Section 3 – Defining farmer-led irrigation development

In this section you'll learn about:

- How to define farmer-led irrigation development, and
- How to identify farmers' irrigation initiatives.

What is farmer-led irrigation development and how does it differ from other forms of irrigation development?

Put simply, farmer-led irrigation development is an irrigation development process that is initiated by farmers.

We define 'farmer-led irrigation development' as a process in which small-scale farmers drive the establishment, improvement and/or expansion of irrigated agriculture, often in interaction with external actors. These external actors' include: neighbouring farmers, agro-dealers and traders, craftspeople, agriculture extension agents, irrigation engineers, administrative authorities, local and national policy makers, civil society and development aid agents.

Farmer-led irrigation development can:

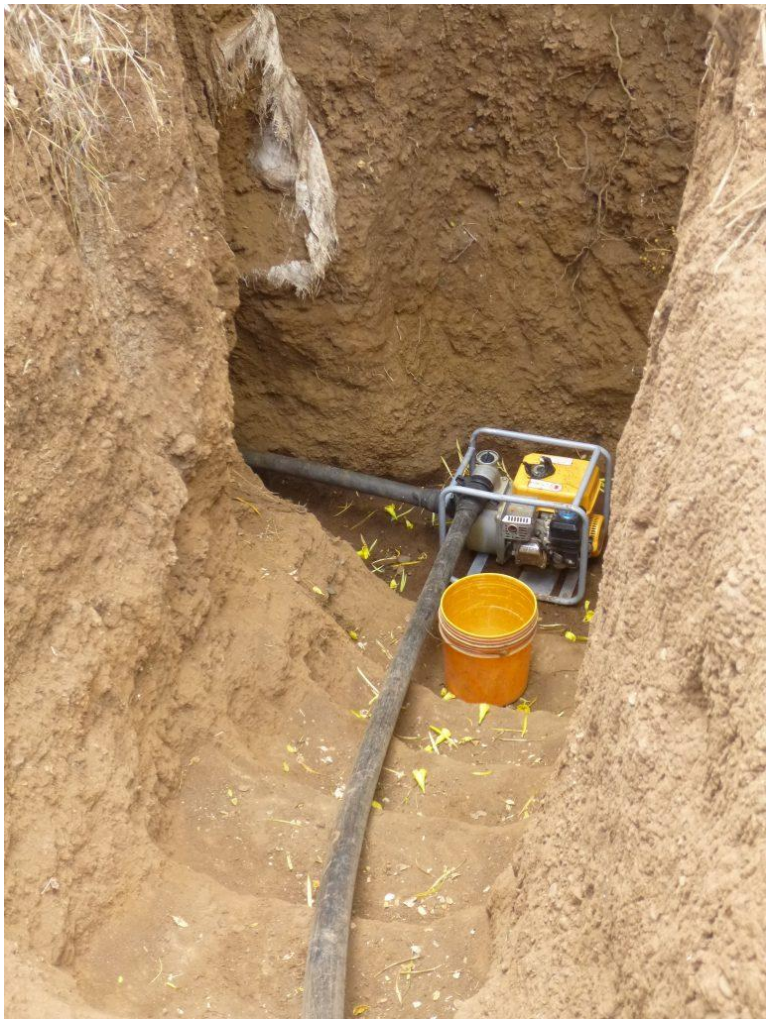
- take place at different scales,
- be used to grow a variety of crops,
- rely on various technologies and governance arrangements.

Examples of farmer led irrigation development

In the following images you will see a number of scenarios which depict farmer-led irrigation development. Each image is followed by a short description explaining what has been implemented.

Harding, Rowena. “Farmer-led Irrigation Development. Tanzania.” 2018. NEF.

Farmers started this irrigation system by digging earthen canals from the water source to their fields. Later, they actively requested government support to line certain sections with cement, to reduce the need for maintenance and prevent water loss.



Harding, Rowena. “Farmer-led Irrigation Development 2. Tanzania.” 2018. NEF.

When rivers used for irrigation dried up, farmers started using shallow wells and petrol pumps to irrigate. By putting the pump closer to the water level, farmers’ saved on fuel and reduced the need for maintenance, leading to a “chamber” being dug next to the wells. Farmers grow maize, beans and vegetables, often for the market. There has been no government involvement.

Harding, Rowena. “Farmer-led Irrigation Development 3. Tanzania.” 2018. NEF.

On land previously farmed by a European settler and later by a state owned company before being abandoned, a group of ten small-scale farmers began irrigated production using a pre-existing canal to bring water from a stream flowing down a mountainside. Commercial crops of tomatoes and cabbages are grown, often on contract with local traders. In recent years farmers have been contracted to produce green beans and ‘baby corn’ for export.

Five years ago the system was selected for upgrading by a World-Bank funded project that installed an additional pipe up the mountainside enabling sprinklers to be driven by hydrological pressure.

Harding, Rowena. “Farmer-led Irrigation Development 4. Tanzania.” 2018. NEF.

