

The transition of dysfunctional irrigation schemes towards Complex Adaptive Systems: The role of Agricultural Innovation Platforms

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The Challenge

Irrigation schemes overcome the water shortages faced by dryland farmers, theoretically removing the main barrier towards increased yields and food security

Adding control over water increases complexity.

Irrigation scheme: huge engineering investment which requires human capacity and institutional arrangements to manage the complex interactions between the different system components (hardware, production systems, Institutions)

Complex Adaptive Systems

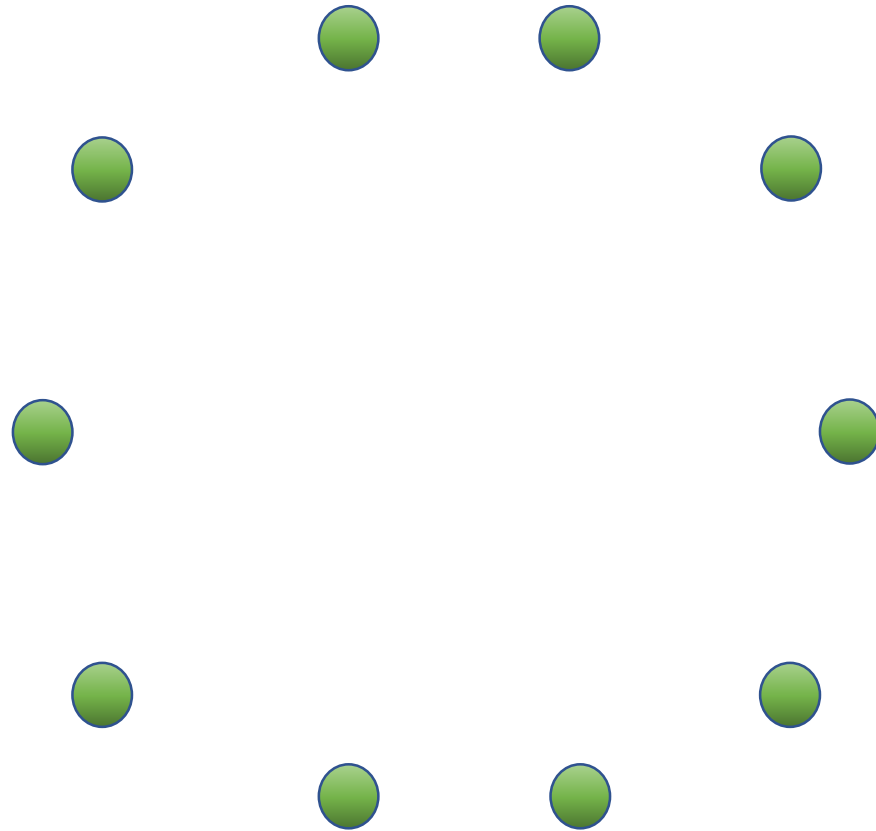
- The conceptual partitioning of variables into classes and subclasses.
- The existence of relatively separable subsystems that are independent of each other in the accomplishment of many functions and development but eventually affect each other's performance.
- The agents interact by sending and receiving signals or information, which results in learning, adaptation and the development of feedback systems.
- The adaptive capacity of these systems allows them to change in response to new information and to recover from external shocks, leading to higher resilience.
- CAS produce unpredictable patterns such as emergence, path dependence and co-evolution
- CAS are self regulating with many and complex feedback loops (no central control)

Main principles of the agricultural innovation system concept

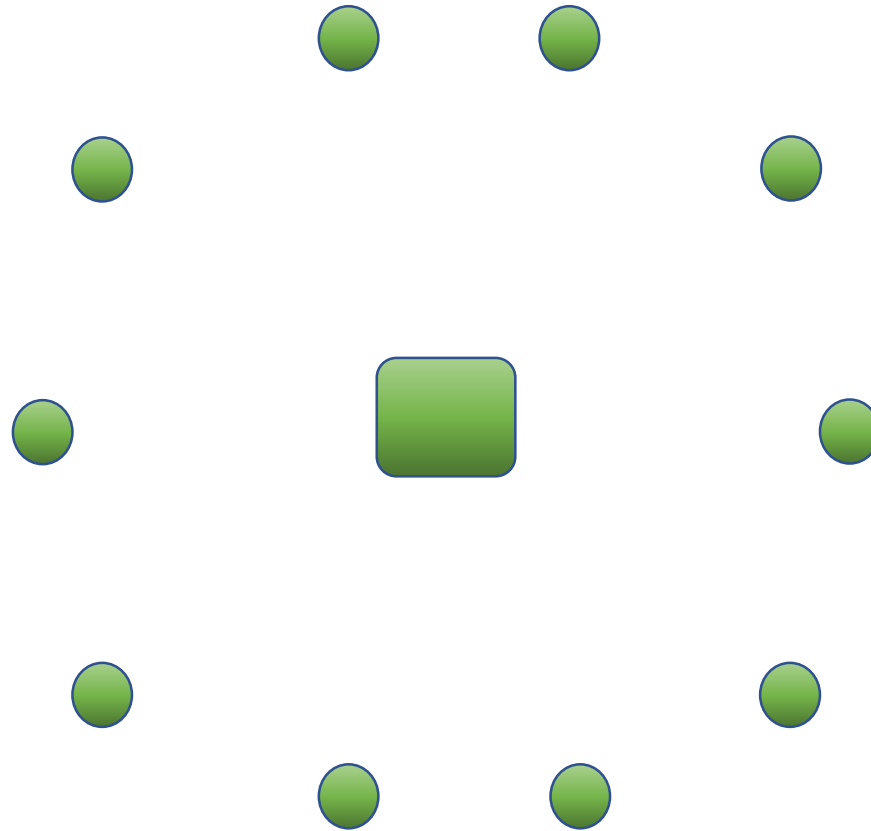
(adapted from Hall et al., 2006; and Otim-Nape, 2010)

