The effect of demonstration plots and the warehouse receipt system on ISFM adoption, yield and income of smallholder farmers: a study from Malawi's Anchor Farms

"ISFM MALAWI"

An overview of our project 2014-2019

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Origins: 3IE Thematic Window 4

- This project is a collaboration between the Clinton Development Initiative (implementation partner), our research team (evaluating partner) and the funder 3IE (and coordinated by AGRA/IFAD)
- International Initiative for Impact Evaluation (3IE) started the a Thematic Window for Agriculture in 2012 (TW4)
- International, multi-disciplinary, teams were invited to join in and participate in a matching workshop at AGRA in Nairobi where teams of researchers are matched with ongoing AGRA/IFAD projects in 2013
- TW4 was concluded in 2020 with 13 research projects

Agricultural Innovation Evidence Program | 3ie (3ieimpact.org)

Motivation

- Agriculture in Malawi accounts for 35% of GDP and employs 90% of the population
- 51% of farmers live under/close to the poverty line
- Declining soil quality and stagnating yields
- Integrated Soil Fertility Management – ISFM – can improve soil health, i.e. its ability to store and gradually release nutrients and water
- Yet, the adoption of ISFM techniques remain low
- Our implementation partner, CDI, introduced the Anchor Farm Project in Malawi in 2008 to address this low uptake

Today’s presentation

- Overview of the main components and findings of our 5 year research program (2014 until 2019)
- Implications for practice
- Implications for policy

For more information and references, download our final report on the 3IE site:

Project final report

Or contact: a.maertens@sussex.ac.uk

Introducing our project team

Wezi Mhango	Late Ephraim Chirwa	Cheryl Palm	Chris Barrett	Hope Michelson	Annemie Maertens
					

Our program coordinator: Eric Kaima

And the many students associated with our project, among others, Annie Matiti, Christopher Phiri, Vesall Nourani, Kwabena Krah

Introducing ISFM: Improving soil health

Optimal planting practices, leguminous integration (intercropping, crop rotation), mineral fertilisers, soil amendments, organic matter (crop residue, compost), agro-forestry (fertiliser trees), crop rotation, legumes, conservation agricultural practices, hybrid seeds

Pictures taken with permission of participants

Introducing CDI's Anchor Farm Program

- AFM aims to increase agricultural production, income and food security of Malawi's smallholder farmers through adoption of ISFM - and soybean production in particular
  - Extension activities (demonstration plots and farmer field days)
  - Marketing activities (access to new output markets)
- Rational: Farmers have information constraints due to thinly stretched extension activities and farmers lack remunerative output markets

Component 1: Farmer clubs

- AFP is implemented through farmer clubs
- Farmers form clubs of 10 to 20 members and select a lead farmer, chair, treasurer and secretary
- CDI employs extension agent to liaise with the clubs via the lead farmer
- Clubs pool labour (and some capital) to work on the CDI project together

