Reflections on irrigation finance in Africa

Réflexions sur le financement de l'irrigation en Afrique

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Abstract

The paper first describes five sets of difficulties that often affect the financing of small-scale projects in African irrigation development: these are problems arising from project design, from the beneficiaries, the lending institution, the government, and the donors. The author then draws various lessons, about project design, supply and demand for credit, appropriate institutional development, and relevant policies. The final section proposes ten rules for sound development of projects. The aim of self-sufficiency is emphasised: dependency on credit should be minimised, equipment should be as cheap as possible and rapidly repayable. Governments and project designers should not focus too rigidly on production-enhancement objectives as these may be negated by other aspects of the local context, such as post-harvest losses or weak market mechanisms; the investigation of such factors, and steps to alleviate them, should be an integral part of pre-project planning. Where credit is a necessary project component, it should as far as possible be managed through local decentralised micro-finance institutions which are near to the borrowers and able to know their circumstances.

Résumé

On décrit cinq catégories de difficultés qui souvent affectent le financement de petits projets d'irrigation en Afrique : ce sont des problèmes liés à la conception de projets, aux bénéficiaires, aux organismes de crédit, au gouvernement, et aux bailleurs de fonds. L'auteur tire des leçons concernant la conception de projets, la demande et l'octroi de crédits, le développement institutionnel, et les politiques associées. Enfin, dix règles sont proposées pour favoriser le développement de projets crédibles. La notion d'autosuffisance est soulignée : la dépendance sur le crédit est à minimiser, le matériel acquis ne doit pas être trop coûteux et doit être facilement remboursable. Des gouvernements et des concepteurs de projets ne doivent pas mettre trop l'accent sur les objectifs d'amélioration de la production car ils courent le risque d'être neutralisés par les éléments en rapport avec le contexte local tels des pertes post-récoltes ou des mécanismes faibles de marché. L'analyse de ces facteurs et l'identification de mesures pour les lever doivent être partie intégrale de la planification pré-projet. En ce qui concerne le crédit, il doit être géré, autant que possible, par des institutions de micro-crédit locales décentralisées qui sont proche des emprunteurs et qui comprennent leurs réalités quotidiennes.

1. Problems in irrigation finance

Experience to date with the FAO's Special Programme for Food Security provides information on problems encountered and lessons learned from past efforts in the financing irrigation development projects. Those who are familiar with agricultural credit will undoubtedly note that many of these problems are not intrinsic to irrigation, but apply generally to all types of agricultural lending. The difficulties encountered generally fall into five categories:

- Difficulties linked to faulty initial design of projects;
- Difficulties linked to the beneficiaries themselves;
- Difficulties caused by the lending institution;
- Difficulties caused by governments;
- Difficulties caused by donors.

In the following sections these five problem categories are reviewed, and thereafter various principles of project design are described with the general objective of avoiding or reducing these difficulties.

2. Difficulties linked to faulty initial design of projects

Probably a majority of irrigation finance problems are the direct result of defective project design. Some of the most common project design errors include the following:

2.1 Giving lip service only to the participative process

Despite considerable effort and lip service by various parties, the *participatory process* continues to be mostly artificial. Most often, it consists only of "sensitisation" meetings, explaining technical decisions already taken elsewhere by "experts." Many of these schemes are hatched by foreigners with little knowledge of local customs and conditions. The schemes are often too complex for potential participants to understand, or to enter as effective partners. Beneficiaries, often represented by only a few leaders, are typically presented with a *fait accompli* (the programme will provide you with such-and-such equipment, which will cost you so much, and which will provide you so much income and profit…). A sensitivity analysis, to help potential borrowers assess the risk of success or failure, is almost never presented.

With the exception of certain World Bank efforts (notably the PSAN project in Burkina Faso and the PDPI project in Senegal), which seem truly well appreciated by beneficiaries (LeBrun 1998: 7), irrigation projects have generally deliberately by-passed this preliminary phase of briefing beneficiaries on future developments, which is absolutely necessary for success. These two World Bank projects succeeded because they fully involved participants, not only in the conception of the programme, but also in the specifics of project implementation, and even in project monitoring and evaluation.

Nearly everyone gives lip service to beneficiary participation in project design, but very few project designs, in reality, adequately involve those who will be most affected by their execution. This is frequently due to the need to write project proposals quickly, and as the old adage goes, "haste makes waste."

2.2 Inappropriate / excessively costly and complex technical solutions

When faced with the choice between a simple, inexpensive solution and a costly, complex one, many professional project design officers, desiring to display their command of the subject matter, have a tendency to choose the latter. Thus they violate one of the most fundamental rules of development work, the KISS ("Keep it simple, stupid!") principle. As one micro-irrigation expert puts it, "Western entrepreneurs and trained engineers have difficulty unlearning enough of what they've been taught, to innovate, design, and market micro-irrigation systems that are affordable enough for poor farmers to take advantage of them."[1]

Typically, the family income is only two or three hundred dollars a year, far too little to afford the modern irrigation devices available off the shelf that are often promoted by development "experts." However, without improved irrigation, they cannot fully benefit from green revolution inputs. Furthermore, many development experts expect that in an open marketplace, small inefficient farms will be taken over by larger and more efficient farms. In the face of rapid population growth, however, actual farm size in developing countries is instead steadily decreasing. The failure of the development community to take these simple facts into account is a major factor constraining the emergence of practical solutions, both to improved irrigation performance and to hunger and poverty.

Bilateral donor-funded agricultural development projects frequently also have an inherent, built-in problem, i.e., statutes in the donor country require that equipment used in development projects be manufactured in the donor country. It doesn't matter that the donated equipment may be five times as expensive as alternative irrigation equipment made locally in Africa or imported from India or China. It also may not matter that a much less complex and vastly less expensive solution may be more appropriate.

[1] Paul Polak of IDE, quoted in Keller, Adhikari, Petersen and Suryawanshi (2001).

Experience with complicated equipment or technologies, such as power pump-based irrigation and animal traction, in areas with little tradition of using them, has often been disastrous. Project designers have greatly underestimated the difficulties of introducing such new technologies in contexts where the population has no experience with machines or care of animals.

For example, instead of using expensive European motor pumps, it may be possible to pump water much more cheaply and with less dependence on foreign technology, spare parts, etc., by using alternative equipment like locally-made treadle pumps and rope pumps. Accordingly, those in the business of designing irrigation development projects or project components need to make a much more eloquent and convincing effort to convince bilateral donors that, if they really want to sponsor sustainable development, they should agree to less costly and less complex designs. Most of the time, "small truly is beautiful." Donors have to realise that insistence on using equipment manufactured in their country of origin will at least seriously undermine the project's probability of success, and at worst render profitability and sustainability completely impossible.

