DESIGN CONSIDERATIONS OF SSI SCHEMES FOR THEIR SUSTAINABILITY AND FARMERS' MANAGEMENT SIMPLICITY

YUSUF KEDIR (Irrigation Engineer, M. Sc.): EARO

TENA ALAMIREW (Ph. D): Alemaya University

INTRODUCTION

- The first question in any discussion of irrigation is the definition.
  - Certainly the application of water to plants is **IRRIGATION**.
- There could be, however, differences between countries and agencies over what is meant by “small”.
  - Small according to the Indian definition is regarded as large in Africa.

- Irrigation systems can be classified according to
  - size, source of water, management style, degree of water control, source of innovation, type of technology.
- The best working definition seems to be
  - Irrigation, usually on small plots, in which farmers have the major controlling influence and using a level of technology which the farmers can effectively operate and maintain.
- In terms of management, there are three broad types of smallholder schemes:
  - government managed, farmer managed, and jointly managed schemes.

- Unlike its definition,
  - almost all authors agree on the advantages of SSI over weighs its disadvantages especially in the developing countries (Walker, 1989; FAO 1996; Mekuria, 2003).
- Despite its small scale, it is complex;
  - success and sustainability demand careful holistic design (Chancellor, 2000).
- Sustainability concept, when viewed within the context of SSI development generally
  - refers to the long-term ability of the beneficiaries to operate and maintain their schemes profitability with little or no external intervention other than the normal extension services.

- Therefore, sustainable SSI development entails
  - the devising of a technical, social and economic production system,
    - which guarantees that the farmers' goals of increased levels of income, increased levels of food security in the household, employment opportunities and general improvement of their standards of living are sustained through effective management of their irrigation system (Tom et al., 1999; Stephen, 2002).

- So, to be sustainable, the irrigation management system should be simple.

- Besides irrigation management simplicity, sustainability requires that farmers have appropriate incentives, normally financial, for continuing to irrigate.

- Among various issues that affect sustainability in smallholder schemes, **'design of the irrigation scheme**' is the major component that needs special consideration (Chancellor and Hide, 1997).

ISSUES ON DESIGN CONSIDERATIONS

- By “design consideration” we mean
  - *a condition that needs an account during the planning and development of the physical works of irrigation schemes and helps for the sustenance of the scheme.*
- The main issues on the design of technical components are installation, operation and maintenance costs of irrigation systems, mechanisms to achieve efficient and equitable water allocation and to control water losses (Hasnip, 2001).
- These all have played a crucial role on the management and sustainability of smallholder irrigation schemes.

- From the past experiences concerning the development of SSI, irrigation systems are often designed to maximize efficiencies and minimize labour and capital requirements.

- Questions that are common to all irrigation systems are when to irrigate, how much to apply, and can the efficiency be improved.

- For sustainability and management simplicity, a number of considerations must be taken into account in the selection of an irrigation system.

- These will vary from location to location, crop to crop, year to year, and farmer to farmer.

- In general, however, these considerations have common natures and will include the compatibility of the system with other farm operations, economic feasibility, topographic and soil properties, crop characteristics, and social constraints (Walker, 1989).

Irrigation layouts and Water Management

- The design, which involves the lowest investment cost per hectare, may not be the most cost effective solution if it also involves large numbers of staff for its operation, or if, because of operational difficulty, it cannot be utilized to capacity.

- Apart from this general assertion, other issues that merit debate are:

  - Does the layout of plots and water allocation plan demand that farmers accept a “scheme-wide” cropping pattern?

  - Do farmers have opportunity to influence decisions on cropping pattern?

- Do technical factors concerning plot layout and water allocation play a large or small role or no role at all, in determining the mix of crops grown and the time of planting?

- How are decisions about water allocation made? What freedom do farmers have to decide when and how much to irrigate?

- Does reliability seriously influence farmers' business decisions and are there any general trends linking scheme type, form of management and consequent reliability of supply?