- **Focus on innovation** rather than production. Innovation is understood to be the application of knowledge (of all types) to achieve desired social or economic outcomes.
- **Interaction and learning.** Innovation is an interactive process through which knowledge acquisition (from different sources) and learning take place.
- There are **new actors** and new roles in the innovation process. The concept recognizes that:
 - (1) there is an important role for a broad spectrum of actors outside government;
 - (2) the actors' relative importance changes during the innovation process;
 - (3) as circumstances change and actors learn, roles can evolve; and
 - (4) actors can play multiple roles.

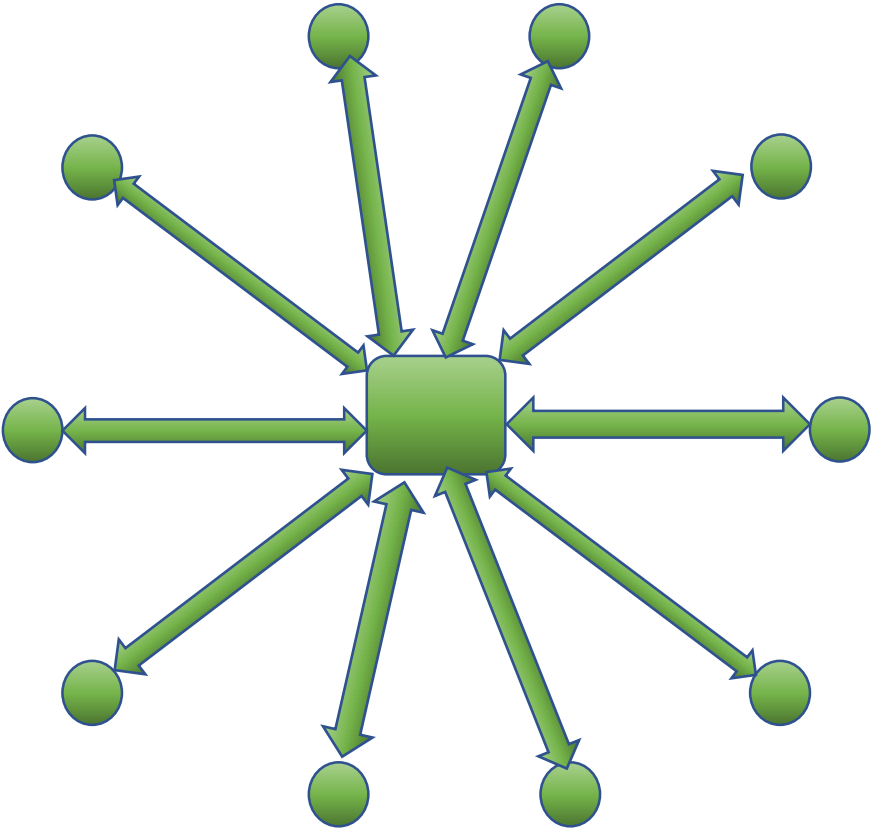