Some project design officers' continuing preference for expensive and complicated irrigation solutions is difficult to understand, particularly since the benefits and advantages of focusing more on micro-irrigation equipment have been so well documented. They include:

- By replacing surface systems and practices that have traditionally been used to irrigate small plots with low-cost micro-irrigation systems, the area of land that can be fully irrigated from a given volume of applied water can be significantly increased. However, of perhaps even greater importance from the perspective of basin-wide water resources, the production per unit of water depleted by evaporation and transpiration is often increased by 30 to 50 percent. The improved use of increasingly scarce water resources is well suited to peri-urban irrigators, with water consumption reductions of up to 60 percent in comparison to traditional (furrow) irrigation. Furthermore, the availability of affordable micro-irrigation systems in small kits unlocks these potential benefits for literally millions of resource-poor farmers who have access to as little as 20 to 500 m^2 of land. In addition, it opens the potential benefits of irrigation even to smallholders in places where water supplies were considered insufficient or too costly to acquire for traditional irrigation methods to be practical. These technologies are significantly lower in cost, available in small packages, operate at very low pressures, and are easy to understand and operate.[2]
- Labour savings
  - through reduction of time spent in water control in the field;
  - through reducing the gross water requirement for a given area and, therefore, the time spent in water acquisition.
- Opportunity to exploit a limited water supply
  - from a manual or small motorised pump;
  - where water must be carried over a distance;
  - from a small or erratic stream or canal flow.
- Improved conveyance and application efficiency, leading to saving of water and reduced risk of raised water tables.
- Improved control over the timing and depth of irrigation, permitting more accurate application of fertiliser, and hence leading to possible improvements in yield and quality of output.
- Potential benefits of tapping shallow aquifers and not mining deep water.

[2] Keller et al.(2001), p. 1.

- Effective irrigation of coarse or shallow soils and sloping lands (avoiding need for land forming / terracing).
- Reduction in the area of land taken up by the distribution system.
- Better use of poor quality water, provided that appropriate management practices are adopted.
- Reduced risk to health, by elimination of standing water.
- Unaffected by wind (as regards drip systems).
- Avoids leaf scorch and reduces risk of foliar fungal disease (as regards drip systems).
- Localised soil-wetting reduces evaporative losses and weed growth between rows.
- Operates at relatively low pressure, thereby saving energy, and in many cases eliminating the need for expensive pumps.
- Simple to install and easy to operate by men, women and children and ideal for vegetable cultivation, but also used extensively to irrigate small plots of HYV paddy. In Asia, at least, water-saving micro-irrigation of wheat, tobacco and jute enabled irrigators to harvest remarkably higher yields compared to rain-fed farming.
- The benefit: cost ratio on treadle pump investment is in the neighbourhood of 5:1; the internal rate of return (IRR) is variously estimated to be around 100 percent; the payback period is usually less than a year. For a marginal farmer with US$50–100 to spare, there are few "capital investment propositions" more attractive than a treadle pump (Shah et al. 2000: 29).
- Scalable, divisible and portable technologies with low capital investment requirements (US$100 or less, sometimes under US$10) with potential for poverty alleviation via wealth creation.
- Improved household nutrition levels.
- Low operation and maintenance costs.

Specific areas with the greatest potential for successful micro-irrigation include:

- Areas with chronic water shortages;
- Hillside farming systems in proximity to good urban markets;
- *Fadamas*, *dambos*, and *goulbis*;
- Peri-urban zones of major cities.

As previously stated, a key factor in the disappointing performance of many poverty alleviation initiatives is their failure to address the fact that most of the farms in developing countries are less than two hectares in size. The key to tripling the global harvest through modern seeds and inputs has been irrigation, but until recently commercial irrigation devices have been too large and too expensive for small farmers. This has left them on the outside, looking in on many of the accomplishments of modern agriculture. Yet because small farmers are themselves poor, and are disproportionately concentrated in food-deficit rural areas, increased productivity and income are central to practical approaches to poverty alleviation. For most small farmers in developing countries, affordable small-plot irrigation may be the first step to wealth creation (World Bank; Winrock; and IDE 2000: iii).

Similarly, in some cases, the basic problem to be solved by the project is misdiagnosed during the project identification and design process. For example, the "problem" to be resolved by a proposed new project is often stated in terms of "low production" or "low yields." However, with post-harvest losses typically 30 percent or more of the entire harvest, a more viable project concept might well be warehousing grain until prices rise shortly before the next harvest. If farmers could sell that lost 30 percent or more rather than losing it to spoilage, or sell the ***entire*** crop at a much higher price later

in the year, their profitability would increase dramatically without having to get involved in complex, expensive, and unproven imported technologies. If post-harvest losses are not directly addressed by a proposed project, it should be remembered that even the doubled or tripled production that a costly and complex project may produce is also subject to post-harvest losses.

2.3 Lack of a market development approach

The strategy of subsidising the cost of conventional irrigation systems to farmers with small plots has generally been proven to be unsustainable. It has not been a very efficient mechanism for addressing the needs of farmers of small plots, nor has it resulted in the expected improvements in irrigated agricultural performance. A growing number of irrigation experts believe that, for economically sustainable success, the uptake of micro-irrigation systems for use on small plots should be ***demand-driven*** and without direct subsidies. Thus the systems must be financially feasible (or affordable), and farmers should be willing to pay the ongoing costs (including reasonable profit margins) associated with producing and marketing their crops once the market demand is well established.

Funding the development of low-cost systems and establishing demand-driven markets for them is proving to be a very appropriate and cost-effective role for donors, replacing the direct subsidies provided to farmers in previous irrigation projects. Product development, supply chain and market development, and product promotion are technologies that Western countries providing technical assistance are quite effective at.[3]

The shift in emphasis from the technology development phase (although this phase is still important) to the phase of developing a private-sector-led supply chain and rural mass-marketing of the equipment characterises the present approach to smallholder irrigation development (as opposed to earlier approaches of appropriate technology). The overriding principle of all successful approaches is that they ***treat farmers as entrepreneurs*** motivated by profit, who make investment decisions based on information available to them. Successful technology transfer depends on finding farmers who fit this profile and using them as demonstrators who will influence their less entrepreneurial or more risk-averse neighbours.

2.3.1 Components of the Market Creation Model

The market-creation model of development involves these steps:

1. ***Feasibility Study*** building on previous local irrigation experience and emphasising the participatory approach, as well as identifying opportunities for marketing the increased production (especially high-value crops where local smallholders may have a comparative advantage) resulting from irrigation.

2. ***Development of the Technology Package***. This involves decisions about importing versus local manufacture, types and sizes of micro-irrigation equipment and kits, principal crops to be promoted, aiming at a limited product line that is affordable to poor farmers and ***that can pay for itself in a season or, at maximum, a year***.

3. ***Supply Chain Development***. Once the product(s) are identified, they must be procured or manufactured, preferably the latter, as the Kenya experience shows (see following page). Although drip tape is not produced in many developing countries, PVC pipe and other plastic products are widely produced. Micro-irrigation kits can easily be produced using micro-tubes, which can be manufactured with a minimal upgrade at a PVC pipe factory. The method of manufacture is linked to the selection of technology and these decisions must be made in tandem. Also, it is critical to determine how and by whom the products will be distributed. It is desirable to have as wide a distribution network as possible, not just to one target area within the country. Local agricultural outlets, hardware stores, etc., are logical candidates to be retailers. The structure and relationship of

[3] Heierli, U. and P. Polak, (2001) pp 1–31. Readers wishing a more in-depth explanation of the "market creation" approach around which donor thinking on irrigation finance is coalescing should consult this document. Figures 1 and 2 have been adapted from those developed by Mr. Heierli.

manufacturer, wholesaler and retailer need to be determined for each programme. Questions of quality control, guarantees and other issues need to be resolved. Various types of supply chains have been developed, and to ensure sustainability it is essential that all parties in the chain make a profit.

In the development of supply chains, provisions are made for private sector enterprises to supply the associated inputs (seeds, fertilisers, soil amendments, plant protection agents, etc.) that the smallholder farming community will need in order to take maximum advantage of the water-related technologies. In addition, provisions are made for the private sector and/or government agencies and NGOs to provide necessary farmer training.

The availability of credit is a major factor in the successful mass dissemination of productivity-enhancing technologies for the smallholder; special consideration is given to building into the supply chain mechanisms for credit for the smallholder.

