Section 6 – History of irrigation design

In this section you'll learn about:

- participatory design and its implications for farmer-led irrigation development.
- the importance of real participation.

Irrigation systems for smallholders designed by experts often fail to deliver the expected results.

As we have seen in section two, participatory design methodologies have previously been promoted as an approach towards sustainable irrigation development. However, from the early 1990's until around the late 2000's, there was a standstill in the development and improvement of approaches to designing smallholder irrigation systems, coupled with a period of very low international investment in such systems.

Interest and investment in irrigation has now picked up again – but technocratic design and implementation practices still seem to have the upper hand. Why?

Definitions

To understand how we can best work with farmers in a genuinely participatory manner, we need to define key terms.

- A design is the end product of the design **process**.
- Design **approaches** are methods for shaping the design process.
- An irrigation **system** is the infrastructure needed to take, transport and deliver water to crops.
- An irrigation design is **not** simply a technical plan. It also encapsulates an implicit social, organisational and economic rationale for the overall design.
- Once construction starts, how a design approach is **operationalised** (either by the engineer as part of the process or by the farmers after the fact through appropriation) is a critical factor in the success of the scheme. However, it is regularly ignored as the official design process often ends when the technical plans are approved.

Colonial irrigation design

The way engineers are taught about irrigation is based on historic principles. Europeans with colonies in Africa and Asia implemented certain ways of doing irrigation for very specific reasons, and these principles are still being taught today.

In colonial times irrigation was used as a way to exert power because the control of land use was influenced by the provision of water. Different colonial powers had different guiding principles. The Dutch maximised the value of crops produced on a given area of land, while the English system maximised value of crops produced for a given amount of water.

This resulted in different technologies because the Dutch system required quick adjustment and measurement, with daily control by an official; whereas the English prioritised variety in the canal flow and a more distributed system.

In the mid-20th century problems arising from blueprint approaches to irrigation design included low performance, accumulation of silt in canals, salinisation, and negative gender effects.

The main responses to this included:

- giving management control to a group of farmers (in jargon referred to as the tertiary level) so they could use the system and resolve problems as they manifested themselves;
- the introduction of water rotation schedules at the tertiary level based on crop water requirements;
- paying attention to organisational structures, for example establishing a Water Users Association to improve farmer organisation at various levels;
- training farmers to use the technology as envisaged by the design engineers.

At that time, the prevalent idea was that farmers could be trained how to use pre-designed irrigation systems and that organising farmers in groups would support these efforts. This implied that a farmer's use of irrigation could be shaped to the system; rather than the system being responsive to the needs and desires of the farmer.

Towards participation

By the 1990s, the importance of participation began to be recognised, as a response to the failures of the more technocratic approaches to design. However, this coincided with reduced investment in irrigation development programs, so opportunities to test it were limited. When participatory approaches were adopted, it was largely a rhetorical claim, rather than a decisive shift in design approach.

Over time, engineers have become more aware that the design of an irrigation system imposes a hierarchy that distributes water in a particular way. How an engineer perceives fairness is reflected in the structures they put in place and farmers shouldn't be expected to 'naturally' understand and agree with the assumptions underpinning this design. As a result, farmers often modify a structure that engineers have put in place, for example by adapting an overflow system.

Below are two images taken from the Mawala irrigation scheme in Tanzania. They show two ways in which farmers have modified existing structures, such as blocking a gate to influence water division and adding pipes to increase water flow into their canal.

de Bont, Chris. Farmers block gate to influence water division. Mawala Irrigation Scheme, Tanzania. 2018.

de Bont, Chris. Farmers has additional pipes to allow more water to flow into their canal. Mawala Irrigation Scheme, Tanzania. 2018.

Practitioners should observe these adaptations, learn from them and understand what kind of structure has been imposed on farmers and what kind of structure farmers propose as an alternative, and why.

Genuine participation remains a complex, demanding process. Particular assumptions that are made in the project formulation can make it difficult later on to change the outcomes in spite of participatory processes. Examples include:

- Assumptions about what a (smallholder) farmer is and can do. The dominant perception is that an African smallholder farmer can work on a 0.5ha piece of land (no more or less). Rather than recognising that there is a multitude of types of farmers, this results in rigid target sets on beneficiaries (for example, a 100ha irrigation system must benefit 200 farmers).
- Democracies have been imposed on local communities, but they are not always fair or representative. There are many examples of traditional African management structures that cannot be translated into voting democracies. Project imposed democratic structures can be a means for power capture by new elite farmers.
- The idea that new 'modern' production methods can simply be transferred through training farmers remains dominant – as is the expectation of a workforce of trained extension workers to translate these concepts into African practices. Consequently, projects are still framed as 'introducing new technologies' instead of identifying the local dynamics through which farmers have developed improved (farmer-led) production practices and disseminating that experience among neighbouring farmers.

Sustainable Irrigation Development Project (PROIRRI) in Mozambique

The PROIRRI project, funded by the World Bank in Mozambique, is a case study of a recent effort to incorporate a social-economic irrigation design approach.