- Compared with other factors that a farmer must take account of when planning what to grow and when– farmer knowledge, supply of inputs, domestic needs, climate, risk of pest and disease, anticipated market demand, etc –

  - ►does scheme layout and management play a large or small part in planning?

- ► The layout of an irrigation scheme has impacts on farmers;

  - firstly, in determining their access to irrigated land and secondly, in determining the nature and extent of work load.

- ► However, layout depends primarily on topography, soils, cost and water delivery choices and should be influenced by the perceptions of the community about how the schemes' size and shape will affect them.

- Inevitably, not everyone will have the same views and needs.

- Thus, it is very important to achieve effective participation of all the stake holders before the layout of a scheme is determined and finalized.

- Management inability to control water losses in the irrigation system layout can dramatically exacerbate the troubling of sustainability issues and erode the achievement of the irrigation schemes through:

  - Adding to the difficulties with predicting available surface water for irrigation and the overall planning of the scheme;

  - Generating user dissatisfaction which demotivates community interest in careful operations and maintenance;

- Increases the marginal costs of maintenance and repair beyond those justified by the production gains;

- Leads to social conflict because part of the user community does not receive the benefits expected; and

- Undermines the expected returns, increasing the unit cost for irrigation and diminishing the rationale for choosing SSI as a food security strategy option.

- In general, scheme layout is strongly affected by the schedule of water at the field level and the functioning of the distribution system affects the overall performances of a scheme.

Participation of Stakeholders

- Irrigation development involves various stakeholders.
  - Stakeholders not only those who initiate, implement and benefit from irrigation schemes, but also those who are directly or indirectly affected by such schemes.
  - Nevertheless, the most essential stakeholder is *the farmer*, who, if not properly integrated in the scheme development, may not feel obliged to play his/her role effectively, thus jeopardizing the sustainability to the scheme (Stephen, 2002).
- In the beginning, the engineers assumed that the farmers could not understand the design or the functions of the structures and explanation followed after implementation.
- Farmers, as a possible source of system design input, are still too often ignored by engineers, and as a result schemes are often inappropriately planned (FAO 1996).

- Stakeholders should be integrated from the beginning of a project through effective coordination and clear definition of their roles.

- In a participatory planning method, farmers' manageable role in each step will be distinguished.

  - Farmers will be asked how they expect the water to reach their farms, how they want to be grouped.

- Moreover, farmers will be allowed to give their suggestions on where the irrigation structures to be placed in the design, where to be the grazing land and together with the engineers alternatives and amendments will be made where needed (Wouter, 2002).

- Successful implementation requires participation in the planning and implementation process by all stakeholders, in order to create a sense of ownership of, and consequent commitment to, the scheme.

- Ownership and commitment by the users are unlikely to be achieved unless they consider that the scheme would meet their felt needs and they have a stake in the equity (FAO 1996; Tom et al, 1999; Mekuria, 2003).

- Involving farmers in system design can also often result in significant cost savings, particularly if the farmers themselves are expected to take a share in the equity by contributing to the investment costs.

- Design should not be done away from the community with the final product presented to them as a finished job. There is need for regular consultation and input at all stages.

Farmers' Socio-cultural and Farming System

- Beyond the confines of the individual field, irrigation is a community enterprise.
- Individuals, groups of individuals, and often the state must join together to construct, operate and maintain the irrigation system as a whole.
- Irrigation often means a technological intervention in the agricultural system even if irrigation has been practiced locally for generations. New technologies mean new operation and maintenance practices.
- If the community is not sufficiently adaptable to change, some irrigation systems will not succeed (Walker, 1989).

- Aspects of design that are apparently primarily technical in nature may be strongly influenced by socio-cultural considerations.

- Farmers must be assisted to appreciate the implication in trade offs between what they want and what is technically possible (Chancellor and Hide, 1997).