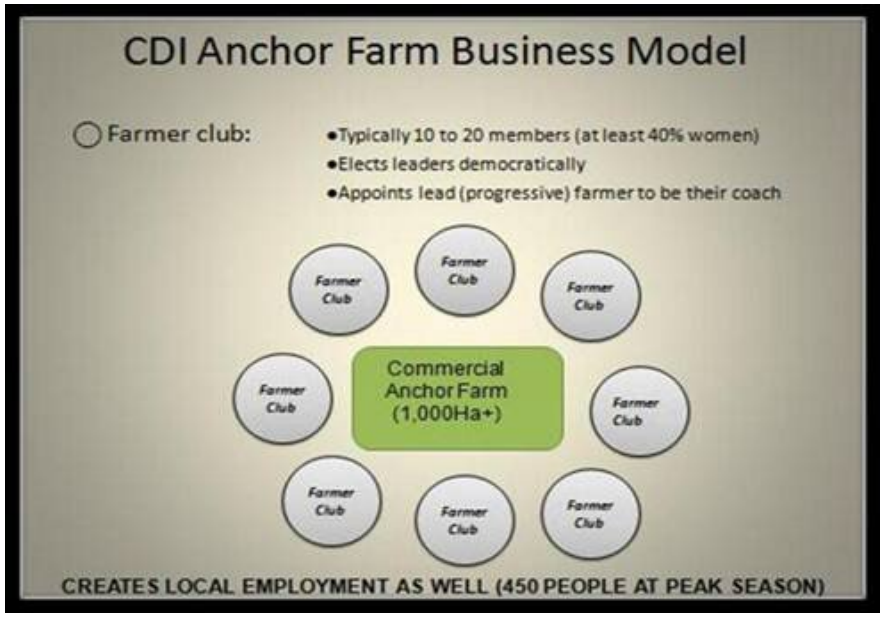


Figure: From CDI Program Brochure

Component 2: Demonstration plots

- Set-up in a central location in the village on a good quality field
- Each plot features control, farmer practice and best practice sub-plots
- Maize, soy, groundnut and common beans
- Best practices include: hybrid seeds, optimal plant density, fertiliser, herbicides, pesticides, seed treatment, crop residues, manure, compost and fertilizer trees
- CDI agents provide guidance and visit the plot regularly
- Farmer clubs manage the plot on a day-to-day basis and share output
- In selected villages, yearly

Pictures taken with permission of participants

Component 3: Field days

Pictures taken with permission of participants

- Took place at the end of the growing season (April/May) on "successful" demonstration plots
- One per EPA, first two years
- Farmer clubs within the EPA are invited to attend
- Event lasts day and is led by CDI agent and lead farmer

Component 4: Output marketing

- Initially, CDI aimed to establish a warehouse receipt system for soy where farmers could deposit their produce and get paid prior to further sales
- This system faced logistical challenges getting off the ground: Transportation, buyers and credit
- Eventually, CDI implemented a revised program with a two year delay, in the penultimate year of our project, in selected villages:
  - Provide weekly information on local market prices of main crops via SMS
  - Guaranteed price contracts for soy buy-up
  - Buyers pick up produce in the village, but farmers are in charge of aggregation and quality control

Theory of change: Hypotheses

(1) Farmers exposed to improved learning opportunities will adopt ISFM practices and experience increased productivity

(2) Having access to a guaranteed price arrangement with buyers will provide security, allowing for further investments in technologies

- The (original) goal of our study was to identify the interaction effects between the various program components
- This appeared not possible, and hence we focus on the first channel of impact

Sample of 250 villages and 2500 households

- Dowa and Kasungu districts
  - Productive area with undiversified maize and tobacco
  - High levels of poverty
  - Drought and rainfed agriculture
  - Agricultural markets thin and unstructured; Lack of access to credit
- CDI was active in several Extension Planning Areas (EPAs) in 2014 (when we started our project)
- We selected two EPAs in which CDI was not yet working:
  - Chibvala in Dowa
  - Mtunthama in Kasungu
- Using government rosters we identified a total of 303 villages with more than 50 households. We randomly selected 250 from these 303 villages, 125 in each EPA
- Using household rosters in each village, we randomly selected 10 farming households