4. ***Rural mass marketing***. In order to convince farmers to buy new technology, major efforts must be put into marketing. This may take different forms depending on the country.

5. ***Agricultural production: Adding value to product, and output marketing***. With micro-irrigation, farmers may be producing high-value crops with which they are unfamiliar. They may need training on variety selection and management practices. Farmers may also need training in the use of post-harvest practices and on-farm processing in order to add value to their products, and to gain access to profitable and stable markets. Promotion of high-value crops may involve policy dialogue with the host government to facilitate relevant infrastructure development and the creation of new markets. Marketing may also involve improved storage and preserving (drying, pickling, cooling, freezing, canning, etc.) of high-value crops carried out on an industrial scale.

6. ***Impact measurement and feedback***. For the programme to work effectively, managers must be able to monitor impacts in order to adapt the programme continuously to meet its objectives. Programmes may need to adapt new technologies, tap new markets, or find new sources of donor funding. In order to respond to changing conditions, programme staff members need to monitor sales, redefine the target smallholders and measure the impact that the technology is having on incomes, employment, and other factors. This data needs to be fed back to the programme to enhance profitability, build sustainability, and ensure greater incomes for the target smallholders.

The process involves a number of actors with a variety of skills to be obtained through the establishment of a network that would include a variety of organisations, including donors, NGOs and other implementers, host governments and the private sector. There is a strong need for co-ordination of the programme to assure that parties work together towards a common goal. A network secretariat would have a major objective of promoting co-ordination among all the actors involved in promoting smallholder irrigation.

Two case studies in Africa (Kenya and Zambia) illustrate the importance of some of these components (World Bank et al. 2000: 11–12):

In Kenya, the Kenya Agricultural Research Institute (KARI) distributed bucket kits. This experience provides two important insights into problems associated with production and distribution. The bucket kit is manufactured in the U.S. and shipped to Kenya in container-lot quantities. Although the shipping costs per kit are relatively low, delays hinder the availability of kits. An entire container is expensive, so the programme must depend on a large influx of funding to import the kits. This means that the programme is not run as a sustainable business.

In the second, the kits have been distributed only at the national headquarters of KARI and several other outlets. They are not available through the private sector at local outlets. Although good demonstration programmes have been conducted, both at the national headquarters and at local agricultural field days, there is no consistent advertising campaign. Only sporadic advertisements and newspaper articles have announced the availability of the kits. This has resulted in uncertainty,

and reliance on distribution through NGOs which buy a number of kits for their target farmers. Finally, spare parts are not readily available as there is no national supply chain of kit retailers.

Market Linkages. The Zambia Dambo development project provides a number of interesting lessons learned. First, the programme emphasised local production of treadle pumps, which lowered costs from US$200 to between US$60 and US$70 per pump. The contractor, IDE (International Development Enterprises), has operated the project in 4 areas of Zambia with 128 retailers, with emphasis on demonstrations to reach farmers. Farmers have been linked to micro-credit. The dispersed nature of the population, and poor quality of transportation and other infrastructure, have hindered adoption. The most significant lesson is that farmers who are linked to established horticulture markets realise the highest incomes. Generally, limited access to markets has prevented many farmers from full adoption of the technology. Zambian farmers tend to be dispersed, and, although access to land and water in *dambo* areas is good, farmers are generally located far from markets, and are constrained by poor road infrastructure.

The various components required in a "market creation" approach are illustrated in the diagrams on the following two pages.

Given the complexity of the market-creation approach, it would seem desirable (if sufficient funds are available) to place the overall management of the development of such systems in the hands of experienced micro-irrigation consulting firms, such as IDE, EnterpriseWorks, HIPPO Foundation and SE3WE, that already have considerable experience in Africa. The first stop in the search should probably be the IPTRID (International Programme for Technology and Research in Irrigation and Drainage) secretariat located in FAO headquarters in Rome (iptrid@fao.org).

Figure 1. Supply chain for low-cost micro-irrigation equipment and services needed by farms to make use of it.

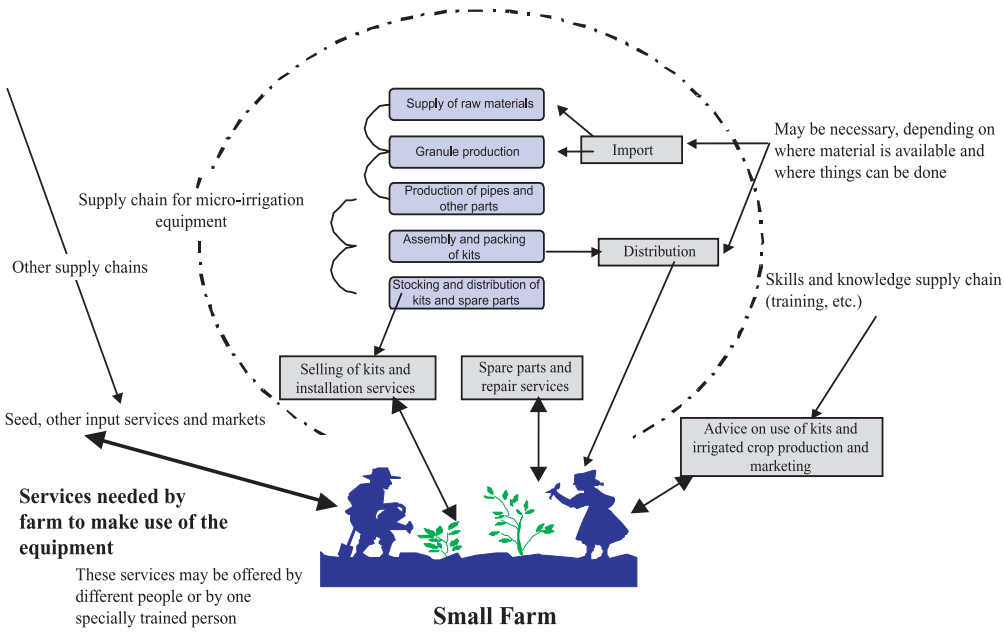
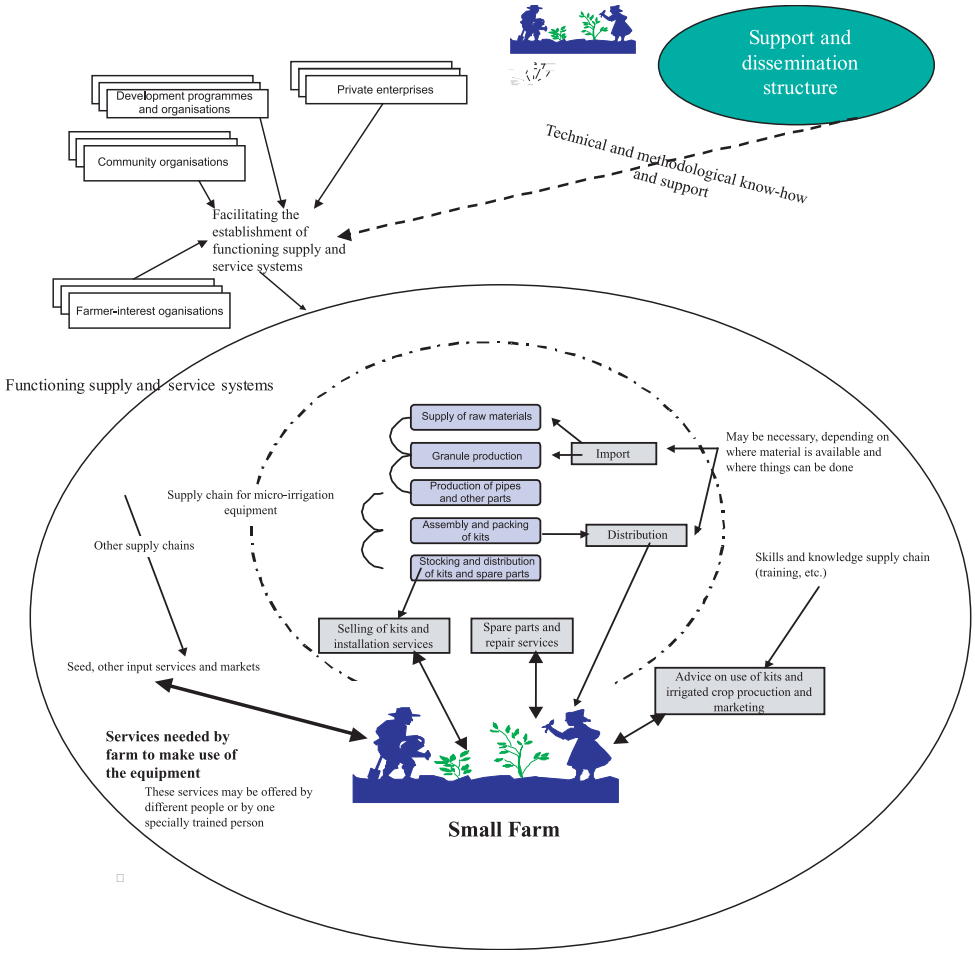