The PROIRRI approach identified key elements:

- infrastructure development
- water management
- production support
- value chain development and
- financial services

PROIRRI was based on the assumption that for a sustainable irrigation development project to succeed, all these elements had to work together.

The project envisaged that many of the social and organisation aspects would be addressed before the technical design of the irrigation was finalised, enabling the operational implications of different designs to be discussed and evaluated as part of the design process. At the end of that process a final design would be made and agreed on by farmers already organised as an irrigation association and/or production groups.

But what happened in reality was different. The social elements of the PROIRRI model became separated from the infrastructure elements and the two progressed independently, with infrastructure choices not taking social structures into account.

The result is that the PROIRRI has repeated the mistakes of post-colonial irrigation development by pushing for infrastructural development without taking the social-economic aspect into consideration within the physical design.

Continuation of the PROIRRI project under the name of IRRIGA sought not to develop more new irrigation infrastructure, but to ‘explain to farmers how to use the irrigation systems’ constructed during the earlier PROIRRI phase.

The concern is that this project could become another example of the assumption that farmers should be taught and shown how to farm, according to the perception of ’modern’ agriculture and technocratic irrigation engineers’ views. It also assumes that farmers will take on the responsibility of operating and managing imposed irrigation systems.

The current situation

Since the late 2000's, interest and investment in irrigation has picked-up again, but technocratic design and implementation practices still dominate.

There are disincentives for moving from blueprint approaches to interactive and participatory approaches, such as:

- Accountability problems: who are irrigation projects accountable to? Projects are generally led by government and donors, and although the design approach attempts to be participatory and create ownership amongst those farmers involved, accountability remains subject to donors' political agendas and criteria on technological progress.
- The blueprint approach results in quicker, more efficient construction and higher profits for the contractor. This provides an economic incentive to minimise engagement with local social processes and to pursue a standardised model of 'modern agriculture'.

A vicious cycle exists. When farmers are not involved in the design, they don't appreciate the system. Consequently, farmers as 'owners' of the irrigation system are blamed for low performance explained through a lack of knowledge of operating procedures.

As farmers are seen as having limited knowledge, they are not involved in irrigation design. And as they are not involved, history repeats itself.

What seems disappointing about examples of irrigation projects such as PROIRRI is that existing knowledge on how to implement an interactive participatory design process is ignored or weakly institutionalised during the project.

For irrigation design to work it needs to reflect the local socioeconomic context. Irrigation practitioners must change from trying to 'adapt the user to the system' to 'adapting the system to the user'.

Irrigation design approach for farmer-led irrigation development

A farmer-led irrigation development approach allows for users and engineers to co-design and create sustainable irrigation solutions that can be achieved by farmers themselves. This approach uses two circular learning processes that form the basis for the (farmer-led) 'Participatory Irrigated Agricultural Development' (PIAD) approach developed by Wouter Beekman and Gert Jan Veldwisch.

An iterative learning process

For participatory irrigation planning with farmers, it is critical that the impetus for the project must come from farmers themselves.

Central to farmer-led irrigation development "must be their own rationality, their own 'wheel', in combination with critical, consensus-based self-analysis by the users, amidst both diverging and shared interests" (Boelens and Dávila 1998, p. 427).

Designing an irrigation development should be an *iterative process* of information exchange, discussion, negotiation and collective decision-making about the future use and related technical features of an irrigation system between the farmer and the actors engaging with that farmer. This ensures that social elements are taken into consideration.

A suggested approach is that the communication between engineers and farmers can be formalised in *learning cycles with planned engagements* between the groups around decision points (Scheer, 1996).

Learning cycles will differ between the engineers and farmers. They may revolve around the same topic and formalised communication is necessary to foster mutual understanding.

A learning cycle is an iterative process that advances in spirals while a constant renegotiation, redefinition of the problem and redesign takes place until the intervention is finished, and often even beyond.

The irrigation design process consists of three phases:

1. Problem identification.
2. Conceptual design.
3. Construction and re-design.

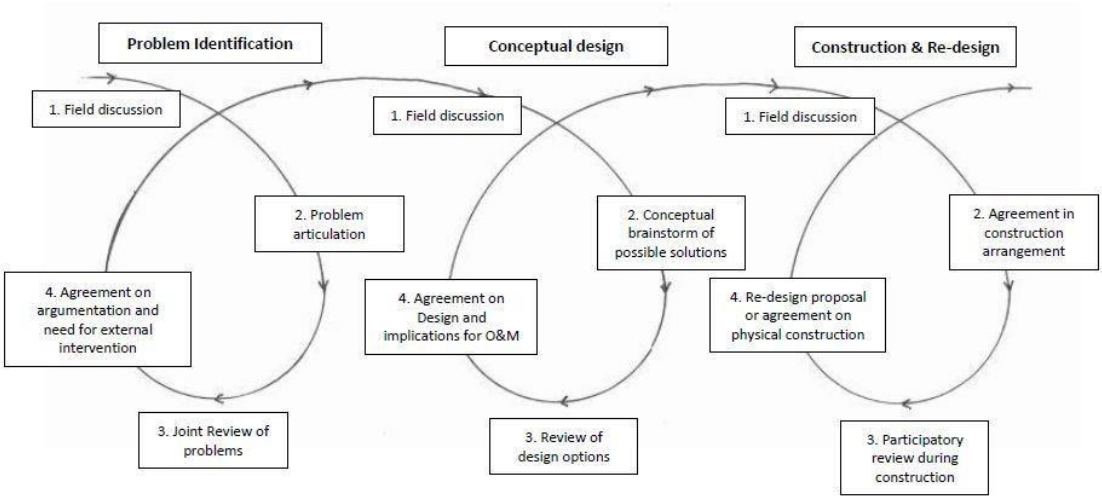

Figure 1. Schematic representation of an irrigation development process focusing on the participatory construction as used in the PIAD approach.

Problem identification phase

The activities in this phase aim to reach a shared analysis of current irrigation practices, potential improvements and solutions.

Irrigation practices are seen as combinations of infrastructure, management processes and institutional arrangements around water management, but also include agricultural production processes and market relations.

It is important to repeatedly question why users perceive a proposed intervention to be necessary, because it helps clarify their analysis of the problem. This results in a process of pushing back and forth between the farmers, trying to externalise their management problems through infrastructural interventions by the project, and the engineer internalising issues as essentially rooted in the management or regulatory domains, until a consensus is reached of what can only be solved technically and what can be solved organisationally. The aim of this process is to formulate the design criteria.

Conceptual design phase

This phase is a continuation of the discussions undertaken in the problem identification phase, in which initial ideas for possible solutions have been raised. However, it is also a distinct phase, as the focus changes from analysing existing problems, to thinking about solutions. It involves comparing and analysing different solutions with varying combinations of institutional and physical change.

An important discussion during this phase concerns the roles and responsibilities during construction and use of the systems by different actors. This discussion clarifies what types of structures are to be constructed, what materials are needed and who does what during the construction.

This feeds into discussions on how the project's operation and maintenance (O&M) is to be organised after construction, and to what extent it requires a change (or re-design) of organisational structures to facilitate it.

This discussion is critical because many rules and regulations in a farmer-led irrigation system are determined by the initial investors or owners, and additional investments by projects are liable to cause organisational change through shifts in "ownership".

The result of this phase is an agreement on what to construct, who takes particular actions and who contributes in the construction phase.

Construction and re-design phase

The start of this phase is marked by the signing of a three-party contract between the engineer/project, the constructor and the farmers. While actual construction activities start soon after the signing, the design activities continue.

The construction phase is an integral part of the iterative process of designing, where new insights acquired during construction lead to further re-design. Even after extensive discussions and visualisation, designs remain very abstract and difficult to understand for many farmers. This can be particularly acute if the proposed solution is one that users are not familiar with. For example, explaining hydraulic principles is difficult to convey without a constructed example.

The process of re-designing during construction is an important element in the appropriation by the farmers of the improvements. It allows for learning cycles through practice and the close interaction with the contractor and engineer, deliberately attempting to put farmers in the driver's seat.

Conclusion

The learning cycles inherent in this iterative approach not only function as a form of project management, but are also supportive of efforts to strengthen local conflict management techniques as translated into operations and maintenance regulations.

These processes are relatively time-consuming (and expensive) when implemented at a small scale, but have good prospects for scaling-up when actively building on the learning processes.

This is backed up by research showing that large-scale projects focusing on small-scale interventions might lead to better results, allowing for active involvement of the farmers in all the design and construction phases. This approach allows for active investments by the users, both in design and in project costs and labour, which subsequently results in the maintenance and replication of the improvements.

Key messages:

- Participatory design approaches are a feasible alternative to technocratic approaches and design.
- Historically, participatory approaches remained outside of the mainstream, due to a drop in investment in irrigation. Although today this is changing, participatory approaches remain largely dominated by technocratic implementation and design practices.
- Making assumptions in the project formulation can make it difficult to change outcomes, in spite of participatory processes.
- Participatory irrigation planning is an iterative learning process which must be led by the farmers.
- Although time consuming (and expensive) at small-scale, the processes have good prospects for scaling-up when building on the learning processes.

Suggested further reading:

Costs and Performance of Irrigation Projects: A Comparison of sub-Saharan Africa and Other Development Regions:
http://www.iwmi.cgiar.org/Publications/IWMI_Research_Reports/PDF/PUB109/RR109.pdf

Mozambique – Sustainable Irrigation Development Project (PROIRRI): environmental and social management framework:
http://documents.worldbank.org/curated/en/650321468062682355/Mozambique-Sustainable-Irrigation-Development-Project-PROIRRI-environmental-and-social-management-framework

Supporting Farmer-Led Irrigation in Mozambique: Reflections on Field-Testing a New Design Approach: https://www.researchgate.net/publication/304186956_Supporting_Farmer-Led_Irrigation_in_Mozambique_Reflections_on_Field-Testing_a_New_Design_Approach

Acknowledgements

- Wouter Beekman, Resiliência Moçambique