Proiect timeline and randomization

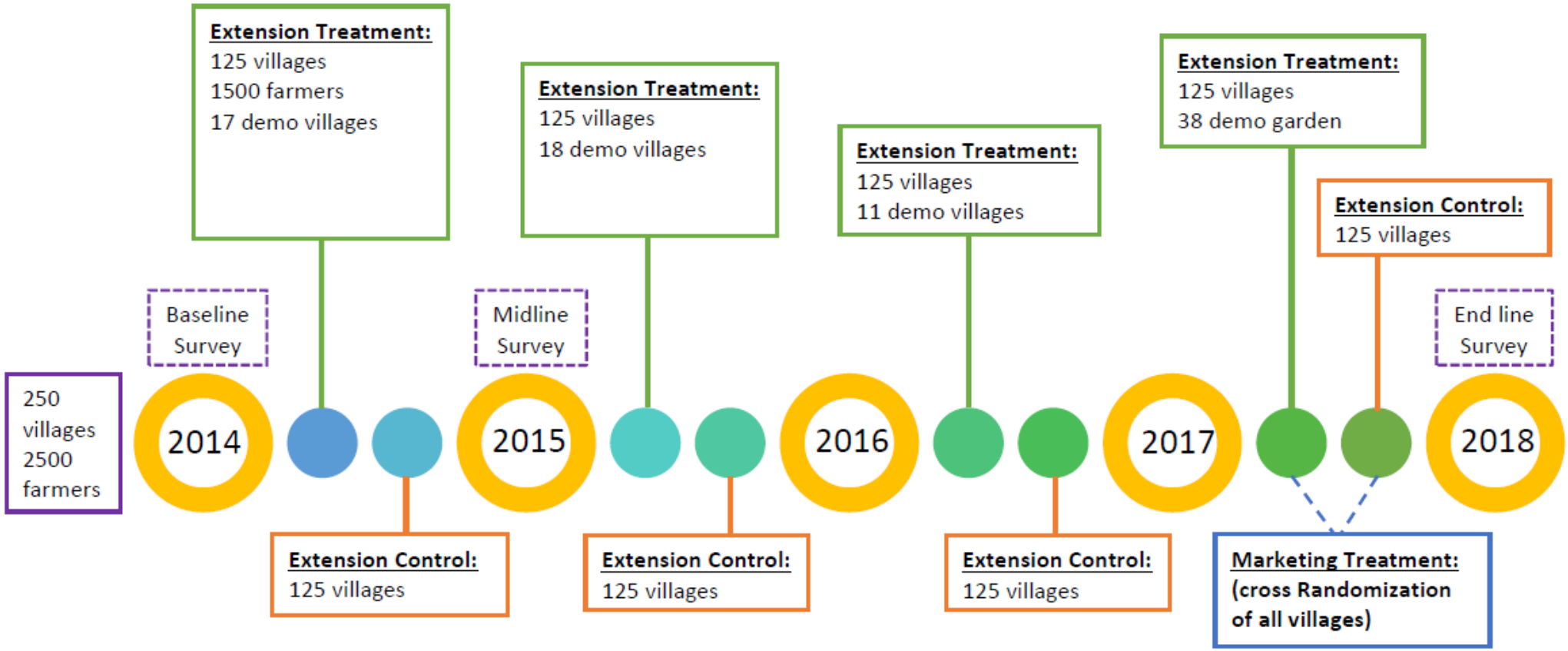
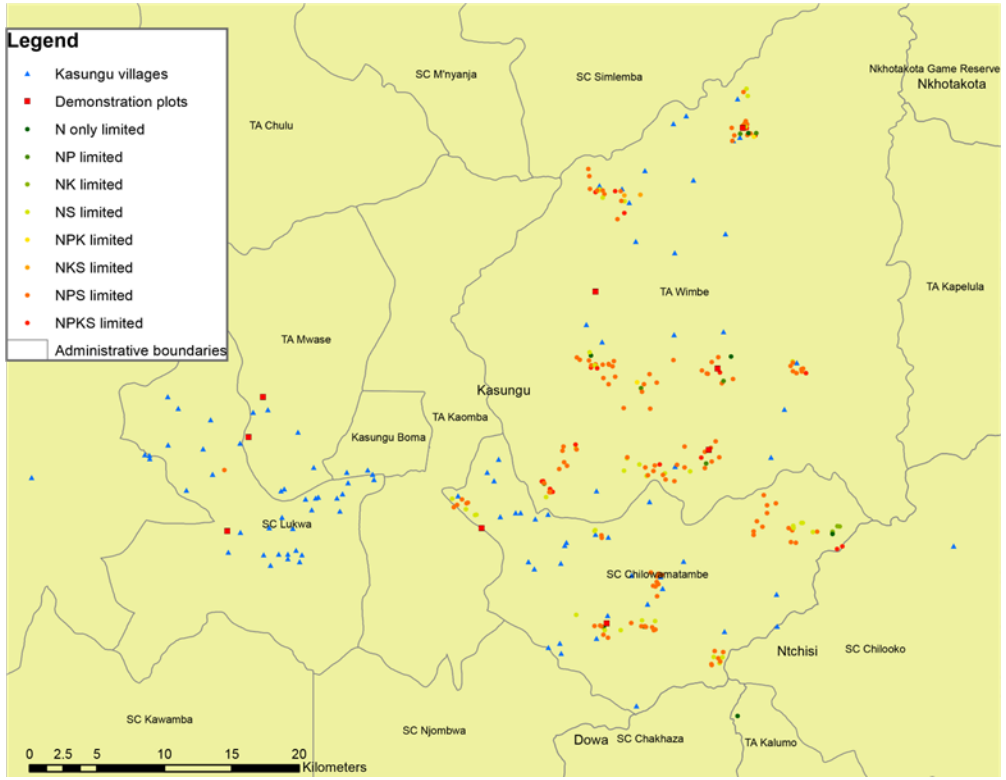


