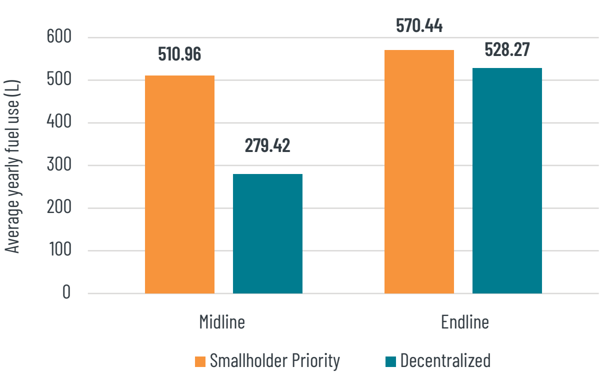
FINDINGS: EFFECTS ON KIT USAGE AND MAINTENANCE

To assess the performance of the different types of groups, the evaluation compares performance at the kit level across several indicators.

Usage. Access to fuel is a primary sustainability challenge of the project: in more than 45% of communities where kits were installed, users reported that at some point during the previous year they could not buy sufficient fuel to use the kits as planned. Contrary to established theory on collective action failures, mid-line and end-line data analyses found that kits provided to a greater number of users with smaller plots were less likely to face fuel shortages and had greater average fuel usage per kit. End-line findings showed a relative "catching-up" on part of decentralized assignees.

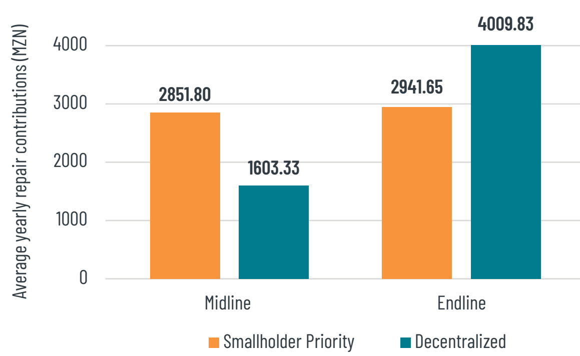
Maintenance. Proper kit maintenance is a key to sustainability of the intervention, which is shown to be a relevant concern: less than three years after the first kits were installed, more than 15% were no longer functional and half had broken parts. Comparing maintenance contributions of larger numbers of smallholders against that of fewer numbers of relatively wealthier farmers showed no statistical difference in performance across the two types of groups.

Figure 4.
AVERAGE FUEL USAGE



P-value of difference under robust standard errors for ML and EL is 0.130 and 0.810 respectively. Prediction is net of kit size fixed effect. Sample includes 45 and 53 communities that reported positive fuel contributions in ML and EL respectively.

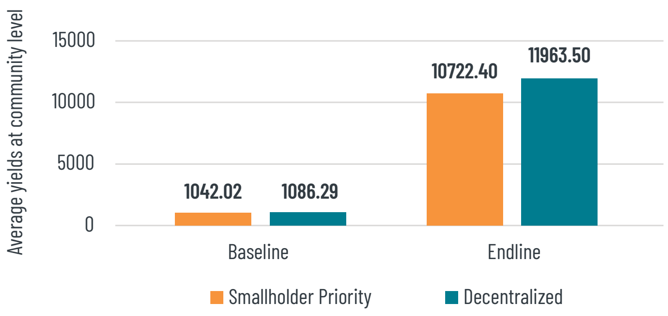
Figure 5.
AVERAGE REPAIR CONTRIBUTIONS



P-value of difference under robust standard errors for ML and EL is 0.186 and 0.401 respectively. Prediction is net of kit size fixed effect. Sample includes 41 and 38 communities that reported positive fuel contributions in ML and EL respectively. Community level contribution is obtained by adding self-reported contributions from household survey.

Land Productivity. Average per-hectare production values were also shown to not be statistically different between the different groups, falling within the bracket of $140 - $210/ ha.

Figure 6.
AVERAGE YIELD PER HECTARE



The sample includes 284 plots inside the kit area at baseline, 914 at midline, and 695 at endline. Yields are defined as production value per hectare of planned kit area. Production value is winsorized at 99th percentile.

Implication. While the exact drivers and incentives that gave rise to these differences still remain inconclusive at this point in the IE, the existence of smallholder-preferential efficiency gains or equivalence illustrates that projects such as SLWRMP, seeking to target larger concentrations of poorer demographics, may not need to worry about related trade-offs in efficiency or sustainability. Where dividends are sufficient, considering area irrigated, fuel usage, repair contributions, and total production, smallholder operations may in fact be better positioned to coordinate and manage responsibility sharing than larger scale entities.

i2i DIME
TRANSFORM DEVELOPMENT

The World Bank's Development Impact Evaluation (DIME) group generates high-quality and operationally-relevant data and research to transform development policy, help reduce extreme poverty, and secure shared prosperity. It develops customized data and evidence ecosystems to produce actionable information and recommend specific policy pathways to maximize impact.

For more information please visit
http://www.worldbank.org/en/research/dime
www.climateinvestmentfunds.org

AFRICAN DEVELOPMENT BANK GROUP