Developing functional networks



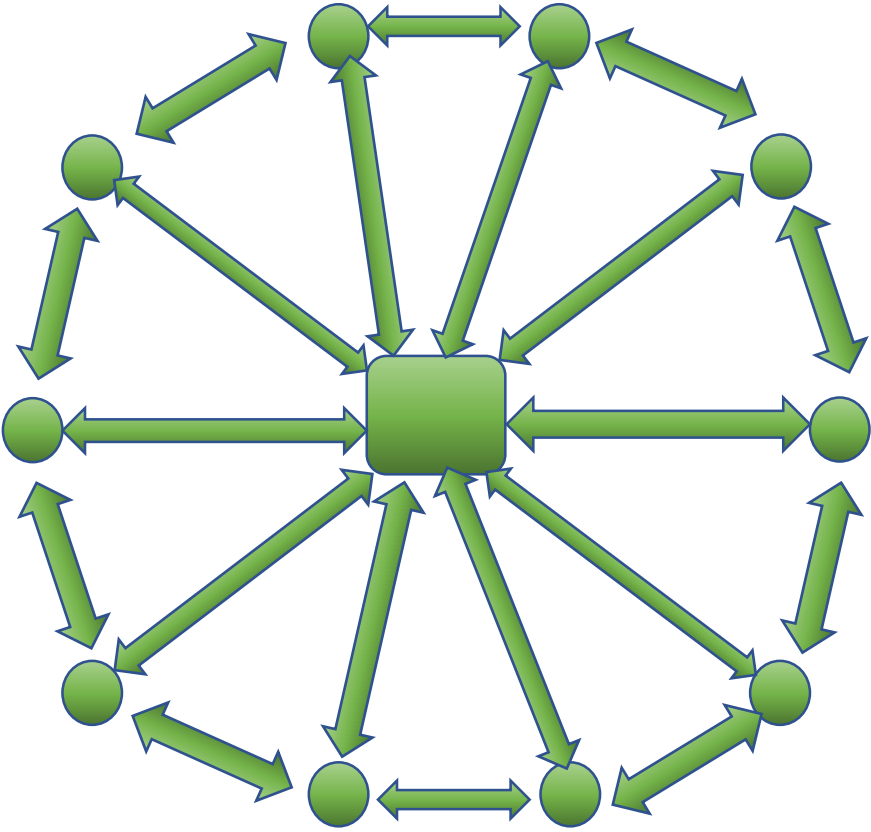
Developing functional networks



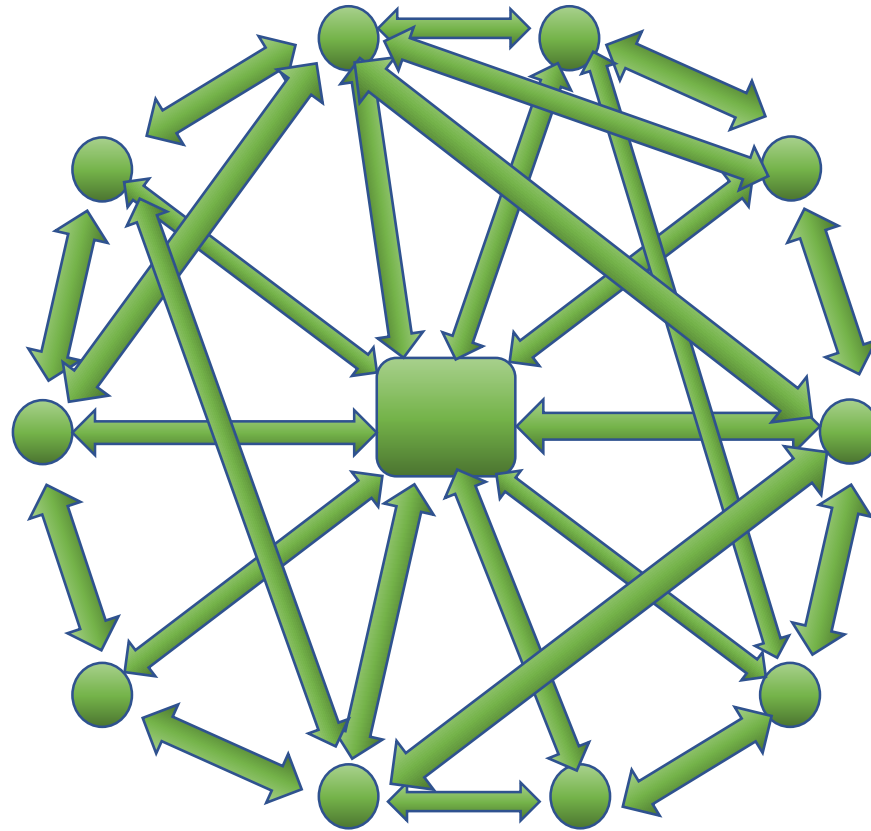
Developing functional networks



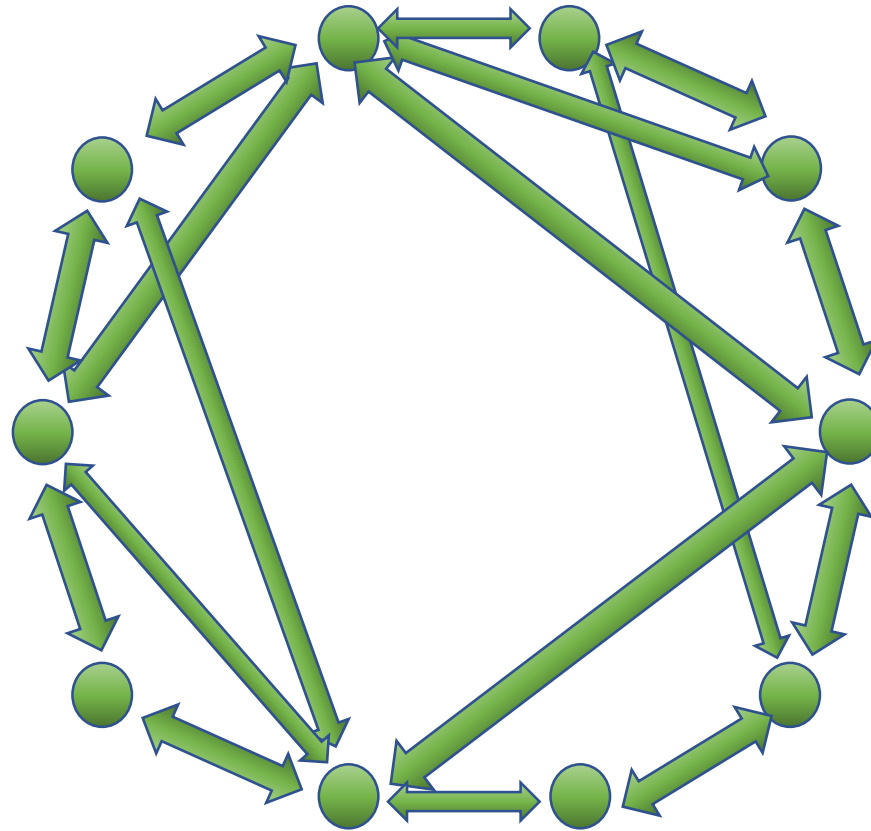
Developing functional networks



Developing functional networks

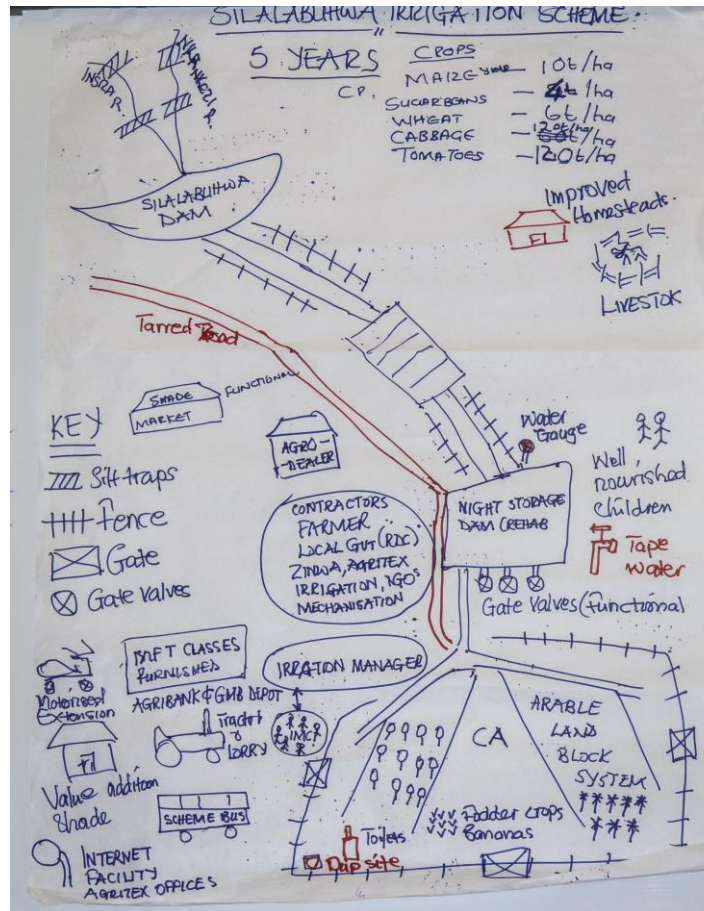
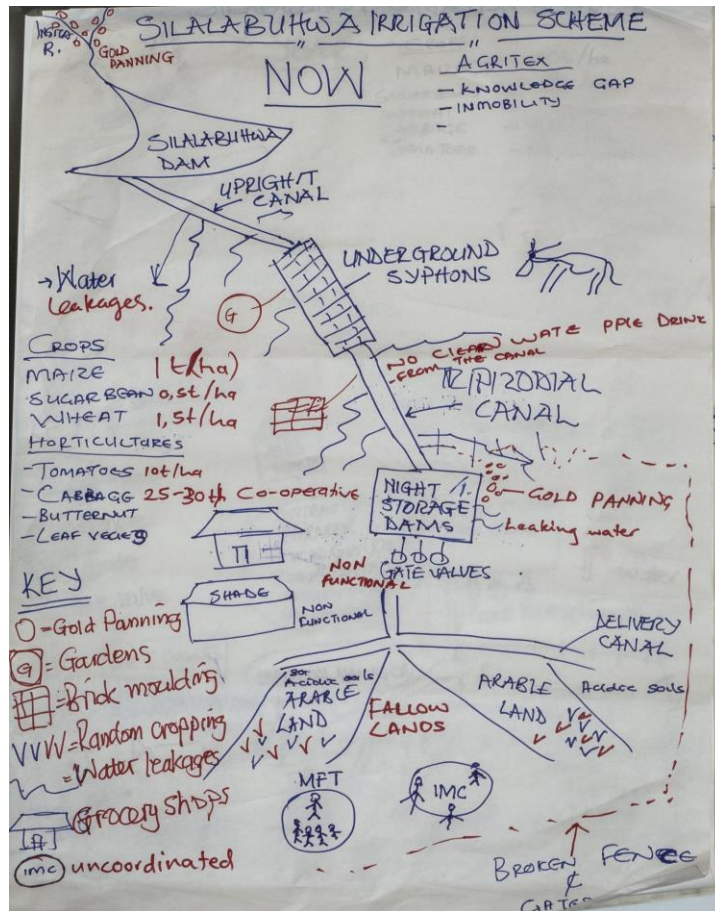