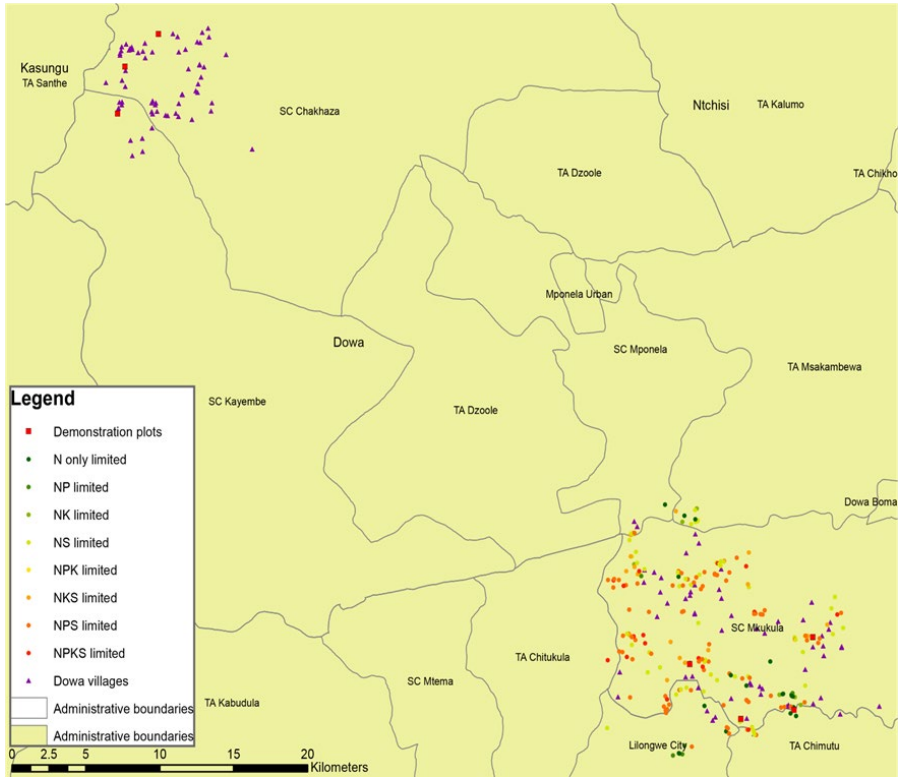
Figure 3 in the report: Timeline of the data collection and implementation

Baseline: Perceptions of soil quality

Question	Question options	Percentage of fields
What is the soil fertility of this field?	Very poor	6
	Somewhat poor	17
	Average	25
	Somewhat Good	31
	Very Good	21
In the last five years, has the soil fertility of this field:	Improved a lot	6
	improved a little	12
	stayed the same	40
	became worse a little	37
	became worse a lot	4
Does this field suffer from soil degradation in the form of:	Soil erosion	43
	Nutrient depletion	53
	Water logging	22
	Salinity/acidity	5

Baseline: Results of soil tests





Map of soil characteristics in Mtunthama (left) and Chibvala (right)