Farmers have started irrigation using locally-available and affordable tools and materials and grow rice for the market. They organise their own water division and maintenance, and work together with (government) engineers and craftsmen to improve their infrastructure.

Harding, Rowena. “Farmer-led Irrigation Development 5. Tanzania.” 2018. NEF.

Using low-cost watering cans, farmers have started irrigating commercial crops such as cabbages. Although one plot may be small, the cumulative area under this type of irrigation can be much larger. The low initial investment costs make this technology accessible to everybody.

Harding, Rowena. “Farmer-led Irrigation Development 6. Tanzania.” 2018. NEF.

In the above image, an individual farmer from the city has purchased land in a rural area, drilled a borehole and installed a large pump. He has employed workers to cultivate for him and will sell his crop at the end of the season.

What can we classify as farmer-led irrigation development with Ramson Adombilla

Ramson Adombilla, an irrigation engineer from the CSIR-Savanna Agricultural Research Institute, Ghana, talks about how he sees farmer-led irrigation development and whether something as simple as a watering can may be classed as farmer-led irrigation development.

Watch the video here: https://youtu.be/QwFIqYNKAos

Video transcript:

Farmer-led irrigation development – it falls within the domain of the initiator – so the farmer leads the development of the scheme and also any improvements. So basically because of handicaps in our resources, farmers normally practise the traditional surface irrigation methods and of course a watering can is also a surface method – though it is traditionally nature [via rainfall] but its efficiency is high when you compare it to other practices.

So basically what farmers do is they look at the availability of local materials (and I think a watering can is very available to farmers in all regions of Africa) so basically that is always the first door to call at for farmers' irrigation.

Of course you have other sources of practising, such as the furrows systems of irrigation, but I think what defines farmer-led irrigation development – it is the person who initiates the process – in this case it is the farmer and not any other person.

Farmer-led irrigation development in official statistics

Farmer-led irrigation development is extensive and increasing, yet remains largely unreported in official statistics.

In dominant narratives and statistical data, small adjustments made by farmers – for instance when supplying water to crops during dry spells in the rainy season – do not qualify as irrigation.

Statistics on irrigation in sub-Saharan Africa is compiled by the UN Food and Agriculture Organisation (FAO) using data supplied by national governments. The FAO's AQUASTAT database records four main categories of irrigation and drainage development. These are:

1. equipped for full control irrigation
2. equipped for (partial control) irrigation
3. water harvesting and
4. non-equipped cultivation in flood recession areas and in wetlands (Table 1).

Although the categories are inclusive of a broad range of types and degrees of water control, in practice the recorded data are often incomplete.

There are a number of reasons for this:

1. Data are generally obtained from agricultural census surveys, with the current version of AQUASTAT intended to be accurate for 2005 or as close to that year as possible. This makes currently available data over one decade old.
2. The FAO defines 'equipped for irrigation' to be man-made activities or actions that control the water movement. While this definition includes irrigation using a bucket or watering can (see below), it does not explicitly include individual pumping systems or irrigation weirs made from stones and branches. Such irrigation technologies would often correspond to farmer-led irrigation development initiatives but are classified as 'non-equipped' and often go unrecorded by governments. The area cultivated with water harvesting techniques is not captured at all in the database and so is excluded.
3. Although categories exist for "flood recession agriculture" and "non-equipped cultivated wetland areas and valley bottoms" only a few countries actually report cultivated areas in these categories. For example, in the period 2008-2017, only four out of 49 countries in sub-Saharan Africa reported on flood recession and only six reported on non-equipped cultivated wetlands.

So, although AQUASTAT categories formally provide space for documenting areas under farmer-led irrigation development, in practice these activities are often not recognised or recorded as irrigation by national government agencies. They are missing from AQUASTAT which reflects national statistics that tend to ignore these activities and focus on donor- or government-funded initiatives in the form of 'schemes'.

Table 1. Categories of Irrigation and drainage development recognised by Aquastat

1. Area equipped for full control irrigation:	1A – Surface irrigation furrow, borderstrip and basin irrigation (including submersion irrigation of rice). Manual irrigation using buckets or watering cans. 1B – Sprinklers 1C – Localized irrigation e.g. drip	Reported in official data for formal schemes
2. Area equipped for irrigation	2A – Equipped lowland areas (i) Cultivated wetland and inland valley bottoms equipped with water control structures for irrigation and drainage (intake, canals, etc.); (ii) Areas along rivers where cultivation occurs making use of structures built to retain receding flood water; (iii) Developed mangroves and equipped delta areas. 2B – Spate irrigation (sometimes referred to as floodwater harvesting) uses the floodwaters of ephemeral streams (wadi).	Reported in official data
3. Water harvesting (no data included on spatial extent)	Areas where rainwater is collected and either directly applied to the cropped area, and stored in the soil profile or in a water reservoir	Not reported in AQUASTAT
4A. Flood recession cropping area non-equipped	Areas along rivers where cultivation occurs in the areas exposed as floods recede and where nothing is undertaken to retain the receding water.	Not reported in official data
4B. Cultivated wetlands and inland valley bottoms non-equipped	Wetland and inland valley bottoms that have not been equipped with water control structures but are used for cropping. They are often found in Africa. *They will have limited (mostly traditional) arrangements to regulate water and control drainage*.	Not reported in official data

Source: FAO. 2016. AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO).

