



## **IRRIGATION MANAGEMENT NETWORK**

### **DESIGNS FOR SUSTAINABLE FARMER-MANAGED IRRIGATION SCHEMES IN SUB-SAHARAN AFRICA**

**J J Speelman**

# **DESIGN FOR SUSTAINABLE FARMER-MANAGED IRRIGATION SCHEMES IN SUB-SAHARAN AFRICA**

**a compilation of results of recent international meetings**

**compiled by J J Speelman**

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J J Speelman is a member of the Department of Irrigation and Soil and Water Conservation, Agricultural University, Wageningen, the Netherlands. A version of this paper was originally prepared as a contribution to the International Workshop 'Design for Sustainable Farmer-Managed Irrigation Schemes in Sub-Saharan Africa' held at the Agricultural University, Wageningen, the Netherlands, 5-8 February 1990.

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(Footnotes by Mary Tiffen)

### 1 INTRODUCTION

This paper gives a concise overview of the findings of seven recent international meetings on irrigation in sub-Saharan Africa. Their proceedings and publications are listed in the bibliography. Given the widespread decline in per capita food production in Africa, all the meetings unanimously assigned important roles to irrigation development<sup>1</sup>. However, they all stressed the need to learn from past failures. The common objective of these meetings was to identify various features of irrigation development and irrigation technology that are likely to be most appropriate to regional needs in the future. Most of the discussions contained the message that irrigation schemes should be regarded as socio-technical systems where neither social nor technical aspects can take automatic priority. Furthermore, efforts were made to identify the key areas of interface between both domains.

This paper also summarises some implications for irrigation design that resulted from these meetings.

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<sup>1</sup> *As the meetings were attended by those with a professional interest in irrigation development, this is not surprising. There is a need, perhaps, for governments to take a harder look at the circumstances in which they could achieve their objectives of increased food production or export-orientated production through the development of rainfed agriculture, through the encouragement of traditional forms of water management in low-lying areas and swamps, or of water harvesting in arid areas.*

## **2 THE KEY ISSUES ADDRESSED AND THEIR RELEVANCE TO THE PRESENT WORKSHOP**

In all these meetings there seemed to be a consensus on some of the major drawbacks of irrigation projects and the future challenges they face.

### **2.1 Policy, Planning and Donor Roles**

It was repeatedly stated that the process of systematic irrigation planning and policy formulation has not yet started in many sub-Saharan countries. Irrigation planning requires knowledge on numerous physical, economic and social variables and on their interrelations. It also requires that priorities be set for national and community objectives which change in time, and this makes it essential to have feedback to policy and planning levels. A need was identified for clear objectives, clearly formulated agricultural policies framed in the national and regional context, the development of project-planning and implementation capacity, and training and research addressing both the physical and the social conditions for development.

Supportive and complementary actions from international donors are needed to contribute to project sustainability, for example, by technical assistance in training, and with management and administration of irrigation development activities, long-term financial commitments and short-term acceptance of recurrent cost deficits. The local, national and international information base needs improvement from a systematic feedback from past experiences.

These issues should influence the broad strategies for irrigation development. 'Modern' capital-intensive irrigation within Africa is seen as the least cost-effective option. Furthermore, it creates a series of potential conflicts of interest between users and irrigation agencies. For countries without substantial irrigation experience it seems more remunerative to learn from small-scale developments. However, small-scale development does not guarantee better performance than large-scale, if similarly conceptualised. Irrigation should be based on a concept that initiates a development process rather than that plans a development action. Moreover, in the documents studied there is a general agreement about the need

to include more than a one-sided consideration of the Economic Internal Rate of Return<sup>2</sup> in irrigation planning by giving greater weight to human and social advantages or disadvantages of specific options.

The above clearly indicates the need for approaches to irrigation design that take different socio-economic and socio-political factors into consideration. What remains unaddressed in the reports under review is the fact that the objectives of national governments and donors often prevail over those of future users in irrigation planning. Therefore, external biases characterise the role that designers often unintentionally and almost always unwittingly play.