Baseline: Adoption of ISFM

		Percentage of households
Have you used any of the following methods of soil Fertility Improvement in the past 5 years [% reports yes]	Crop Residue	66.7
	Animal Manure	63.4
	Inorganic Fertilizer	93.2
	Improved Fallow	18.0
	Legume Cover crop	3.5
	Compost	51.2
	Intercropping	34.8
	Crop Rotation	84.6
	Other	81.5
Have you planted any of the following legumes in the past 5 years [% reports yes]	Soybean	82.6
	Pigeon pea	12.8
	Groundnut	91.8
	Common bean	89.5
	Other	9.7
Have you planted any of the following soil fertility enhancing trees in the past 5 years [% reports yes]	Tephrosia	6.6
	Gliricidia	6.8
	Sesbania	2.8
	Other	12.1
Have you used any of the following pesticides/Herbicides in the past 5 years [% reports yes]	Insecticide	20.5
	Herbicide	1.2
	Fungicide	2.8
	Fumigant	2.1
	Other	0.1

Demonstration plot soy yields

Treatment	Grain yield (kg ha$^{-1)}$			100 seed weight (g)
	Chibvala	Mtunthama	Mean	
Soya Control	1050.45	328.46	689.46A	14.47
Soya BPA	1364.56	709.53	1037.04B	14.46
Mean	1207.51b	519.00a		14.46
P value				
Site	<0.0001			0.6957
Treatment	0.0001			0.1343
Site x treatment	0.6707			0.0341

Soybean yield from Chibvala and Mthunthama EPAs, 2014/2015 season
BPA= Best practice agronomy; Means in a row or column followed by same lower case or upper case letters are not statistically different at p=0.05

Program effects after one year

- Farmers who participated in demonstration plots planned to adopt 22% more of the recommended ISFM technologies compared to farmers who were invited to participate in field days (and control village farmers)
  - Participation increased inoculating soybean, using hybrid seeds and planting fertilizer trees
- Farmers who participated in demonstration plots scored 8% higher on a test measuring knowledge of ISFM compared to farmers who were invited to attend field days (and control village farmers)
- Qualitative evidence: Demonstration plot farmers were able to recount and illustrate the various ISFM techniques, whereas those who attended field days had learned considerably less

Maertens, Michelson and Nourani, 2020. How do farmers learn from extension services? Evidence from Malawi

(Lack of?) program effects after five years

- Five years after the extension program, ISFM adoption increased by 11% among demonstration plot farmers
- Heterogeneity explains these smaller effects: While some villages had demonstration plots throughout the four project years, others had demonstration plots just one year. Demonstration plots also varied in their performance
- We note no other effects on yields, price, revenue and income
- Being assigned to the marketing component does not have any effects on any of the outcome variables
- Nor do we detect any interaction effects between the extension component and the marketing component

Challenge: Low take-up of marketing program

Unexpected effect on maize prices

Recall: Farmers who were informed about the program also received weekly information via SMS on prevailing market prices of the main crops in nearby markets

- As farmers anticipated this information weekly, farmers might be able to postpone sales or consider new markets
- Conditional on CDI club membership, attending CDI's marketing meetings increased the price of maize by, on average, 1,636 MK/50 kg. This is an effect size of 37%

Possible implications for practice

Cost effective extension:

- Make field-days fit for purpose
- Sequence information delivery mechanisms

Beware of heterogeneity:

- Beware of learning traps

Return to:

- Combine credit intervention with extension interventions

Farmer clubs:

- Pay attention to the creation of farmer clubs
- Reduce free-riding within farmer clubs

Considerations for policy-makers

- Incentive extension workers through reward payments, tracking or simply changing the selection
- Combine extension and credit services
- Improve infrastructure in rural areas
- Reach farmers via cell phone using simple, timely, tailored messages
- Revisit the minimum pricing scheme and its implementation

Thank you

More information

- 3IE project site with policy briefs, blogs, final report and summaries
- Pre-analysis plan at RIDIE
- Data and questionnaires at FIGSHARE under ISFM-Malawi

