Section 4 – Farmer-led irrigation development in Mozambique and Tanzania

In this section you'll learn about the findings of the recent Studying African Farmer-led Irrigation research project in Tanzania and Mozambique.

Farmer-led irrigation development in Tanzania and Mozambique

The Studying African Farmer-led Irrigation (SAFI) project is a partnership between social science researchers and irrigation scientists from Europe and Africa. The project aims to understand whether current investment by farmers in small-scale irrigation could offer a model for broad-based economic growth in rural areas of Africa.

Key research questions

1. What characterises small-scale farmers' own initiatives in developing agricultural water management, and what social and economic changes are associated with them? And how are these socially differentiated (gender, age, ethnicity, etc)?
2. What are the perceptions and responses of agricultural development agencies (government, donors, NGOs, commercial investors) to irrigation developed by small-scale farmers?
3. Can we get more accurate estimates of the total extent of irrigated areas?

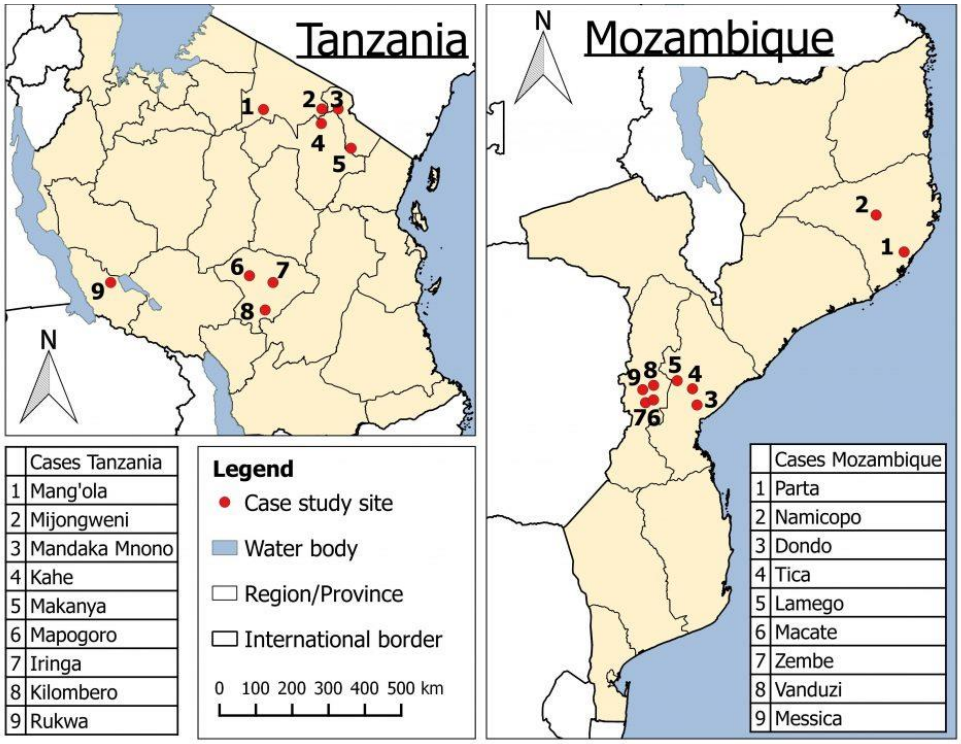
How the research was done

The following methods were used:

1. Field studies of specific cases where farmers influenced the purpose, location and design of irrigation.
2. Field studies used an initial quick characterisation, using group and individual interviews and transect walks, and secondary data to identify the extent of irrigation, its history, and the key people involved.
3. A second phase used in-depth interviews to understand engagement by local and external actors.
4. A third phase undertook a survey of irrigating and non-irrigating households.
5. National-level policy workshops were used to generate dialogue with policy makers and technical advisors about the phenomenon of farmer-led irrigation development.
6. Underlying assumptions among technicians and authorities were identified in analysis of policy documents and implementation.
7. Opportunities and constraints were probed in interviews with policy makers, donors, practitioners and farmers.
8. An analysis of field data was discussed with policy makers.
9. A pilot study was undertaken to explore the potential of analysis by satellite imaging.