Figure 2. The challenge of supporting the establishment of viable supply and support systems for low-cost micro-irrigation.



2.4 "One size fits all" project designs

Unfortunately, most previous irrigation projects used a "one size fits all" type of technological solution. Typically, all participants received the same expensive European motor pump, regardless of the size or condition of their farm, and received the same chemical inputs, etc. Unfortunately, each farmer's situation is different, and the approach should be tailored to his or her circumstances. Even neighbours' farms can be vastly different, requiring different approaches and inputs. The ultimate result was that many farmers were coerced into borrowing money to pay for expensive, inappropriate solutions, and when they did not benefit after the technology failed, they felt little obligation to repay the loans.

Several factors combine to determine what technology is most appropriate for a given farmer, requiring a customised solution for each farmer, depending on various factors such as:

- The capital and operating costs of the equipment;
- The value and availability of water, land, labour and cash;

- Field topography, layout and soil type;
- Crop type;
- The nature of the water supply at the field edge;
  - Hand carried;
  - Gravity flow in a stream or other open channel;
  - Piped supply from a pump or other source;
- The technical skill of the farmer and his or her previous experience with irrigated farming;
- The farmer's access to equipment and spares;
- The availability of a market for irrigated produce;
- The quality of advice and technical support from government or private-sector extension services.

With so many factors determining what is appropriate irrigation equipment for a smallholder, it is impossible to identify one technology as the best one for everyone. Undoubtedly drip and sprinkler irrigation are the least expensive, entry-level technologies that have potential for adoption by resource-poor farmers, followed by treadle pumps. However, the exclusion of techniques such as buried porous pots or clay pipes, low-head and pressurised bubbler systems, or lay-flat pipe in place of open field channels, does not imply that these technologies are not appropriate in some farming systems, or that low-cost drip is a universal "solution" (Cornish 1998: 3).

2.5 Inadequate management information systems

Project designers frequently forget or overlook the importance of a high-performance management information system (M.I.S.) within any kind of credit programme. History shows that when the number of loans goes beyond a few hundred, control of disbursements and loan repayments tends to deteriorate rapidly, with the result that the programme goes out of control and usually fails, if there is not a good M.I.S. The lender absolutely must have daily, weekly and monthly listings of loans coming due and those overdue, so that loan officers and other staff can quickly follow up. When these reports are not available, lending programmes quickly get out of control, defaults rise dramatically, and lending and production targets are not attained.

Therefore, project designers should make sure to build in both sufficient numbers of computers and banking software licences for the foreseen volume of credit, branches, cashiers and back office personnel needing access to loan portfolio information.

Fortunately, we have within FAO access to state-of-the-art banking software. FAO developed the DOS version of its Microbanker software over a decade ago, and it is being successfully used in well over 1,500 financial institutions in every region of the world. This very capable software is already available in English, French and Spanish, as well as certain other European and Asian languages. Project designers should also not underestimate the effort it will take to train lending institution staff in how to use and exploit the software effectively. At a minimum, one should foresee an initial intensive training of key users for not less than 2 weeks, followed by a refresher course of a week to 10 days 6 months later. Those who have some experience with the DOS version of Microbanker know that it has a rather steep learning curve, and that it frankly is not the most user-friendly software in the world. Fortunately, a new, much more user-friendly Windows version is currently being tested in a variety of sites. MBWin is currently available only in English, but its new architecture facilitates its rapid translation into any language that Windows can use, and can, in addition, be simultaneously bilingual in two languages. French and Spanish versions will also soon be available, and conversions to other languages are not overly complicated. For budgetary purposes, project design officers desirous of using MBWin may wish to include its cost, as shown in Table 1.

Table 1. Price structure for Microbanker programme.

	Prices of Microbanker for Windows	
1	**SRTE Stand-Alone Version**	
	- Base Module (General ledger, customer maintenance, configurator, and take-on) and one application module	US$1,000
	- Additional application modules (Savings accounts, current accounts, time deposits, share accounts, and loan accounts)	US$250 each
2	**SRTE LAN Version (for Windows NT Server or Novell Netware)**	
	- Base Module (General ledger, customer maintenance, configurator, and take-on) and one application module	US$1,500
	- Additional application modules (Savings accounts, current accounts, time deposits, share accounts, and loan accounts)	US$400 each
3	**Site Licences**	
	- First 10 sites	US$800/site
	- Next 40 sites	US$600/site
	- After 50 sites	US$400/site
4	**The EXTE version** (user-customisable code), with unlimited number of site licenses, is also available, but most users will not need this.	US$75,000

Technical and pricing questions about MBWin should be directed to Mr. Ake Oloffson, AGSM, Rome (Ake.Oloffson@fao.org).

3. Difficulties linked to the beneficiaries themselves

The greatest constraint in this category is farmers' frequent ***pre-existing indebtedness*** to formal and informal lenders. Ideally, new irrigation loans should not be granted to those already over-indebted, but in the absence of credit bureaus in most African countries, it is frequently difficult to determine this before granting a loan, particularly if the lender is not located in the same community as the borrower. (This is a reason to try to use decentralised financial systems as much as possible – they know the local population much better). A related problem is the frequent inability of the proposed recipient of an irrigation loan to raise the necessary counterpart funds, typically from 10 percent to 25 percent of the total cost, as well as pay the increased farm operating costs after the installation of the new irrigation equipment.

In general, the almost systematic ***under-capitalisation*** of farmer-borrower farms renders them very vulnerable to the slightest unexpected event. In the case of the seemingly excellent farmer associations on the Senegal River, for example, using seven high-capacity motor pumps, borrowers had always been up to date in their payments to the lender. But when they started to exceed the capacity of the pumps, they all broke down. Since they had already spent all their available funds on operating costs, however, they could not repair the pumps, and the crops ultimately failed.