Appendix materials

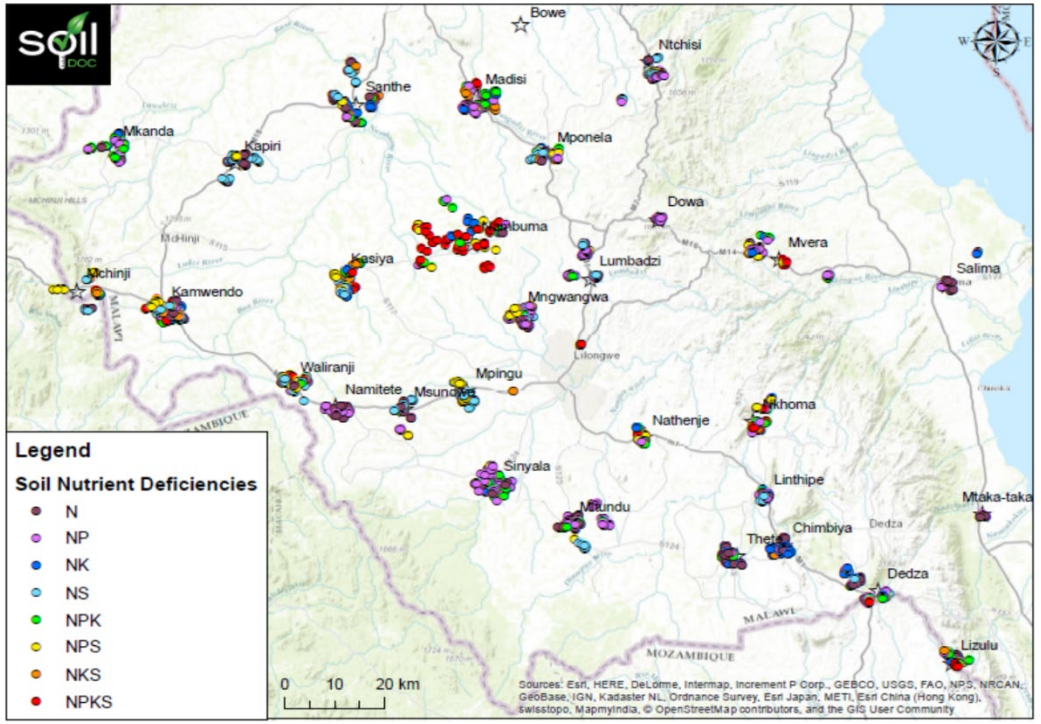
Demonstration plot maize yields

	Grain yield (kg ha$^{-1)}$		
Treatment	Chibvala	Mtunthama	Mean
Maize control	2662.00	1883.34	2301.44a
Maize farmer practice	3630.24	2576.85	2982.28ab
Maize BPA	2688.73	3924.57	3728.95b
Maize BPA + fertilizer trees	3015.05	2576.85	3009.28b
Mean	3156.17	2991.50	
P value			
Site	0.8264		
Treatment	0.0179		
Site x treatment	0.2213		

Maize yield from Chibvala and Mthunthama EPAs, 2014/2015 season
BPA= Best practice agronomy; Means in a row or column followed by same lower case letters are not statistically different at p=0.05

Build on previous presentations at IFPRI Malawi

Patrick Mutuo spoke to you about soil fertility management in Southern Africa in May 2019