Where the fieldwork was done

The map below shows the location of field-work sites in the two countries studied.



	Cases Tanzania
1	Mang'ola
2	Mijongweni
3	Mandaka Mnono
4	Kahe
5	Makanya
6	Mapogoro
7	Iringa
8	Kilombero
9	Rukwa

	Cases Mozambique
1	Parta
2	Namicopo
3	Dondo
4	Tica
5	Lamego
6	Macate
7	Zembe
8	Vanduzi
9	Messica

There were nine sites in Tanzania comprising 1361 households.
There were nine sites in Mozambique comprising 1372 households.

A sample of 150 households at each site was initially randomised, based on lists provided by local administrative authorities. However, this was then adjusted to ensure that the sample for each site included a minimum representation of at least 50 irrigating and non-irrigating households. Non-irrigating households were farmers who relied on rainfall only.

About the sites

The sites grew rice, maize, vegetables, beans, onions, tomatoes and bananas – or a combination of these crops.

Some farms had received government investment, others had not. The irrigation sites were all initiated by farmers but sometimes they successfully lobbied the government for support to improve their irrigation systems. This included the construction of more permanent water diversion structures or the provision of funding for lining earthen canals with cement.

Irrigation methods included: motor pumps to draw surface water from rivers or lakes or ground water from wells; weirs to divert streams into canals; lifting water using buckets from a river or well; spreading of flood water across fields (spate irrigation); management of water movement in wetland areas or a combination of these methods.

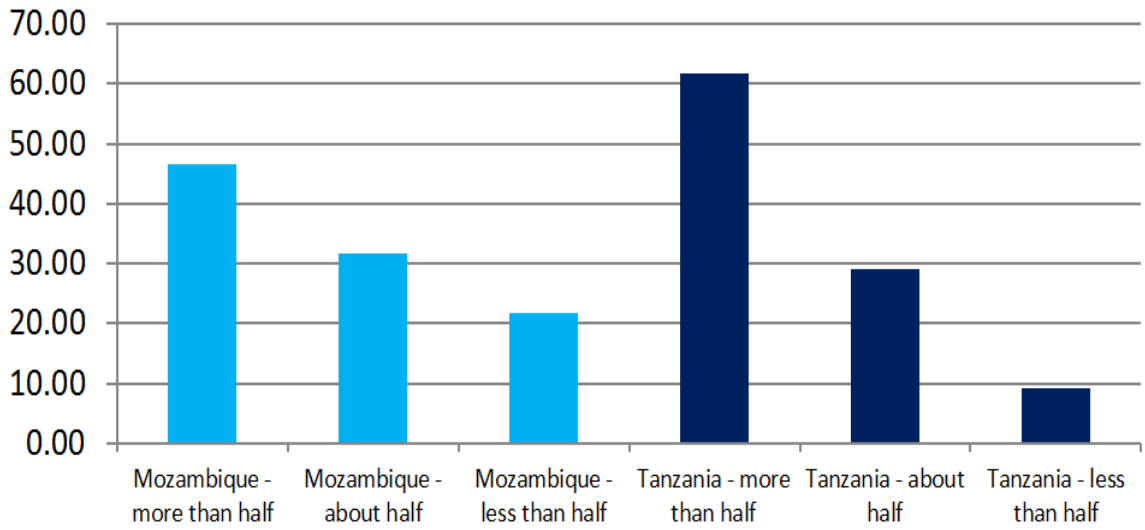
Key household findings

Irrigators generate cash by selling crops at expanding, urban food markets. Commercial trading networks and improved communications are vital for these activities. Mobile phones are increasingly prevalent amongst farmers.

Households that irrigate are wealthier than those that do not, as the graphs below show. But are they wealthy because they irrigate, or do they irrigate because they are wealthy?