African farmers frequently seem unable (some would say they ***refuse***) to understand the mechanism of ***depreciation*** of fixed assets. Because the borrowers do not set aside funds for replacing the equipment at the end of their useful life, they end up at that point as dependent as ever on external capital. A phenomenon particularly widespread, but not limited to French-speaking West Africa, is that the cost of donated equipment is not factored into the price of whatever production results from that equipment, so that when it needs to be replaced, there are no funds to replace it. This phenomenon probably originates in the "hand-out mentality" that has developed, where farmers become convinced that, after all, they can get some donor to finance the next pump when the current one wears out.

Illiteracy, on the one hand, and lack of institutional ***organisation***, on the other, most often prevent farmer-borrower groups from maintaining adequate accounting records or even from properly filling out the loan application. As a result, these tasks are confided to third parties (teachers or children, typically) who do not have a personal stake in seeing that it is done right.

Lastly, the high rate of ***post-harvest losses*** (typically 20% or more for rice, 30% or more for tomatoes) before marketing the produce reduces the borrowers' income greatly, as well as their

ability to repay their loans. The lesson here is for project development officers to give serious thought to creating viable warehousing facilities, in addition to irrigation equipment to increase production and yields.

4. Difficulties caused by the lending institution

Although the distance from the lending institution or branch office to the borrower's village is not a great obstacle to disbursing the loan, it is often a major obstacle when payments come due, particularly in terms of the cost of transport and lost time, and the inability of a far-away lender to appreciate the borrower's problems. The farmer association reflects the ***average*** member, and not the condition of its most vulnerable members, who risk being marginalised, even forced to rent out their land, as in the case of Fouta-Djalon in Guinea in 1995 (LeBrun 1998: 6).

Most decentralized financial systems are chronically short of long-term lending funds which would permit them to invest significant amounts in medium- and long-term investments such as irrigation equipment. Project design officers, who are frequently under pressure to complete their project papers, often forget to verify the availability of lenders' funds. When the time comes to disburse the irrigation loans which had been promised to farmers, one discovers that the lenders do not have sufficient lending capital. Worse, after disbursing the equipment loans, one discovers shortly thereafter that there are insufficient funds to pay for operating-cost loans. The chronic shortage of lending capital is just another reason to prefer micro-irrigation equipment to more expensive, imported power pumps.

Finally, there is an increasing cacophony of competing rural finance institutions promoting their products. Because some competitors may have subsidised lines of credit, those borrowing from unsubsidised sources may object when they learn how little the competing institution charges. At worst, the borrower defaults, and at best he takes all his future business to the less-costly competitor, thus missing the potential benefits to both borrower and lender of a long-term relationship.

5. Difficulties caused by governments

The principal problems frequently encountered in this category include the inability of local authorities to assure an adequate legal and regulatory framework. Problems also include well-meaning but counter-productive usury laws or directives that interest rates on agricultural loans should paradoxically be lower than for loans to other sectors, despite the higher risk of default. Successful rural decentralised finance systems generally cannot survive on such artificially low interest rates, and the end result is that, instead of protecting farmers from "damned usurers", farmers end up having no access to loans at all. Other problems include government directives to "encourage" certain segments of the population, which may or may not make economic sense to the lender. Another major problem in much of Africa is the inability to pursue a delinquent borrower effectively and legally.

A common problem is also that government officials try to force lenders to grant loans to individuals who do not qualify for loans according to the lender's established loan policy. Accordingly, it is necessary to try to negotiate a clause stating that government will not interfere in a lender's decisions to grant or refuse loans to borrowers. Also it needs to be certified that loans will be granted exclusively on the basis of the merits of the borrowers' projects; their repayment capacity and their likelihood of repayment. Attempts to assure that financial decisions are taken by experienced financial personnel, and ***not*** by politicians are also recommended. Once politics enters the lending decision process, failure will not be long in coming.

A whole other class of problems is derived from deficiencies in the government's development policy itself, particularly when it accords insufficient attention to improving marketing channels (quality improvement through setting of standards, terminating ineffective marketing boards, creating sufficient feeder roads to isolated areas, etc.). The end result of these kinds of policy deficiencies is either to (1) dissuade producers from even trying to fully exploit technologies like micro-irrigation or (2) create a situation where even if production rises substantially, farmers have no place to market the extra production. Project design officers, too, must identify reliable marketing channels before proposing irrigation projects that may considerably increase production. Increasing production alone is not enough to assure the profitability of irrigation loans, and hence their ultimate repayment.

Another problem that is clearly attributable to governments, is their propensity to incur massive budget deficits that provoke high inflation and interest rates. Because of the low rates of return

typically applying to agriculture, these high rates greatly discourage farmers from borrowing and investing in their farms.

6. Difficulties caused by donors

Traditionally, the major development banks faced several obstacles in packaging small-scale irrigation activities into a loan package:

- The minimum loan size to justify the bank's investment in the entire project cycle is often too large for the needs of a national small-scale irrigation initiative. Because their projects had to be large in amount (typically US$25 million or more), the World Bank and other major international and bilateral donors focused principally on larger-scale systems, particularly the expensive mechanisation of large agricultural development perimeters, especially for rice production. Results with this approach have almost always been disappointing, for all the reasons already enumerated: lack of focus on market creation, use of overly complicated, expensive and uneconomical equipment imposed by bilateral donors, etc. Donors thus had a built-in bias against "thinking small."
- Small-scale irrigation is essentially a dispersed, local activity, whereas development bank funding tends to support centralised, large-scale investments or investments targeted at large institutions (e.g., national research and extension systems) capable of absorbing large tranches of funds.
- Traditionally, small-scale irrigation has depended on NGOs, CBOs or private companies to jump-start the process with training, demonstrations, loans, and mass communication campaigns. Development and commercial banks have traditionally focused on public-sector institutions.

Recent innovations in funding and country agreements have reduced significantly these barriers to funding small-scale irrigation initiatives. These new factors include:

- Technological advances, particularly in the area of developing affordable, small-scale water-lifting devices and drip irrigation systems;
- Governments, as the borrowing agencies, have been more amenable to passing on responsibilities and funding to NGOs or other local organisations to plan and implement development activities;
- There have been shifts in the policy environment, favouring private-sector initiatives and increased smallholder participation;
- Targeted micro-irrigation projects have been able to provide a package (training, funds, marketing assistance, etc.) to promote small-scale irrigation;
- Small-scale irrigation, where feasible, can be part of a larger loan package such as a larger water development or rural development project. Such projects often include investments to support other parts of the small-scale irrigation project business model, such as rural roads and marketing infrastructure;
- Heightened environmental concerns—in particular, concern for increasingly severe water shortages and for food security;
- Increased focus on poverty alleviation, achievable by increasing smallholder productivity through affordable small-plot irrigation;
- The emergence of viable market-creation approaches for smallholder development, and growing acceptance that the market creation approach is better than the failed subsidised approaches of the past, and growing commercial interest by manufacturers and irrigation consulting firms in micro-irrigation product development. Markets for smallholder irrigation technologies are, accordingly, evolving rapidly. For example, large irrigation equipment firms, such as Israel's Netafim, which previously were not interested in the idea, are now seriously developing equipment specifically aimed at smallholders in developing countries.

The Niger Private Irrigation Project, currently in the World Bank project cycle for 2001, represents many of these innovations in practice. The government has decentralised management of water resources to local communities and encouraged greater private-sector participation. The project combines tube wells with manual pumps, thus increasing project size, and includes funds for training, technical assistance and finance. An umbrella NGO will implement the project. Advice will include study tours, workshops, demonstrations, field trials, field days, and techniques to improve crop yield and quality. This work will be contracted to the Niger Association for Private Irrigation Promotion (ANPIP). The programme will also create savings associations; provide land-titling assistance for project beneficiaries; and assist local irrigation service providers. Total project cost is programmed at $33 million.[4] It will be interesting to see how successful this project is; doing "all the right things" will hopefully produce results.