Developing functional networks



3. Visioning.

A clear and common vision defines a potential end-state or goal: Rich pictures allow people to (1) articulate the scheme's current state, including the location of households and their immediate surroundings, including markets and other infrastructure; (2) articulate the desired future state – participants express their needs and goals within what is achievable in five years; and (3) develop a strategy for how the transition from the current situation to the visioned future can be achieved.



Visioning

- Sense of ownership;
 - articulating your dreams,
 - the act of drawing it out makes it tangible is very powerful
 - focusing energies in a shared direction,
 - very rich and detailed futures
- Visioning process focus the different actors towards a common goal,
 - each can see their respective role & value in the process
- Diversity of the stakeholders enrich and deepen the understanding of the challenges – cognitive diversity.
- The road map
 - Matching their opportunities with expert advice
 - find places to intervene based on their market opportunities
 - their views on what can work.

4. Iterative innovation process, testing and evaluation

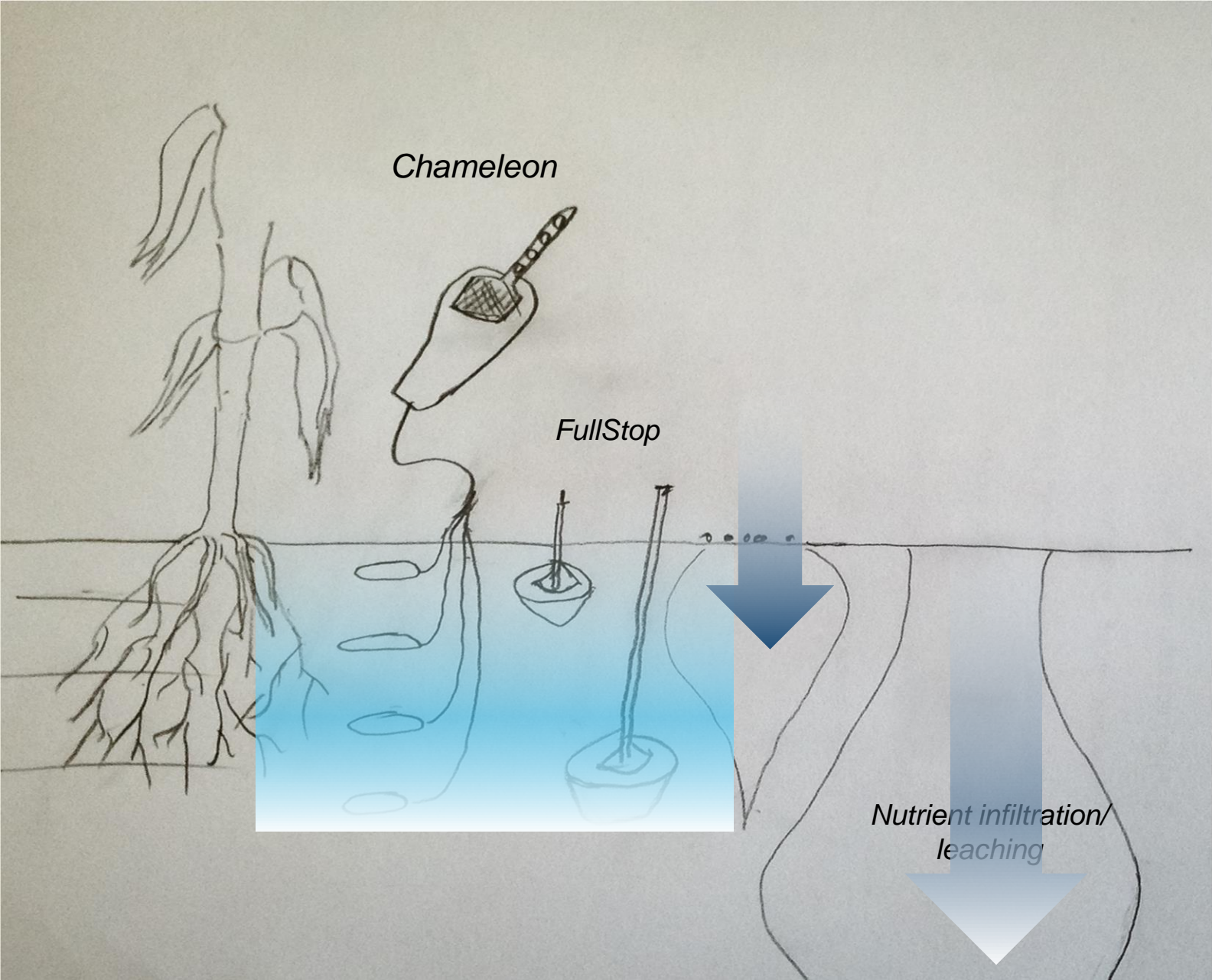
Participants explore different pathways from the current situation to the desired future situation by producing an annotated list of potential strategies. The strategies may be within the control of the farmers and/or their organizations, or might also require larger system-related changes that are out of their reach.