  - So according to Hasnip (2001) scheme design and management needs to account for farmer objectives and resource relationships between subsistence and cash incomes, when seeking a framework to promote business orientated, commercial irrigation farming.

- Irrigation often provides water for drinking, washing, homestead gardens and trees, livestock, replenishment of aquifers, urban water supply, rural industries, fishing and aquaculture.

- The quantities used may be small but vital in maintaining the viability of the livelihoods of certain groups, their income, nutrition and health.

- In some farming systems, the available family labor force may not be sufficient to satisfactorily manage both traditional and irrigated.

- Irrigated agriculture and livestock enterprises often complement each other.

  - Crop residues can be used for fodder and manure for crop production.

  - Irrigation of fodder crops alongside food crops should be promoted in the pastoral area to encourage the herder to adopt irrigation (Stephen, 2002).

It may be feasible to provide watering points to compensate for loss of traditional open to access water.

The case of Doni and Batu Degaga

- There is no any watering structure or through for the livestock so farmers are using irrigation canals.
  - Hence, there will be an opportunity of damaging the structures.
- The design of the irrigation schemes did not consider this situation.
  - However, large amount of water has been wasted in various ways that could be allocated for the livestock (Yusuf, 2004).

Irrigation Users' Capacity and Skill

- Apart from the obvious technical and financial conditions,
  - the key condition for sustainable development impact from an irrigation investment project is its implementability.
- This requires that the institutional demands of the scheme are matched to local institutional capacity
- Moreover, in the conventional planning process, detailed start-up and implementation plans have generally been considered as beyond the ambit of the identification/preparation team's work.
- So schemes should be planned to match local capacity for implementation, which implies that planning teams should first acquire a thorough appreciation of this capacity.

- If necessary the scheme scope and content may be reduced to match existing implementation capacity.

- Technical assistance can then be applied selectively, rather than indiscriminately as often in the past, for genuinely sustainable capacity to be built.

- The design process should give specific attention to an analysis of institutional capacity, and to providing a detailed programme to enable the implementers to prepare themselves for carrying out the tasks expected of them (FAO 1996).

- For example
  - a design that features large plots will increase the users' need for mechanisation and farm power, thereby increasing their production costs.
  - Field application of water, by gravity via long furrows or by pressure delivery through sprinklers, determines user need to level land or plough even furrows.
- Designers should identify
  - who will be responsible for land preparation i.e. his skill and
  - what their access to resources will be and take this into account when considering the type of design that is needed if farmers are to use the available water effectively (Chancellor, 2000).

Operation and Maintenance

- Irrigation systems designed to deliver a service matched to crop water needs have, in general, failed to perform as intended.
- Structured design with clear operational rules, results in irrigation infrastructure that can deliver reliable services and also allow the farmers to determine their own optimum cropping systems.
- The question that arises for field operations in the design is how to implement and operate the system on the field.
  - How will the irrigator know what flow rates are actually running into the furrows,
  - when to terminate the flow into one set of furrows and shift the field supply to another set?

- For instance,
  - Sprinklers are often seen as a solution to land levelling problems.
  - On sprinkler problems arise in relation to technology-use, availability and cost of spare parts.
  - Reliability of pumps could be crucial to SSI and may result in poor performance due to poor care and operation, (Chancellor, 2000).
- On the other hand,
  - Earth canal can be relatively cheap to construct, using farmers' labour.
    - Don't require specialist skill for operation and maintenance.
- In general,
  - Poor design, construction or maintenance can seriously affect the proper functioning of the scheme.

Traditional Irrigation Practices

- Irrigation development in formal systems takes no account of the existence of large areas of traditional irrigation,
  - developed on the initiative of farmers rather than governments, and have continued their existence in the same way.
- In some countries the area under traditional irrigation far exceeds the formal irrigation,
- The most important feature of these systems is
  - local initiative,
  - responsibility and
  - control (FAO, 1996).