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<sup>2</sup> *As an initiator of the discussion on the role of the EIRR, I have been surprised by the way the debate has developed in the irrigation community in Africa. The research upon which my papers were based showed that it is extremely important for the sustainability of irrigation schemes that designers satisfy themselves first on the soundness of their **financial** analysis. By this is meant first that the scheme must provide much more attractive incomes to farmers, in cash and in kind, than their present or alternative occupations, to reward them for the extra work irrigation entails, and that there must be an assurance of regular financial resources at the scheme level if the maintenance of the scheme is to be guaranteed. Only if these two financial analysis are positive, will there be an economic benefit at the national level, which is what the EIRR measures. My argument was that the financial analysis must be regarded as the first test of a project's viability; only if this could be assured was it worth proceeding to an estimate of the EIRR. It is also true that unless the farmers find the scheme financially attractive, and unless some organisation has the resources to operate and maintain it, there will not be any **social** benefits, such as increased security of food supplies, less migration to towns, etc, because the scheme will collapse or perform badly. It has been pointed out that in some village schemes in Sahelian countries (and probably elsewhere) the costs of irrigation are provided by the remittances of migrant workers, while the scheme exists to provide food for their families. Such family separation is hardly an ideal social situation, although it may be the best solution currently available to the problem of rural poverty.*

## 2.2 Local Farming Systems

Most forums agreed that irrigation development may disrupt the family economy by imposing rapid transformation of subsistence farming into competitive commercial 'farming'<sup>3</sup>, rather than innovations in or improvements of pre-existing activities. Also, irrigation schemes that impose uniform production patterns on many farmers may be unpopular. The newly introduced component to the local farming system should be brought into balance with other food-producing and cash-earning activities, in a combination attractive to farmers and acceptable to other actors. For instance, if rainfed farming increases, the productivity of irrigated plots sometimes drops. This underlines the symbiosis between rainfed and irrigated agriculture. Many farmers prefer combining these types of agriculture rather than depending solely on irrigated production.

Therefore, irrigated agriculture should not compete for pre-existing resources (land, labour, capital and water) beyond the extent acceptable to farmers. For example, farmer preferences and irrigation project pre-suppositions frequently diverge in regard to the labour input required by irrigation. For farmers, labour shortages are important. There may be wide variations between households, but at peak periods labour supply emerges as a key constraint because of the marked seasonality in African farming. Overstretching labour and other resources should be prevented by taking account of the complementarity that exists among productive activities.

Access to land is another example of why plans should be based on an in-depth farming systems analysis and consultations with farming families. By wishing to impose crop choices, cultivation techniques and timing of operations, governments cause those tilling the land to become more like tenants rather than landowners.

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<sup>3</sup> *Of course in many parts of Africa farmers have been combining subsistence farming with the sale of farm products for many decades, and in these cases they may be already well integrated into the commercial economy, either through traditional trading networks or through linkages developed by governments or external firms.*

Leases allow project authorities to control the production process, because these authorities have the power to remove a person's tenancy rights. However, conditional tenancy diminishes the farmer's commitment to modern irrigation. Furthermore, customary laws are still very much in operation. It seems appropriate that irrigation planning should take these traditional arrangements for the management of land-use into account, particularly to avoid conflicts between different groups of people.

In general, all the documents reviewed underline that for better irrigation performance one has to get to the roots of the social, organisational and motivational aspects from a farmer's perspective. A first requisite in this respect is to know how male and female farmers choose, combine, manage and rank the various activities they engage in.

The complementarity of different activities has implications for irrigation design:

- plot sizes and land allocation principles should enable households of different size and composition, and changes over time to be accommodated;
- plot sizes should only be chosen after farmers' budgets have been financially appraised. The plot size should guarantee an acceptable income without eliminating other important productive activities (even if this means modifying the size to allow for a small supplementary activity);
- low cost irrigation systems or methods that can give acceptable returns when used only for supplementary watering of traditional crops should be identified;
- land-use systems that integrate crop production and livestock rearing should not be ignored;
- anything that can make a system more reliable, robust and simple should be adopted, to minimise requirements for farm labour;

- the design should anticipate irregular periods of absence of the farmers, otherwise it may prove to be inappropriate in real-life conditions;
- designers should search for design options that can reduce the labour demands of the operation of an irrigation scheme without increasing the capital-intensiveness of production.