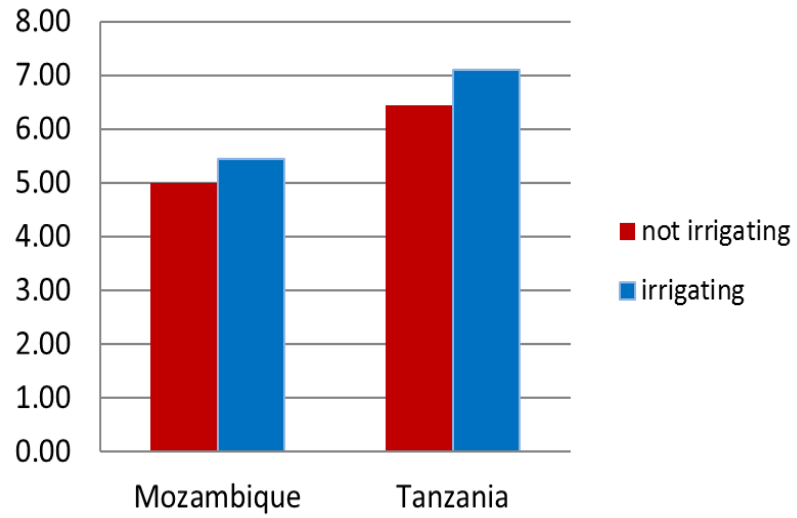
In both Mozambique and Tanzania between 80%-90% of households that irrigate said irrigated crops account for at least 50% of their income. This suggests that irrigating households are dependent on income from irrigation for their higher accumulation of assets.

Contribution (%) of irrigated crops to irrigators' total income



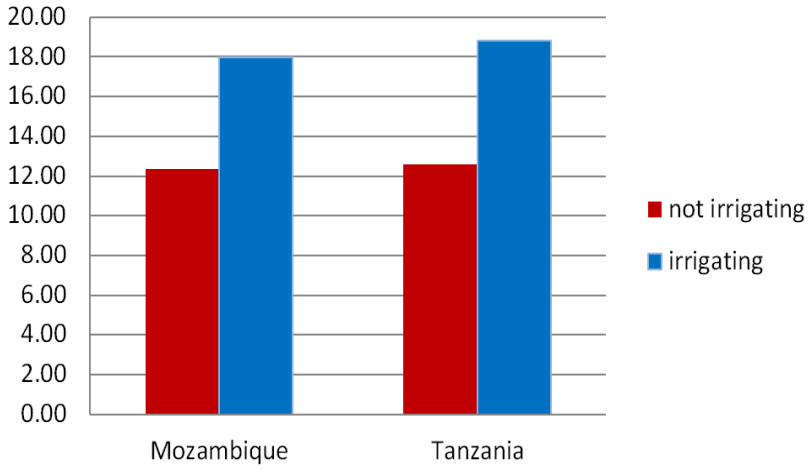
The following are indicators of household wealth that suggest higher wealth levels among irrigating households than non irrigating households.

Housing quality index



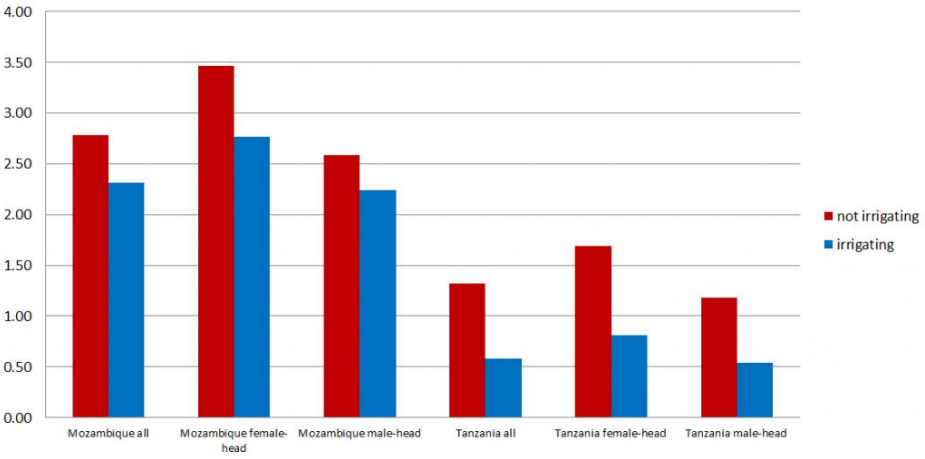
The graph above shows that households that irrigate have housing which ranks higher on the quality index.