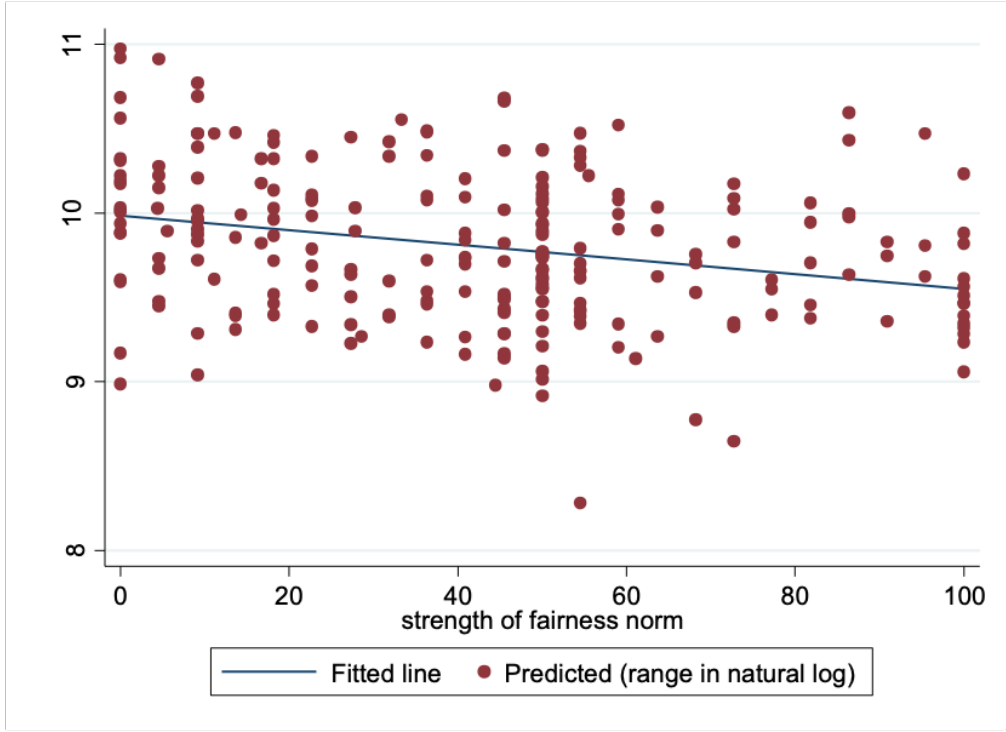


The agronomic reports are available in our FIGSARE project account:

[ISFM Malawi: Evaluating the effects of an Extension and Marketing Program on Farmers in Malawi (figshare.com)]

Previous presentations at IFPRI Malawi

Kwabena Krah spoke to you about the role of fairness norms in the land rental market in Nov. 2021



Krah, Nourani, Michelson and Maertens. Village Fairness Norms and Land Rental Markets

Public good provision and democracy: An experimental study of the farmer groups

- Loosely organized informal village groups to legally constituted cooperatives
  - At the centre of many projects aiming to engage smallholder farmers (e.g., catholic Relief Services, One Acre Fund)
  - Problems: Low asset levels, limited knowledge about new technologies, frequent failures in credit, insurance, agricultural inputs, and output markets, low bargaining power
  - Solutions: A base for information exchange; Group-based credit; Bargaining; Informal insurance
- The success of these farmer groups depends on their ability to overcome free-riding
- In the Anchor Farm Project program groups of 10 to 20 farmers implement the various component of the program

Modified public goods game

- We worked will all clubs at baseline
- Each club member was asked to divide 400 Malawian Kwacha (~1 USD) and provided by the research team) into two envelopes
    1. Individual account
    2. Common account: multiplied by two and shared with all the other members of the group
- The decision is made in private, and recorded in a confidential manner by the researchers only and we contribute an unknown - to the group members - amount to the common pot
- Club members decide what to use the money in the common account for (we record this decision)
- What drives contributions to the common account?

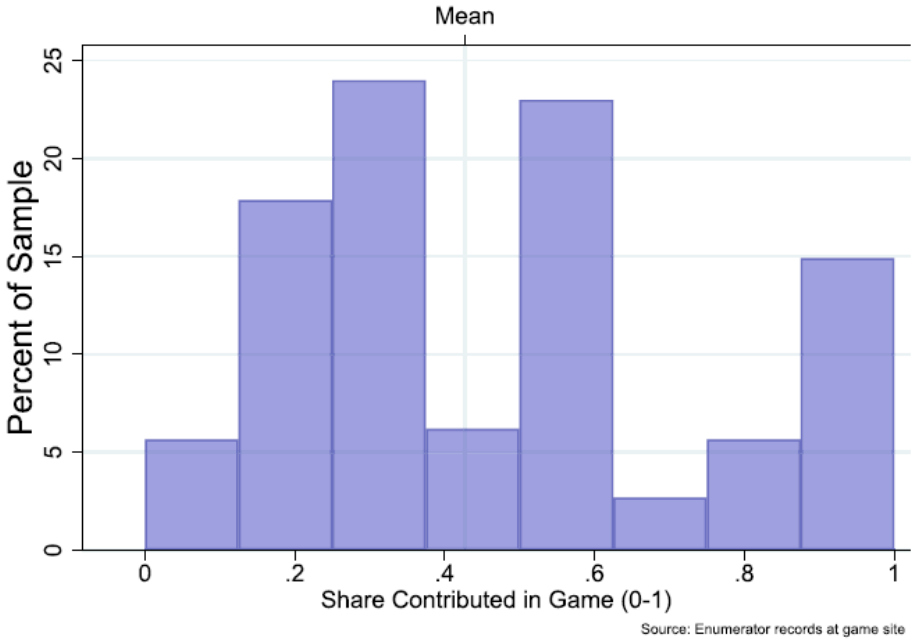


Fig. 2. Histogram of contribution to the common account in first experiment.