Apart from advising that location where land and water rights are already contested should be ignored, the documents reviewed contained no recommendations that designs should take land tenure/land rights into account<sup>4</sup>. Furthermore, resources like water, cash, agricultural equipment and knowledge were barely discussed, if at all.

### 2.3 Irrigation Management

There is general awareness that irrigation management has been weak in many African farmer-managed and agency-managed schemes. In the African setting three areas have proven problematic in farmer management time and time again; achieving corporate identification and accountability on a non-kinship basis, managing money, and managing equipment shared between more than one operator. Unfortunately, irrigation projects require fairly high levels of proficiency in all three domains. However, many have observed that outsider-staffed scheme management does not necessarily promote development, due to the lack of government funds and an ineffective and top-heavy bureaucracy. Therefore, discussions on institutional constraints generally come down to the recognition of the need to delegate scheme management to water users' associations as much as possible.

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<sup>4</sup> *There is, however, an extensive section on land tenure and its implications by Mary Tiffen in ed Moris and Thom, 1990, **Irrigation Development in Africa**. Note that this is the full version of the summary **African Irrigation Overview**, 1985, with valuable new material that was not incorporated in the summary document. There are also a considerable number of new studies, reviewed in the accompanying Newsletter.*



As regards the three problematic domains mentioned above, water users' associations should preferably be formed on the basis of traditional forms of cooperation. Organisations of people involved in irrigation systems are **not** implemented in a social vacuum. Therefore, preparatory studies should devote time and energy to finding and assessing what form of organisation will fit in the existing local socio-political network, given the prevailing traditional forms of cooperation and mutual aid. Knowledge of local community structure and of village or clan leadership relationships is necessary for this aspect of institution-building.

Existing local organisational structures should be modified as little as possible, while at the same time ensuring that the project revenues be recognisably fair to all, with safeguards to prevent progressive loss of economic and political power by the relatively poor in favour of the relatively wealthy.

The design implications for irrigation design most often made is that schemes should be laid out as a series of modules, each of which is capable of operating semi-independently and which is adjusted in size according to the number of irrigators in a group. The optimal group size mainly depends on the degree of social cohesion in the local community. Furthermore:

- designs should be such that they can realistically be maintained by local irrigators and, if necessary, can operate reasonably well even under sub-optimal maintenance;
- designs should allocate/distribute water in such a way that is **locally** perceived to be equitable. For example, division of water in fixed proportions, irrespective of its availability;
- design and construction methods have to be better adapted to local capacity for operation and maintenance, for example by requiring minimal adjustment during the cropping season.

## 2.4 Women and Irrigated Agriculture

Statistics suggest that women provide two-thirds of all working hours invested in African agriculture. However, the factors that matter to women - legal security, access to credit, to land, to water, to labour available for productive activities, and a share in profits - tend to be ignored in irrigation planning. It was agreed that it is incorrect to assume without investigation that the farming family is a homogenous unit, with a single purse, and with freely interchangeable or free family labour. A false assumption can contribute to the phenomenon of women 'losing out' in the transition from traditional to modern forms of agricultural production. Especially when projects seek to commercialise what was originally subsistence food production, women risk ending up with the best land, that they formerly used, passing into the hands of men, and they themselves being left with marginal areas or working as labourers on men's crops. The development of irrigation may have a differential impact on the various categories of women within a community, depending on the traditional socio-economic status of their families, and within one family (age, marital status)<sup>5</sup>.

All the documents reviewed mention that balance should be rectified and more attention should be given to women's needs, problems and potential, which for cultural, religious and economic reasons may be different from men's and less visible.

The various meetings concurred that in addition to a sensitivity to women's issues, irrigation design also requires knowledge of the existing social structure in the project area and an alertness to the processes that may arise as a result of development measures. Some general recommendations are to identify target groups by gender, to collect data on the socio-economic organisation of farming, giving special attention to the gender-based divisions of labour and responsibilities, to assess the likely impact on men and on women both inside and outside the irrigation scheme, and to make specific

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<sup>5</sup> *The documents perhaps put insufficient emphasis on the way the rights, role and wishes of women may vary between countries and within countries, according to local social and cultural conditions.*

plans to ensure that both men and women are given access to land and water, equipment and services<sup>6</sup>.