Index of asset ownership



The graph above shows that households that irrigate accumulate more assets than those that do not.

Average number of months of food shortage



Households that irrigate also have greater food security. Although there are fewer female-headed households among irrigating than non-irrigating households, these female-headed households could benefit more from irrigation.

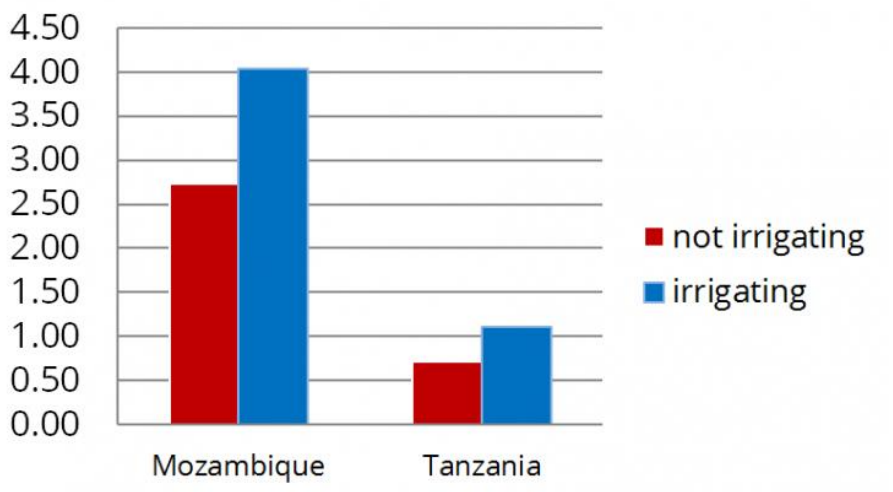
On average, households who irrigate in Mozambique said they endured food shortages annually during an average of 2.34 months compared to 2.87 months for households without irrigation. In Tanzania, these figures were 0.58 months compared with 1.35 months.

When female-headed and male-headed households are compared, the irrigating female-headed households appear to benefit more relative to their non-irrigating neighbours; reducing their annual period of food shortage by 0.67 months in Mozambique and 0.91 months in Tanzania.

The reduction in duration of food shortage for irrigating compared to non-irrigating households is smaller (0.42 months in Mozambique and 0.68 months in Tanzania) among male-headed households.

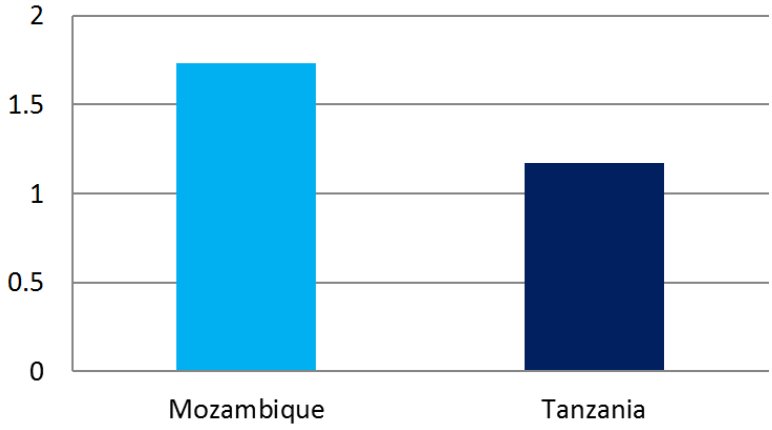
Irrigating households tended to have more land and invested more in inputs such as fertiliser and hired more labour.

Average area (ha) farmed per household



The graph above indicates that on average, farmers using irrigation farmed a larger area than those who relied on rainfall alone.