The case of Doni and Batu Degaga

- Despite the design of the irrigation schemes,
  - farmers have been traditionally practicing very short and zigzagged furrows that are dictated by the slopes of their fields.
  - These types of traditional furrow orientations, however, help the farmers to maximize water distribution efficiency of the system (Yusuf, 2004).

Choice of Irrigation Technologies

- Choices of irrigation technologies, and the anticipated levels of farm mechanisation, are made when schemes are first designed.
  - these choices affect the management and performance of irrigation schemes (Hasnip, 2001).
- The choice should be based on its appropriateness for the cropping patterns intended and should also consider cost-effectiveness.
- The technology also to be matched to the level of operational capacity of the users.
- Equally, the designer must consider how the user will manage his land, and the implications that have for scheme layout.

- Design process must start from a consideration of how the users will operate the system;
  - this should then be designed to provide the optimum combination of efficiency in water use, operation and maintenance.
- On the other hand, irrigation technology needs to be adapted to the specific agro-ecology and a stepwise approach to development is required.
- For example, “high tech” sprinklers seem to be attractive when furrow irrigation might be just as effective.
  - It is not advisable to start with 'high-tech' approaches especially in places where there was nothing before (Mekuria, 2003).

- There are many examples where the introduction of new techniques into existing farming has failed.

- Farmers must have the means, the skill, the incentives and the support to successfully managed new technologies.

- Generally, in considering the choice and use of any irrigation technology in general and for SSI schemes in particular, questions that arise are (Hasnip, 2001):

  - **User objectives** – Will the technology be adequate to meet the needs of the farmers?

    - How much system flexibility will the objective require?

    - Does the technology restrict choice amongst the users forcing them to adhere to a fixed pattern of work or

    - Does it permit flexibility & independence between users?

- **Operating & Management Costs** - How much are people willing and able to pay for their technology?
  - Should cheaper alternatives be sought?

- **Operator skills** – What level of skills is available?
  - Does the technology match the available skills?

- **Maintenance** – Can the technology be serviced quickly, reliably and locally?

  - Can spares and service components be obtained quickly and cheaply?

- **Risk** - If part of the system breaks down, what are the consequences?

  - does it affect a large part of the scheme for a long period, a small area for a short time or some mid point?

- **Management** and **support services** – What management is needed to deal with the chosen technology?

- Methods of water application and maintenance requirements are determined by the design and
  - farmers should not spend much time so that being discouraged by structure maintenance (Chancellor and Hide, 1997).
- The most effective management practices are dependent on the type of irrigation system and its design.
- The selection of the in-field technology carries a lot of implications on the management and operation of SSI schemes by the farmers that could be reflected on
  - the sustainability of the scheme.

External aspects

- A supportive policy and legal environment is crucial to the **sustainability**
- A facilitating legal framework is critical to give WUAs the ability to deal effectively with external groups, operate bank accounts and undertake other activities.
- However, the legal framework should be flexible enough to allow members to adapt their organizations to local circumstances.
- It should also balance rights with responsibilities for WUAs in order to ensure that members have sufficient incentive to participate.
- Clear assignment of property rights over water and over the physical infrastructure of irrigation systems to WUAs can be a potent tool for strengthening the organizations,

TO CONCLUDE

- Many SSI development initiatives have been **unsustainable** over the long term.
- SSI provide opportunity for participatory development and for orderly devotion for farmers of costs and responsibilities for operation and maintenance.
- The designer is faced with a larger number of choices concerning aspects of scheme **design, construction, operation and maintenance.**

- Necessary decision extends from **harder engineering concern such as the type of the intake, to softer choices** about the type of distribution best suited to potential irrigators.

- Designers must consider and fully understand the **background of the end users (farmers)** through effective participatory planning and implementation process of SSI scheme design.

- *There fore, important issues affecting the management performances and sustainability of the schemes need to be thoroughly investigated prior to their design.*

Thank you !!!

YUSUF KEDIR & TENA ALAMIREW