Democratic groups perform better

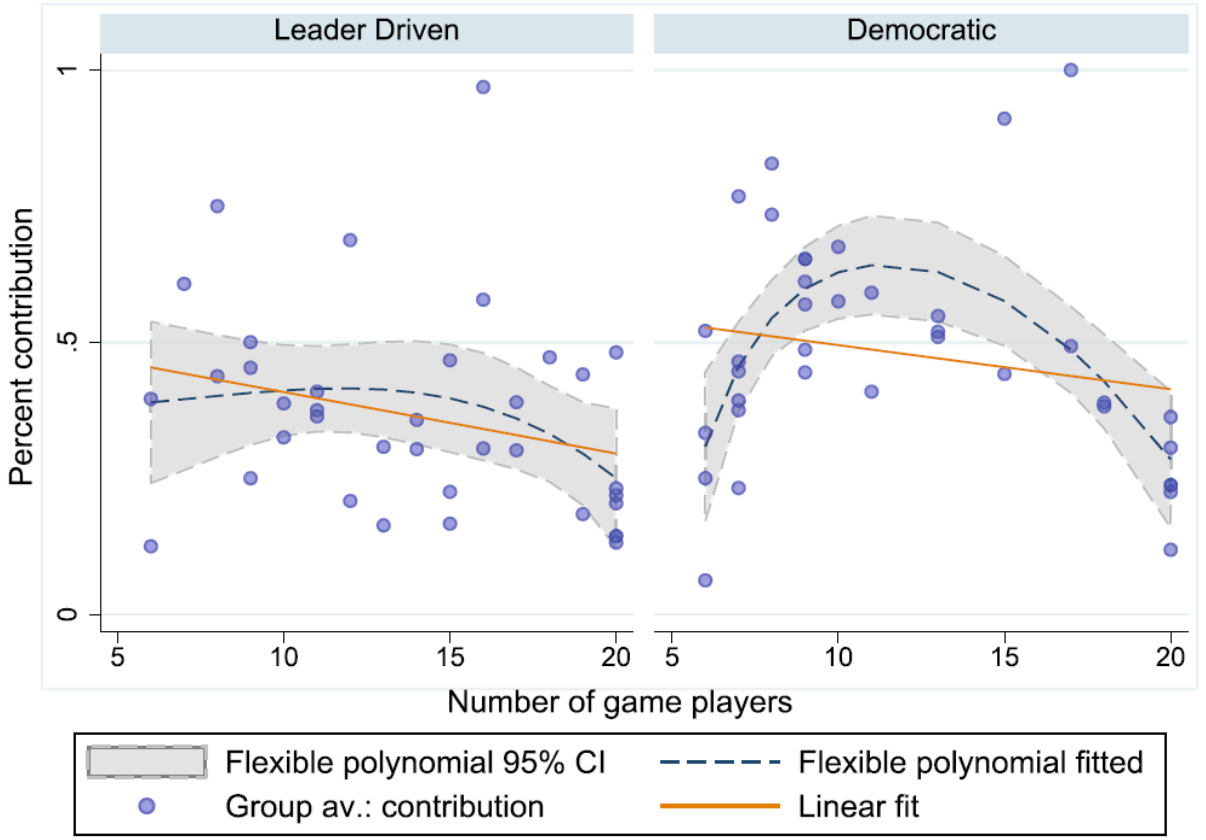


Fig. 3. Average contribution to the common account by group size and decision-making method in the first experiment.

Nourani et. Al. (2021). Public good provision and democracy: Evidence from an experiment with farmer groups in Malawi.