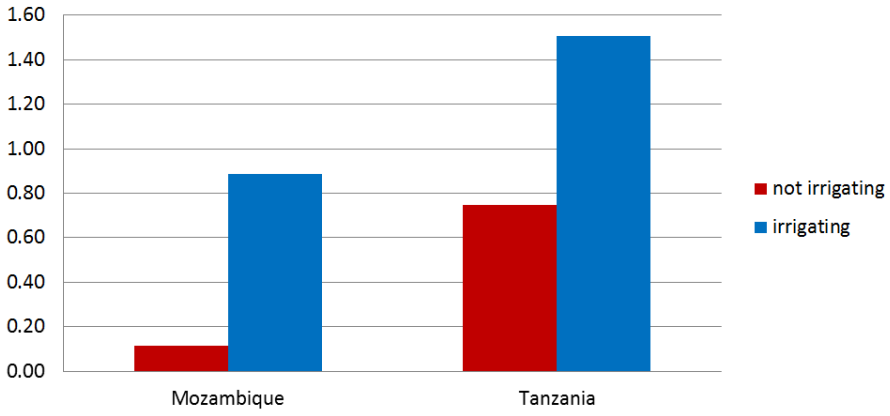
Average area of irrigated land (ha) per household using irrigation

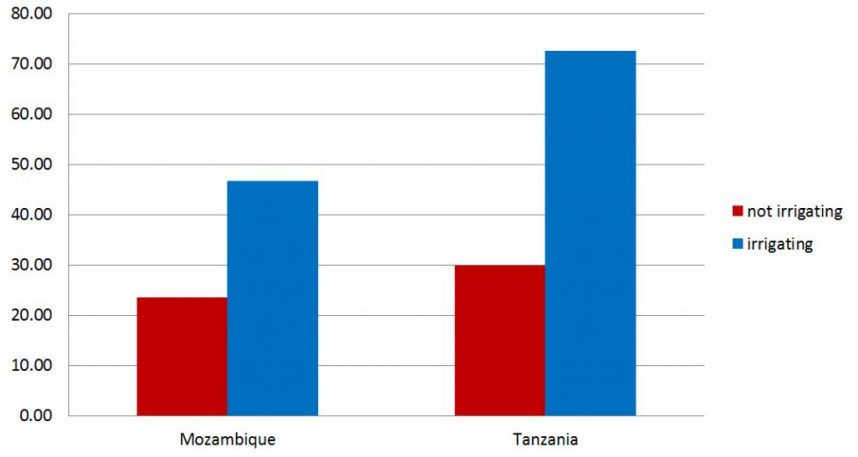


The area of crops irrigated averages 1.8 ha per household in Mozambique and 1.2 ha in Tanzania. Although this area is fairly small, production was strongly market-oriented.

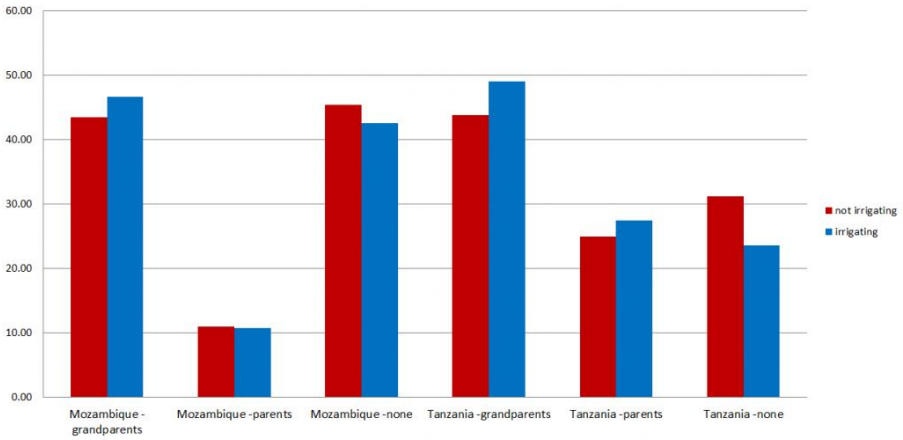
Input use (index of fertilizer, improved seed, pesticide) & % of households employing farm labour

The first graph below shows that irrigators tend to have a higher input use; whilst the second graph shows they employ more farm labour, when compared to non-irrigating households