Addressing major stumbling blocks

Including institutions such as water- and local government authorities, who have great control over systems via previously unidirectional directives, now become part of the multidirectional information sharing and innovation process;

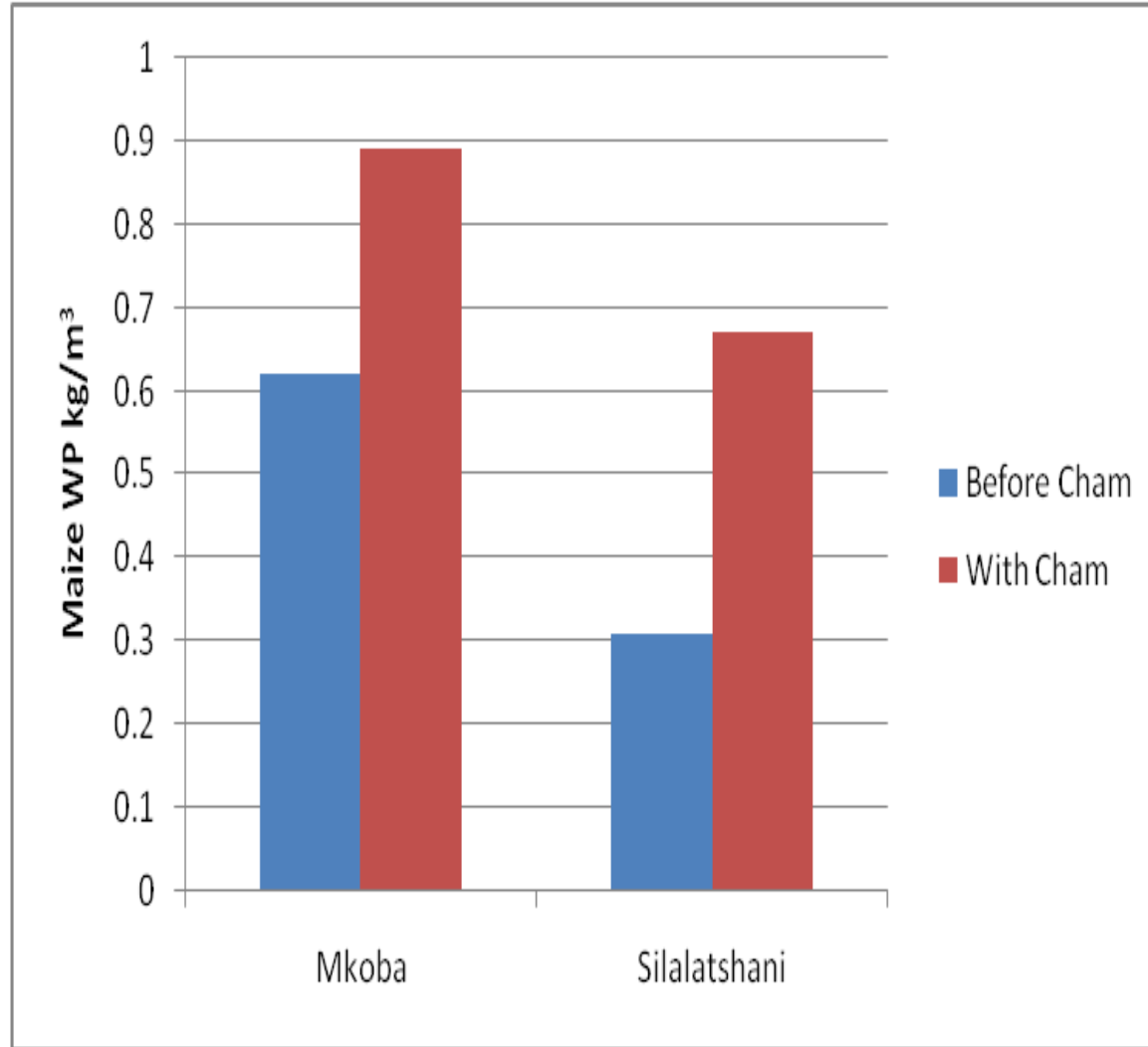
- The Irrigation management committee owed the Zimbabwe National Water Authority US\$ 280,000; the result of years of underpayment, multi-digit inflation and unrealistic exchange rates when the Zim\$ collapsed and the US\$ was introduced. ZINWA's understanding, and subsequently reducing their bill to US\$ 80,000 to be paid back at 1% interest, unblocked the system and farmers were prepared to pay the bill the bill and work.
- Occupancy at the irrigation scheme was very low at the beginning of the project because many plots were owned by "irrigators" who were no longer actively using the scheme. The Regional District Council engaged in a land audit confirmed access to and reallocated unused plots.
- Cropping schedule/calendar used to dictate the crops to be grown....