Only a few recommendations directly concern irrigation design. For example irrigation can alleviate women's workload by incorporating facilities for non-agricultural use of water. The location and size of the household plots should be carefully considered, and forage options and livestock movements maintained.

## 2.5 Irrigation and External Factors

Irrigation is highly sensitive to external factors. The level and nature of food demand, countries' economic situation, actions of financing agencies, population growth, increase in rate of urbanisation all encourage the demand for irrigation. Other factors impede it (deterioration in earnings of foreign exchange, reduction of external aid).

More direct influences on the performance of irrigation relate are those linking irrigation with the region and the nation. For example, if the output delivery system, comprising roads, rivers, railways, transport, power supply, spare parts, maintenance and competent operation, is defective, farmers are unable to respond to signals emanating from the market place. Inadequacy in the input delivery system can also be a constraint. The provision of inputs has proved difficult for some governments to arrange, especially where irrigation has become very sophisticated and external inputs of credit, seed, fertilizers, pesticides, pump and tractor fuel, spare parts, and mechanical maintenance are needed. Project strategies based on introducing intensive, modern techniques are even more vulnerable in small-scale projects, since their smallness and scatteredness brings them more problems in securing inputs, services and timely technical advice than their larger-scale equivalents.

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<sup>6</sup> One has to note, however, that this may conflict with the recommendation on page 10 that designs should respect what is locally perceived as equitable.

The same applies to extension and training services. It is often unquestioningly assumed that farmers will, spontaneously, become expert managers, accountants, and mechanics without adequate and sustaining training. Furthermore, as the success of small-scale irrigation has generally depended on the cooperation of a large range of government institutions and individuals, small schemes tend to have more budgetary and institutional problems than major schemes. Almost all the above mentioned services require capable and enterprising managers, who are currently likely to be extremely scarce.

Most recommendations on this subject deal primarily with institutional and policy reform, developing training capacities, etc. Only a few recommendations deal with irrigation design; for example, that irrigation schemes should rely on simple design of pumps and other items of small-scale equipment that can be manufactured locally. This is to avoid failure as a result of a technology that cannot be serviced ('orphan' equipment). Loan financing for infrastructural costs should also be avoided. Intensive preparatory work with farmers can often stimulate them to generate simple structures from their own resources. Projects should refrain from being involved in the operation and maintenance of irrigation infrastructure and re-designs are needed to simplify the management tasks. Furthermore, production practices that minimise cash costs (external inputs) and indebtedness should be promoted.

The central questions, whose importance has now become clear, are how input supply, marketing, extension and external management are arranged, and to what extent this could/should be arranged by the state, the private sector or by the farmers themselves. The risks arising from the farmers' dependence on external factors beyond their control should be minimised as far as possible by modifying physical designs of irrigation schemes. Designers have made over-optimistic assumptions on the reliability with which external relations can be arranged.

## 2.6 The Design Process

There is a need to distinguish between poor technical irrigation design and inappropriate 'system architecture'. By 'system

architecture' is meant the imaginative piecing together of the various parts of an irrigation system by a multi-disciplinary group

including local farmers. The major factors signalled as leading to poor irrigation performance as a result of inappropriate designs are:

- Time pressure caused, for example, by unrealistic timetables for implementation; technical assistance units' overriding impulse to show immediate results; governments and donors wishing to minimise the duration of their involvement; and the disregard of the importance of incorporating elementary socio-economic conditions, creating a tendency to move to action before the situation warrants. Time pressure impedes the participation of the beneficiaries in the preparation of project proposals and design.
- Poor preparatory studies caused, for example, by feasibility studies conducted under pressure to produce high EIRRs; poor communication between researchers of different disciplines; and shortcomings of survey procedures. A feasibility study should include an assessment of the sustainability of the project, in which constraints at farm level and farmers' priorities primarily dictate the content of the applied research, and not only economic criteria. The study should ultimately lead to sound criteria for the final design of the project.
- Premature decision-making: crucial decisions on Terms of References (TORs) and projects' scope, size and institutional form are made **before** the main feasibility study is undertaken and may preclude the best solutions. The TORs of consultants may require them to design a particular type of project as decided centrally, even if it appears not to be the best alternative given local objectives, resources and constraints.
- A communication gap between policy-makers, field officers and farmers.