7. Elements of reflection/lessons learned

7.1 Irrigation project design considerations

By this point, the reader would have noted that the author has made a number of pertinent observations on how irrigation projects or project components should be designed. First of all, it should be clear that projects should be designed and implemented with the full participation of the farmers most affected by them, and should not be hurried by project design officers in the faraway capital city or even foreign countries. The second major observation is that project design officers should not just see their jobs as increasing production or yields. The task at hand is much bigger than that. The "market development" approach presented above, and generally accepted by the donor community, now requires projects to take this approach.

So, yes, do take the time to figure out (with the farmers who will be using it) what is the most appropriate technological package, but in addition, you also now have to figure out who will manufacture the micro-irrigation equipment (importing is not a sustainable solution), how it will be distributed, how other inputs (seeds, seedlings, fertilisers, pesticides, etc.) are going to be delivered on time, from where financing will come and, finally, where the huge increase in production is going to be marketed. In short, you now have to take a systems approach to the design of irrigation projects and components.

Secondly, project design officers should make sure they have identified the real problem to be solved. Is it really low production or yields, or is it the large proportion of post-harvest losses and/or the farmers' inability to hold on to the harvest long enough for prices to rise? You may be able to increase local food production by 30 percent or more simply by creating storage capacity. Certainly farmers' incomes could be greatly enhanced if they can manage to delay the sale of their produce until later in the year when prices are higher. Accordingly, projects based on reducing post-harvest losses or warehousing of crops may be a more appropriate solution than an irrigation project or component. At a minimum, a post-harvest loss reduction component in your irrigation project would certainly complement and enhance whatever production and yield results are obtained.

Hopefully, the benefits of low-cost micro-irrigation technology (drip systems, low-pressure sprinklers, treadle pumps, rope pumps, etc.) are clear and obvious. They offer greater productivity and incomes for the masses, not just a few working on a single large irrigation system.

These low-tech micro-irrigation technologies do not work in all circumstances. If surface water is unavailable, or if pumping heads are more than 10 meters, none of the aforementioned technologies will work. In addition, intensification will necessarily require more costly solutions to the extent that power pumps must be imported. Project designers need to argue more eloquently the case to bilateral donors that expensive pumps do not represent responsible development, and that if they really want to help Africa to develop, then they should agree to finance the purchase of equivalent, but much less costly, power pumps from Asia. No matter where the power pumps come from, however, the project design needs to make sure that there are mechanisms built in to supply sufficient quantities of spare parts and backup pumps to replace temporarily pumps that break down. The project also has to somehow assure that there will be sufficient maintenance and repair capacity available to farmers. The absence of these latter features has doomed a majority of previous irrigation projects.

[4] The preceding discussion was inspired by World Bank, Winrock International and IDE, 2000, pp. 4-5 and 20.

Credit is not always the solution. In fact, if one accepts the premise that preference should be given to micro-irrigation technology over expensive power pump solutions, it follows that most African farmers probably don't need credit to purchase US$25 or US$50 micro-irrigation equipment. They can just buy them for cash. The problem is to create the manufacturing and distribution systems that make them available to the masses.

At this point in time, leasing is not a technology that can be definitely recommended as a sound approach. Ongoing experience with this approach in Mali and elsewhere, though, should be closely monitored, so that if successful approaches to leasing do appear, they can be replicated.

7.2 Credit supply and demand

The first recommendation in this area to project designers is that they should try to assure the objective of close proximity through the creation or support of one or more existing local DFSs (decentralised financial systems), such as a credit union, village bank or rural bank, through sensitisation of the population, capacity building and institutional development. The DFS thus created or strengthened has the considerable advantages of knowing the borrowers and is more able to monitor the loans closely than development project staff ever will. Of course, the project will have to abide by the DFS's overall credit policies and interest rate structure.

If the local DFS is a member of a federation, then it may be possible to negotiate considerable outreach to widespread sites where DFSs belonging to that network have been implanted. The federation may, as is increasingly the case, have a central liquidity, or rediscount, facility, that will be able to provide and manage the additional liquidity that the irrigation project may require. The federation may well help to negotiate, if necessary, with commercial or development banks, lines of credit that the rediscount facility can redistribute to its member DFSs.

It is becoming more and more common for DFSs to successfully mobilise large amounts of savings to lend their excess liquidity to other DFS networks (e.g., the case of FUCEC-TOGO). If there are no DFSs in the region where you want to implant irrigation technology, there are but two choices: (1) take a long-term perspective, and create the required DFSs, probably in collaboration with one or more existing networks interested in expanding into the zone or (2) choose a more propitious region already served by one or more networks of DFSs. Working with commercial banks, for reasons already cited, has in general produced experiences considerably less than satisfactory.

Detailed agreements will have to be negotiated with each federation, rediscount facility, bank or DFS. This is a time-consuming process that should not be minimised in the project document; if it is, the implementation of the project will fall behind schedule very early in the process. Fortunately, samples of previous agreements of this type can be used for inspiration.

A second recommendation is to make absolutely sure, in project design, that there is a definite and adequate source of funds for financing a considerable amount of medium-term irrigation loans. Most DFS networks will not have enough long-term funds, so they may have to be found from such sources as: capital grants through the project (although these are less and less attractive to donors); lines of credit from commercial or development banks, governments, central banks or even donors; or other sources (NGOs, etc.). Most African countries' banking systems have excess liquidity that can, in principle, be brought to bear, if properly negotiated, but that takes a considerable amount of time, something the busy project development officers are short of. But they have to find the time, because they need to negotiate all of the aforementioned during project design; if you wait until implementation, any significant snags will put the project way behind schedule, or cause it to fail outright.

Another increasingly relied-on source of long-term lending funds is, oddly enough to some, client savings. The war between those who claimed "it's obvious that the poor cannot save" and those, like credit union leaders, who claimed that "the poor can and do save", has been won by the latter. Most micro-finance specialists now acknowledge that the poor are able to and do, in fact, save considerable sums. Although there are many (especially proponents of the Grameen Bank approach) who still preach that it is "obvious" that poor people cannot save, and that it is necessary to "prime the pump," evidence now clearly shows quite the opposite, and most donors no longer are interested in hearing the tired old "poor people can't save" refrain.

The question is, therefore, no longer "do they save?" but rather how can we capture these savings and use them to finance development? The work of many micro-finance practitioners, especially the World Council of Credit Unions, shows that significant sums of savings can be mobilised from the poor. To attract a stable and rapidly growing pool of savings from such a population, you must pay positive real interest rates (i.e., greater than the rate of inflation, rates on such deposits being based preferably on "Consumer Price Index-Plus" formulae).

It is also frequently necessary to clean up the DFS's balance sheet, and write off defaulted loans and other accumulated "junk assets," as well as improve the services and image of the DFS through the introduction of modern methods and techniques, especially computerisation, modern loan-monitoring systems, and strict loan write-off procedures — sometimes a new coat of paint is really all that's needed. The combination of these measures frequently provokes a veritable explosion in savings growth, and the problem then becomes one of managing the DFS under the stresses of constant rapid growth (such as the need to double staff every year).