Collecting data on farmer-led irrigation development

Once you are aware of farmer-led irrigation development and the fact that it is unreported, you can start to get more insight into where it takes place, what it looks like, and what its impacts are. To do this, you can for instance use satellite visible spectrum or radar images, specific questionnaire apps such as Open Data Kit (ODK), and government reports.

Using satellite imagery and remote sensing to identify farmer-led irrigation development

Satellite imagery analysis by the International Water Management Institute (IWMI) has produced findings suggesting that, across sub-Saharan Africa, irrigation may be two to three times more extensive than previously thought. In some countries, such as Ethiopia, it is even greater.

Satellite imagery isn't a perfect solution. For example, it may not always distinguish between irrigation and natural vegetation. But even when it is unable to provide an accurate estimate of the extent of irrigated agriculture, it still provides valuable information to help us understand the presence of irrigated agriculture.

Satellite. Source: SpaceX on Unsplash

Mapping farmer-led irrigation development is more challenging than registering large-scale government projects that have fixed infrastructure. Not only are farmers' irrigation initiatives expanding more rapidly than can be captured by typical surveys conducted at 5-year intervals, but development of irrigation will also expand and contract in response to variations in water availability (i.e annual rainfall variation). Therefore, the frequency of mapping is much more important for farmer-led irrigation development than the rather static government-initiated irrigation projects.

How one project used radar imaging

- The Studying African Farmer-led Irrigation (SAFI) project has undertaken a pilot study using radar imaging data from ESA Sentinel-1 satellites to estimate areas of paddy rice in a number of regions in Tanzania.

- High-resolution (10 metre) images available since September 2016 provide images at 12-day intervals that are unaffected by cloud cover.
- GPS coordinates for sites of irrigation, observed from the ground, were used to identify data points with which to 'train' an algorithm to recognise a time-series 'signature' of reflected radar signals for irrigated crops over the course of a growing season.
- The extent of an irrigation 'signature' is then mapped at a regional scale.

The pilot study suggests that the areas with a radar reflection pattern characteristic of irrigated (paddy) rice are between three and ten times larger than the areas of irrigation recorded in agricultural census data. The discrepancy is likely due to farmers' initiatives in controlling water for paddy cultivation being overlooked in surveys.

Using geographic information systems to identify farmer-led irrigation development

If you want to identify large areas of land that may be irrigated, but which have not been identified in official reports, then geographic information system mapping may be able to help.

A geographic information system (GIS) is a framework for gathering, managing, and analysing data. GIS integrates many types of data. It analyses spatial location and organises layers of information into visualisations using maps and 3D scenes. GIS can also help identify what crops are being grown as well as whether irrigation is taking place.

QGIS is an open-source GIS application that you can download and use free of charge. Their website provides many tutorials and training materials so that you can get started on your own.

Collecting data on farmer-led irrigation development when you're in the field

Government reports, or satellite mapping can give you some information about the occurrence of irrigation in an area. But to help you understand irrigation activities being carried out by farmers themselves, you'll need to speak to the farmers to get greater information about their crops, the irrigation procedures, how they are managed, the impact irrigation has – and much more.

To collect this data, you can use tools such as the Open Data Kit (ODK) application on your phone or tablet, which can make it easier to collect, process, and analyse data than paper-based surveys.

Using Open Data Kit you can:

- Create a questionnaire form for use on mobile devices;
- Fill out the online form in the field, which is then transmitted to an online database;
- Store, view and retrieve aggregated data for analysis;
- Have accurate information about the site where you did the interview, because of GPS links to real-time mapping and monitoring.

Key messages:

- Farmer-led irrigation development is a process in which farmers initiate the establishment or improvement of irrigation.
- Farmer-led irrigation development is characterised by the central role of farmers' own initiatives, and cuts across existing irrigation typologies defined on basis of scale, technologies, crops or governance arrangements.
- Stakeholders in irrigation need to be alert to recognising farmer led irrigation development, as it often takes place informally and does not always match the dominant definitions of irrigation.
- Technologies can allow us to gather information from the field and analyse land use.

Suggested further reading:

Re-introducing Politics in African Farmer-Led Irrigation Development: Introduction to a Special Issue: http://www.water-alternatives.org/index.php/alldoc/articles/vol12/v12issue1/475-a12-1-1/file

Getting Started Using QGIS: https://docs.qgis.org/3.4/en/docs/

Using Open Data Kit (ODK): https://www.google.com/earth/outreach/learn/getting-started-with-mobile-data-collection-using-odk/

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