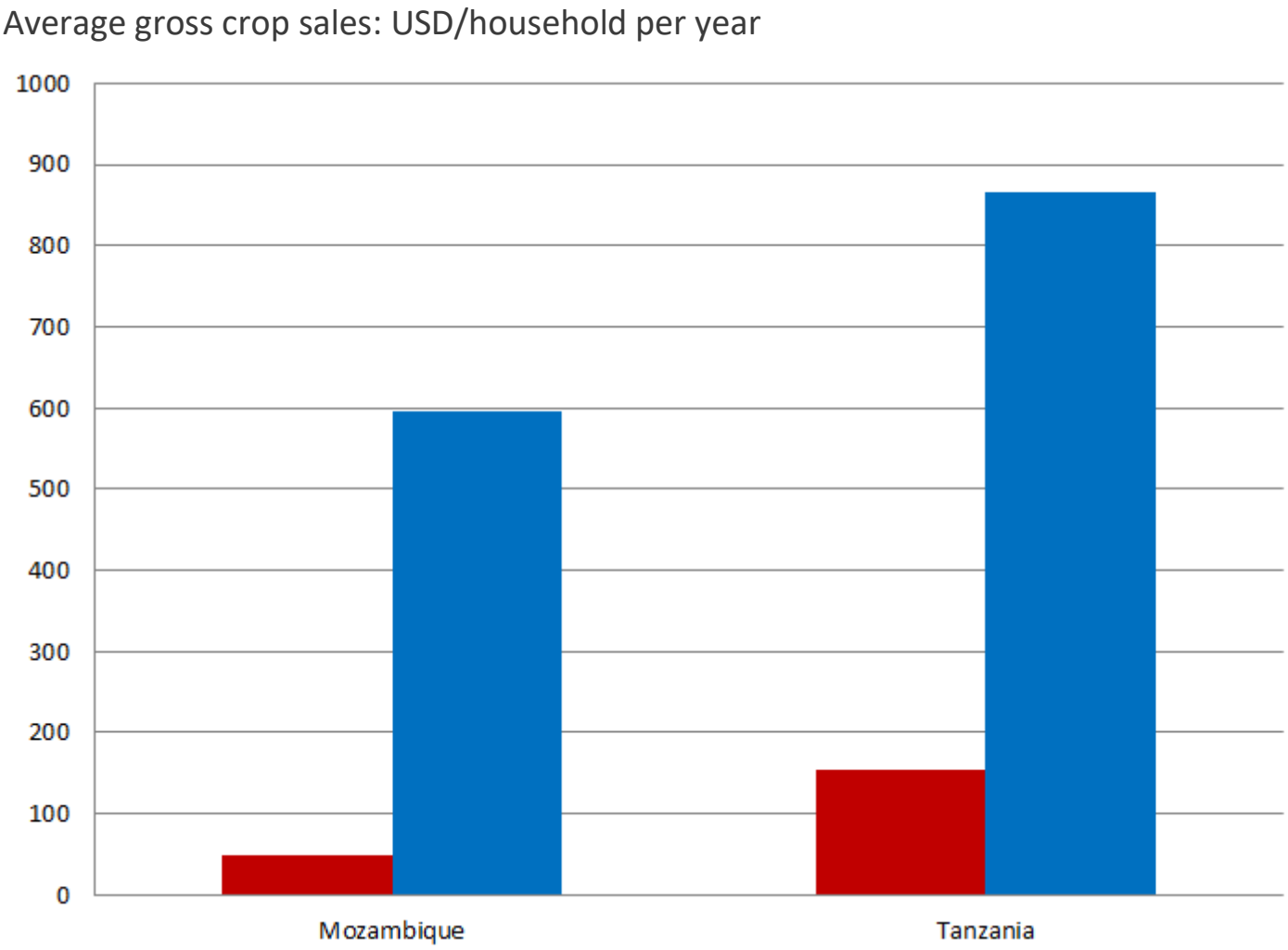
Farmer's prior links with the area (%)



Data recorded on households' prior links to the area in which they are farming shows relatively high percentages of households (25% in Tanzania and over 40% in Mozambique) with no prior family links to the area. Although these incoming settlers included both irrigating and non-irrigating households, the former tend to be less common than among households with previous family links in the area.