Another recommendation is to make sure that the term of irrigation loans is within the expected and useful life of the assets in the local environment (not in the environment prevailing in the country where it is manufactured). Past (and painful) experience has shown that many irrigation credit schemes' loan terms were too long, so that farmers continued owing money to the lender long after the equipment was already exhausted and retired. Experience shows that poor African farmers tend to over-use their expensive equipment in the hopes of maximising its output, but in doing so, greatly decrease its useful life. Accordingly, diesel and gasoline-powered pumps' repayment terms should in no case exceed 5 years. Electric pumps, where usable, tend to hold up better, and their terms can be stretched out to 7 or 8 years at the most.

Wherever possible it is necessary to build in a post-harvest loss-reduction component (probably involving warehousing). If an irrigation project succeeds greatly, and doubles or triples the production of rice or other crops, it does not necessarily improve the farms' profitability, if the increased crop results in a collapse of produce prices. A complementary warehousing scheme, in addition to letting the farmer store produce until prices improve, also permits him/her to reduce significantly the losses due to pests and humidity (typically around 30%) that occur in the absence of sound storage facilities.

To make this work, the lender has to be able to provide additional working capital loans during the period when the production is stored. Otherwise, farmers will be forced to sell at least part of their harvest just to survive, and thus will lose much of the benefit of increased production. The Nyesigiso DFS network in Mali has done this effectively by integrating the initial investment loan and extended working capital loans into a single package (LeBrun 1998: 8). Beyond just warehousing cereals or other produce, serious thought must be given to specify exactly how the increased production will be marketed at a profit. It does no good to increase production if it is unsold and rots at the farm.

Continue the tendency to rely less on formal guarantees. This does not mean complete elimination of hypothecation or reducing the lender's legal rights. Rather, because African legal and cultural systems frequently do not permit rapid resolution of conflict through the judicial system, lenders will probably be better protected from loss if they rely more on "joint and several" loan-repayment responsibility by borrower group members, through the creation of effective group solidarity and social pressure.

7.3 Institutional development

Good (or bad) organisation is usually a determining factor in the profitability of an irrigation project. If inputs are provided and applied on a timely basis, if borrower counterpart funds are collected on time, if the credit process is well thought-out, if there are replacement parts and back-up machines available, if there is a technically sound water management system in place, and if reliable marketing channels for increased production have been identified, most likely the project will succeed in increasing production and profits. When any of these elements are defective, the entire programme can suffer greatly. Accordingly, to succeed, project designers will be wise if they formally incorporate into their projects such institutional development activities as training, information services, assistance in improving the management of DFSs and their federations and refinancing bodies, and generally improving the degree of organisation.

Placing the overall responsibility for the management of irrigation rehabilitation projects directly in the hands of those concerned is a relatively new, but rapidly growing approach, and is perhaps best illustrated by the Asprodeb/PDPI project in Senegal. In that case, the farmer borrower associations themselves designed their projects and, with the assistance of their federation, their local lender obtained credit (and sometimes subsidies) accordingly through the CNCAS.[5] This type of approach, based on true, meaningful participation of beneficiaries in the design of their projects, is much more likely to succeed than "one size fits all" projects designed by hurried project designers and technicians "on farmers' behalf" in faraway capital cities. It permits the flexibility to custom-tailor a loan to a particular farmer's (or farmer group's) circumstances and needs. If it fails, the farmer can no longer blame the project or the lender, claiming that they made him or her do something he/she did not really believe in (LeBrun 1998: 8).

In the same vein, the concept of "twinning" between borrower groups that have already successfully borrowed monies for irrigation purposes and those who are just starting the process, is becoming an increasingly popular and effective measure that goes a long way towards assuring the proper application of project resources. This approach was successfully used in the ACODEP[6] project in Mali, particularly in the transition from monoculture to more intensive cultivation and polyculture.

Using this technique, those who have already benefited from the first interventions train those just starting, thus creating a spread effect ("tâche d'huile" in French). Twinning activities may be solidarity-based or may be paid by the receiving parties. They have the additional advantage of creating a peer-to-peer self-help group that can help each other when difficulties arise. Known types of problems can then be quickly resolved, instead of waiting for far-away project or technical officers to come resolve the problem.

While it is strongly urged that project designers make greater use of local DFSs, it is also important to warn that financial activities should be strictly separated from non-financial activities. For example, a village may have a strong village association that is well organised and is significantly improving life in the village. They are doing many worthwhile activities, but up to this point, they have not been involved in lending. The appendage of a financial "window" to such an association is usually a formula for disaster. Management and accounting organisation are almost never adequate to know which activities are profitable and which are not, funds get commingled and are often embezzled. Accordingly, it needs to be made sure that any village financial schemes' funds and accounts are completely separate from non-financial village operations. It is quite possible, and even very common, that the officers of a village association are also the officers of the local DFS; but they must be able to separate these functions in their mind, and keep the funds quite distinct from one another.

7.4 Policy considerations

In a market economy, the role of the State is focused on regulation, creation of infrastructure, and promoting and creating incentives. Four aspects of the State's contribution seem imperfectly mastered at this time in most African countries, as has become clear from a series of FAO (AGSM[7]) workshops in recent years:

- Firstly, governments are still too prone to offer subsidies to "encourage" a certain activity. The distortion caused by subsidies has frequently an effect quite the opposite of that intended. The fact that most African development banks, with their heavily subsidised interest rates, have now disappeared is eloquent testimony to the bankruptcy of that approach. So are the perverse effects of central banks' attempts to make financial institutions charge lower interest rates on farm loans than on those to much less risky sectors.

[5] Caisse Nationale de Crédit Agricole du Sénégal.

[6] An irrigation project in Mali jointly executed by UNDP and ILO.

[7] The Marketing and Rural Finance Service of the FAO's Agricultural Support Division.

- Secondly, as previously indicated, governments may sometimes try to intervene too far, overstepping the bounds of their legitimate duties of safeguarding depositors' interests and assuring an adequate food supply to the country's population throughout the year. To forestall harmful interventions of this type, project design officers would do well to negotiate clauses with governments requiring that they do not interfere in lenders' loan-granting decisions, do not declare loan-repayment moratoriums, nor take any other actions inimical to the success of the lending programme. The ability of lenders to operate without political interference is of fundamental importance to project success. If loans are granted because of political pressure, both the project and the lending institution will be in jeopardy.

- Thirdly, while many countries, especially those that are members of the UEMOA,[8] have made important strides in improving regulations, most still have a long way to go to assure effective prudential control. All countries need to intensify efforts in this area, particularly by clarifying current grey areas. The aim should not be to gain control of DFSs, but rather to assure the public that funds deposited there are reasonably safe.

- Fourthly, largely as a result of the micro-finance "movement" these past few years, many innovative financial institutions and financial service products have appeared. However, many other lenders still rely heavily on traditional practices and products, which are more appropriate for the commercial banking sector than for development finance. All governments need to gently push those involved in development finance to adopt more appropriate institutional forms and financial service products. The IDA of the World Bank Group has developed useful training sessions for local leaders on mastering this type of negotiations.

Finally, the author would like to recommend that the State use its powers of persuasion to sensitise borrower groups and their lenders of the need to create a progressively increased self-financing capacity over time, so that the subsidisation of irrigation equipment can be phased out. This is particularly important for the irrigation sector, given the frequently high cost of the initial investment and most governments' declining ability to support this type of subsidy. As we all know, subsidisation also attracts influential opportunists who frequently benefit from such programmes more than those originally targeted. If we let the market rule, such influential people will not be so attracted.

8. Summary of conclusions and recommendations

In most African countries, there is sufficient liquidity within the banking and DFS sectors to finance all foreseeable irrigation needs. The problem is not one of lack of financial resources, but rather of identifying a sound way of accessing and using them, which will inspire the confidence of those responsible for their management. This paper has attempted to provide some guidance on how to create that confidence through the conception of sounder irrigation projects.