Some of the recommended modifications in the design process are dealt with as follows.

The project concept of fixed targets to be reached within a fixed time-span should be replaced by a phased development in which irrigation is extended or introduced only after it has been thoroughly tested in pilot schemes. The latter is especially important in areas with little or no experience of irrigation. The advantages of phased development include the ability to implement projects in stages, with the possibility of correcting problems with the initial design during implementation, the ability to spend much more time talking to local people before commitment is made to a final project design, and the lack of adequate institutional capacity for alternative, but very demanding approaches. The advantages of flexibility are likely to apply particularly to the development of small-scale irrigation. Beginning with moderately sized schemes allows for the programme to be fanned out satisfactorily as knowledge, experience and qualified local manpower become available.

Dividing the project cycle into stages tackled by different specialists breaks the connection between design and its consequences. The persistence of many social and economic problems in African schemes is evidence that a sharp discontinuity between designers and implementors inhibits the accumulation of useful experience. Donors will need to allow for more flexible, organic, evolutionary pre-design study. This will reduce their ability to control the scheduling of project design and implementation, but will increase the continuity of staffing and institutionalise memory.

It is generally recommended that the design process be reversed. Rather than begin with the design of the irrigation system based on what is technically and economically optimal, designers and planners should begin with the participants and institutions responsible for implementation. Only after the strengths and weaknesses of each of these have been identified and the structure of incentives clearly understood, should technical design begin. This process can then proceed in iterative fashion as governments and farmers decide which changes they are willing and able to make. Thus, first and foremost, design considerations should centre around what is feasible and acceptable to government and farmers and what impact this will have on project performance.

It is very difficult to ascertain just what is feasible in a particular context. Therefore, not only do project designers have to solicit

the views of farmers and executing institutions, they also have to understand and appreciate what these are saying and what they mean. This is why the development of indigenous capacity for project design that includes meaningful participation by all involved in the project, is of the utmost importance.

From the above it may be concluded that irrigation projects need **time, continuity and meaningful interaction between the actors involved to arrive at desirable change.**

## **2.7 Participation**

As discussed in the foregoing sections, farmer participation is a prerequisite for the adequate management of irrigation schemes and for the establishment of an appropriate 'system architecture' in which the irrigation and production technologies harmonise with the experience and resources of farmers and their existing land use. The reports reviewed, moreover, recognize that the erosion of traditional knowledge and skills should be prevented, and that western agricultural knowledge not only has definite limitations but sometimes also has definite negative effects on the development of agriculture in tropical areas. Few reports, however, address the question of **how** local farmers can be actively and effectively involved in different stages of the project cycle.

The concept of participation is frequently ignored (for example, for fear that it will delay the project completion) or is misinterpreted (being seen primarily as a way to reduce costs of operation and maintenance). As a result problems occur because users have not been consulted during the design phase. Others regard participation as a ruse used by outsiders to obtain information to use themselves, in order to diagnose problems **for** the farmers. This as opposed to the approach of trying to help the farmers to consider their situation and diagnose their own problems, to build up their ability to analyse their situation and to decide what further actions to take. It is the latter aspect that should be regarded as the essence of participation.

Moreover, it has been recognised that the willingness of the intended beneficiaries to allocate land to irrigated agriculture, and also their participation in terms of finance and labour should be regarded as a precondition for **any** government involvement in

development. Proposals should be presented, discussed and compromised on with farmers, and their support and commitment for the agreed project should be solicited. Negotiated designing is regarded as possible, particularly in rehabilitation, since farmers will have detailed knowledge of the faults in the existing system and some ideas of its potential should improvements be made.

## 2.8 Environmental and Health Issues

The environmental implications of irrigation development in Africa have been significant. The construction of reservoirs and canal systems for irrigation without adequate drainage, for example, has tended to lead to higher water tables in some regions and to create waterlogging and soil salinity. The introduction of perennial irrigation has also substantially increased the incidence of water-borne diseases. Most of the international meetings reviewed here have recognised the importance of considering these environmental and health aspects of irrigation. The gravity of these topics merits separate attention, not merely passing reference.

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