In conclusion, the SAFI data shows that irrigators cultivate larger plots, use more inputs and employ more farm labour. They also tend to be wealthier, obtain more than half of their income from farming, and experience fewer months of food shortage.

What difference did farmer-led irrigation make?



In Mozambique, farmers who irrigated received, on average, 12 times more in crop sales than farmers without irrigation. In Tanzania, farmers using irrigation saw an increase of five times.

Did irrigation make a difference to the wider economy?

The SAFI project demonstrated that irrigating households generated USD 35-69 million from additional crop sales relative to non-irrigating households in Rukwa region alone. Rukwa accounts for just 3.3% of the Tanzanian population and a tiny proportion of its irrigated land. This is many times more than the USD 2.2 million allocated annually to irrigation in the *national* budget.

The money irrigated farming in Rukwa generates is equivalent to 20 – 40% of the annual average of USD 188 million of donor funding proposed in Tanzania's 5-year budget for Sustainable Water and Land Management Fund (which allocates 85% for irrigation) in the government's Agricultural Sector Development Programme II.

Additional data sources

Official data are only collected through government surveys and these may be run at intervals of 3 to 5 years, which makes it difficult to accurately track the expansion and total area of irrigated land. The SAFI project undertook a pilot study to investigate if satellite data could be used to estimate the area of irrigated land.

Methodology

Radar signals transmitted from satellites onto the earth's surface give a reflected signal that is characteristic of particular types of vegetation and soil moisture. These reflected signals can be collected by the satellite irrespective of daylight or cloud cover. By collecting repeated signals over the growing season, a 'signature' of different types of vegetation growth can be identified.

Using the geographical coordinates of known irrigation sites, an algorithm can be constructed for the radar signal of irrigated fields. This can then be used to assess how widespread that signature is across a region and subsequently allows an assessment of the area of irrigated fields.

The SAFI pilot study was able to use this approach to analyse radar data collected at 12-day intervals by the European Space Agency's Sentinel-1 satellite to assess the extent of paddy rice across three regions in Tanzania.

The pilot study suggested that official statistics may seriously underestimate the expansion of irrigated areas. In the rice-producing region of Shinyanga, for example, the most recent agricultural census in 2007-08 recorded just under 30,000 hectares of irrigation. Nine years later in 2016-17, the reflected radar images, suggested paddy rice fields created by farmers cover approximately 250,000 hectares, or between 8 and 10 times more. Similarly, in the Rukwa region, radar image analysis suggested irrigated areas are between 3 to 6 times larger than recorded in the 2007-08 census.

The pilot study showed that 'training' the algorithm to identify a reflected radar signature for paddy rice meant it was less successful at identifying other kinds of irrigation (e.g. for tree crops) and new algorithms would have to be developed for these.

The large areas of irrigation identified in the pilot study indicate that the value of agricultural output from farmer-led irrigation development is significant. For example, the value of paddy rice produced in Shinyanga Region can be estimated at about USD 155 million, of which at least USD 80 million is likely to be sold (assuming the official average yield of 2.5 tons per hectare and a price of USD 250/ton). The significance of this cash flow in the agricultural economy can be assessed relative to investments made informal irrigation.

Watch a lecture by Professor Phil Woodhouse outlining the SAFI project:
https://youtu.be/ynGPiB6yfhc

Key Messages

- Farmers' initiatives are playing a key role in the rapid expansion of irrigation, even though much of this activity may lack official recognition or support.
- Households that irrigate land fare better in terms of household assets, months without food, quality of housing, size of farm and inputs to raise farming productivity.
- Irrigated production is strongly commercially-oriented and the value of crop sales was significant for both the overall income of households using irrigation and in terms of contribution to the national economy.

- Expansion of irrigated production sets in train important social and economic change and poses new challenges in terms of market access, water management and land tenure.

Suggested further reading:

Find out more about the SAFI project: http://www.safi-research.org/

Messica case study: http://www.safi-research.org/wp-content/uploads/2019/08/Messica-case-study-for-SAFI-online-course.pdf

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