The following "Ten Commandments" of irrigation finance summarise the guidelines for developing such sounder projects:

1. At the project identification stage, make sure to identify correctly the farmers' real principal problems, before attempting to design the most appropriate solution. While this sounds obvious, in reality many problem statements are incorrect or inappropriate in great part because the participatory process has been short-circuited. Make a concerted effort to determine whether the main problem is one of "low production and/or yields," or whether it is huge post-harvest losses (PHL). If PHL is large, consider an initial project or phase that specifically addresses PHL. This will improve farm profitability so dramatically that there is a good chance that farmers will be able to self-finance most, if not all, of the second phase (micro-irrigation) of the project, or of follow-on projects.

[8] Union Economique et Monétaire Ouest-Africaine : West African Economic and Monetray Union.

This would be particularly true if the project design is based on leasing (straight or lease-purchase) irrigation equipment, rather than outright purchase. For more information on proven solutions for PHL, see the FAO publications "Warehousing and Inventory Credit" and the "Manual on the Establishment, Operation and Management of Cereal Banks." These books are downloadable for free from the FAO and are available in booklet form for a nominal fee.

Corollary No. 1 is that project design officers should not short-circuit the participative process; those most affected by the design must be intimately involved in it from the outset. Corollary No. 2 is to abide by the principle of K.I.S.S. (Keep It Simple, Stupid!) during project design, and adopt the technical solution that is least complex (and probably least expensive), consistent with accomplishing project objectives.

2. Recognise that credit is not always, not even in a majority of cases, the most appropriate solution. If numerous inexpensive, locally-manufactured treadle pumps will do the same job as an expensive European motor pump, selling them outright for cash is definitely better and will save many problems resulting later on from credit programmes, particularly from the high defaults typically experienced when using expensive irrigation equipment.

   Similarly, during project design, give serious consideration and allocate time to identifying possible local manufacturers and/or retailers of required irrigation equipment. Maybe the "poorest of the poor" will not benefit directly from the project, but production and profitability will almost certainly improve considerably, and the very poor will still probably at least benefit from the need for additional labour to run the more mechanised and/or larger farms.

3. If, after the above precautions, you still opt for a credit programme or component, make sure that a sufficient quantity of long-term funds is available to finance the projected volume of irrigation lending**.** Do not leave the details of this component as something whose details "will be worked out by project staff during implementation." This is an essential component, and you must be reasonably sure that the funds will be available; because their eventual non-availability would jeopardise the entire project.

   Corollary 1 is that experience so far with loan guarantees has tended to encourage poor performance by lenders, since the latter will recover their capital whether they perform well or not, and hence you should avoid loan guarantee schemes, if at all possible. Corollary 2 is that there is currently insufficient information to support leasing of irrigation equipment as a valid approach, although efforts in this direction in Mali and elsewhere need to be closely monitored to identify sound new approaches.

4. If, despite points 1 through 3 above, you still decide to propose the use of complex, expensive irrigation equipment installations, then use a rational approach to procurement. First, make absolutely sure that there will be sufficient spare (backup) machines, spare parts, and competent, readily available repairmen when pumps break down, as they certainly will. Secondly, make sure to use the most appropriate and cost-effective equipment available to carry out project activities, and not necessarily those preferred by donors, especially in bilateral programmes.

   Often it will be better to introduce an inexpensive technology that is only slightly different from previous practices. Experience shows that radical changes (e.g., from the hoe to tractors or animal traction, and from hand sprinkling to motor pumps) very frequently fail. Purchasing unnecessarily expensive irrigation equipment in the donor's own country is not a sustainable approach. Where surface water and local water tables permit, always opt for micro-irrigation technology, since it potentially can positively affect millions of farmers, not just a few on a big irrigation system.

5. If you still decide to include irrigation credit in your proposed project, try to rely more heavily on the increasingly ubiquitous networks of Decentralised Financial Systems, as opposed to the formal banking sector. (However, since a number of commercial banks

are beginning to be interested in rural finance, at least on a wholesale basis, to proven micro-lenders, do not automatically assume that banks are not interested in micro-credit). DFSs are likely to be located in much closer proximity to the targeted farmers, and are better able to tailor loans to fit their needs, as well as to monitor the loan effectively.

Focus more on the DFSs' institutional development and less on the provision of lines of credit. Project designers do a big disservice to partner DFSs if they overwhelm them with large sums of external "cold" funds relative to their own, locally-mobilised "hot" capital (i.e., savings). Also, don't let the irrigation loan portfolio overly dominate the DFSs' other loan portfolio segments, because to do so would create too much covariant risk. If, despite all the advice provided in this document, you opt for an expensive, imported, power pump-based intensive agriculture, it would be better to work with a bank than to drown local DFSs in foreign money. Too much easy money has already been the ruin of thousands of rural finance institutions around the world.

6. If it is definitely determined that credit is essential to the project, do not spoil local financial markets by building a cheap credit "window" into the project organisation itself using subsidised (less than market) interest rates. Instead, let professionals in successful local RFIs, DFSs and banks manage the entire lending process according to their own policies and procedures, which have stood the test of time. Never try to "force" the lender to grant loans that the applicant is not qualified for according to the lender's established criteria.

   If you decide to "do it yourself" within the project, recognise the high probability of failure and, development-wise, a 100 percent certainty that you will fail to leave an institution that can carry on when your project ends.

7. Farmers must be called upon to self-fund increasing proportions of their irrigation projects, i.e., they must learn to depreciate their fixed assets properly and provide for their eventual replacement, instead of seeking a new loan to finance a replacement pump every 4 or 5 years. Remember that a development project may help farmers finance their first pump, but it is up to the borrower to finance its replacement when the first one must be retired. A corollary here is that the term of the loan (or lease) should correspond to the expected useful life in Africa, not in the equipment's country of origin.

8. Lenders must do a better job of learning from each other, and continue to adapt their products to the specific needs of farmers involved in irrigation. Encourage full participation in the networks of micro-finance institutions that now exist in nearly all African countries. Build in study tours abroad for key personnel to successful irrigation finance programmes. At the client level, try to integrate twinning programmes whereby experienced micro-irrigation clients are associated with those just joining the programme; this has been proven an effective way to spread micro-irrigation technology and techniques.

9. Don't just focus on using irrigation technology to increase production. Re-orient the whole approach to market creation and institutional development. That is, recognise and build in the upstream manufacturing and distribution of micro-irrigation equipment, the inputs (seeds, seedlings, fertilisers, pesticides, small tools, etc.) supply chain, the necessary mass marketing required to make the product a household name, as well as the forward linkages (processing, storage and market outlets). For farmers to benefit truly, it is not sufficient to double or triple production; the product has to be sold without glutting the market. The latter must be addressed during project design. If it is left until implementation, and markets are not found, then time, effort and money would have been wasted.

10. A good M.I.S. is essential to any credit programme. Accordingly, project designers should build into the budget sufficient numbers of licences for a capable M.I.S. such as Microbanker for Windows (MBWin), sufficient computer equipment, and sufficient training for the expected number of users. If, despite all the accumulated evidence and the

advice presented in these ten commandments, you still decide to go it alone and have project staff, instead of DFSs, manage an irrigation credit programme, the M.I.S. commandment is doubly true. In fact, having a good M.I.S. will likely be your only slight hope of success.

A number of current projects are researching these issues in search of effective solutions. Let us continue to learn from these and share from each other's experiences through networking.

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