Soil moisture and nutrient monitoring

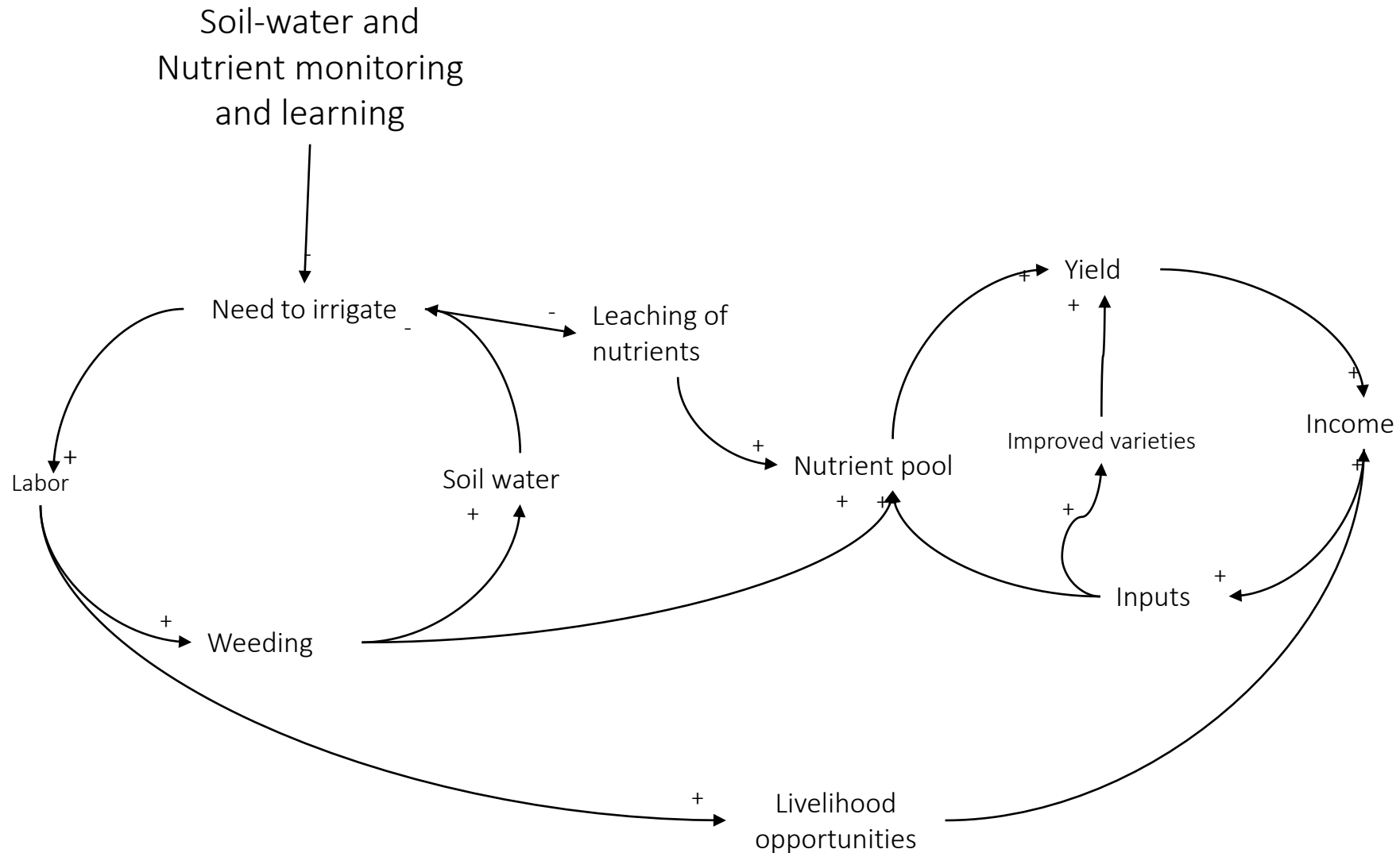


Doubling crop yields with halving of water use

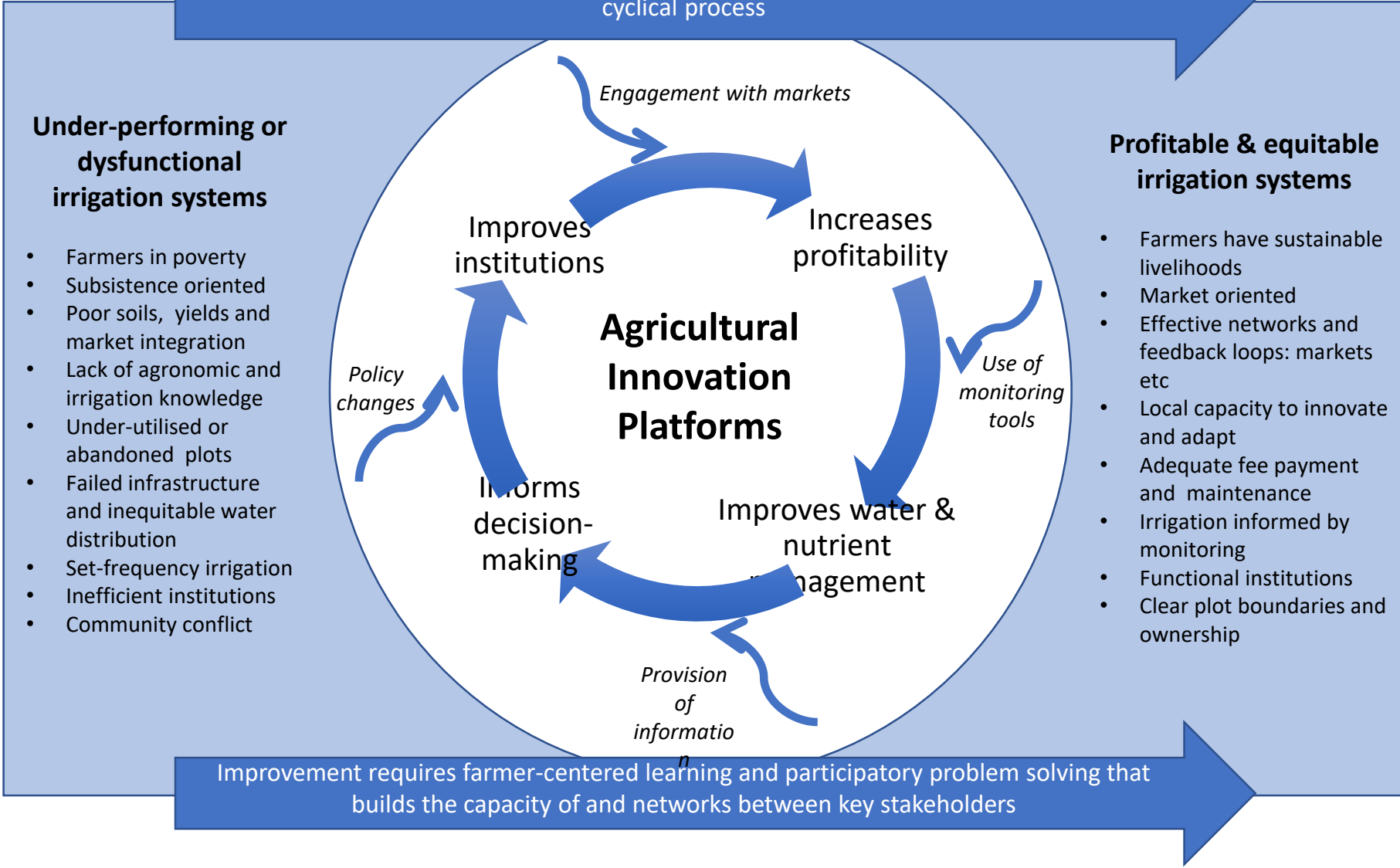
- Farmers Only irrigate 50% of opportunities
- Women Saving Labor!
- Increased weeding!
- Less nutrients leached
- “Night storage dams” remains more than 50% full = Less friction amongst irrigators!



The impact of soil-water and nutrient monitoring and learning: Influence diagram illustrating the impact of reduced irrigation on system dynamics



Irrigation schemes are complex systems that need complementary interventions through a cyclical process



Improvement requires farmer-centered learning and participatory problem solving that builds the capacity of and networks between key stakeholders

Appreciate your Attention



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