8. Irrigation Cost Study in sub-Saharan Africa (World Bank and IWMI)

BACKGROUND AND JUSTIFICATION

Understanding the issue of initial capital investment requirements is a key step in removing obstacles to irrigation development and achieving food security in sub-Saharan Africa (SSA). High irrigation investment costs coupled with declining world prices for food and the failures of many past irrigation projects have made donors and governments in sub-Saharan Africa understandably reluctant to invest more resources in the sector. Evidence from Asia suggests that the decline in world rice prices and increasing real costs per hectare of new development contributed to the decline in lending for irrigation by international agencies (Rosegrant and Svendsen 1992; Aluwihare and Kikuchi 1991). In addition, high investment costs result in low rates of return for new irrigation construction (Kikuchi, Maruyama, Hayami 2003; Rosegrant and Svendsen 1992; Aluwihare and Kikuchi 1991) and diminished poverty reduction impact of investments.

Earlier reports on costs of irrigation focusing on sub-Saharan Africa includes FAO (1986) and van Steekelenburg and Zijlstra (1985) followed by a number of other assessments until the mid 1990s (Aviron, et al. 1991, Brown and Nooter 1992, World Bank Operation Evaluation Department 1994, several World Bank Technical Papers). These studies all reported high per hectare capital investment costs of irrigation in sub-Saharan Africa relative to north Africa and the rest of the world with only a few exceptions. A 1994 Review of the World Bank's experience with irrigation between 1950 and 1993 suggested that irrigation investments in SSA averaged more than US$ 18,000 per ha, over 13 times the South Asian average. What is clear is that costly investments are unlikely to deliver positive economic returns – particularly if they are to be used for the production of food crops. Yet, FAO estimates that much of the future increase in the demand for food crops will have to be met from increased investment in irrigation or water management.

Various reforms have been implemented since the mid 1980s to early 1990s which include reducing government involvement while encouraging greater private sector participation in various phases of the irrigation project cycle, irrigation management transfer, partial to full cost recovery, and shifts of focus from large-scale, resettlement irrigation projects to small-scale, simple irrigation schemes. National level reforms include structural adjustment programs in the early 1990s implemented in many SSA countries (Brown and Nooter 1992, World Bank-OED 2000, Wobst 2001) as well as changes in institutions and even changes in (types of) governments. There are reasons to believe that some changes in the factors that determine and drive irrigation capital investments costs must have occurred in the span of almost two decades.

In addition, it is still not properly established whether costs in SSA are significantly more expensive than in other regions. A good understanding of components and factors contributing to costs would be instructive. A number of explanations on why investments in agricultural water development in SSA maybe more costly have been advanced. These factors have something to do with the relative quality of appraisal and feasibility studies, implementation capacity, use of inappropriate technologies and cost ineffective design (resulting in some cases from past policies of developing irrigation at any cost), possibly more limited competition among contractors, more focus on construction of new schemes rather than rehabilitation of existing infrastructure which is the case in Asia, and failure to realize the potential of alternatives to conventional irrigation in water management. Other

explanations have been offered which include: (a) higher proportion of investments allocated to appurtenant infrastructure; (b) higher mobilization costs due to more remote projects; and (c) higher construction input prices (including higher costs of labor, materials, and equipment; and lack of qualified local contractors) among others. Examination and resolution of these and other possible reasons is essential if water management investment costs are to be meaningfully reduced and more investments to be attracted to the sector in order to meet food production targets.

OBJECTIVES AND SCOPE

The specific objective of this study is to address the question of whether per hectare investment costs in irrigated agriculture in sub-Saharan Africa are really high and determine factors contributing to costs. And if indeed costs are high taking into account various considerations (typology of irrigation projects, crops irrigated, and expected benefits), identify ways and opportunities to reduce costs. The overall goal to which this study aims to contribute is to help reverse the declining interests of donors and national governments in irrigation development by reducing initial investment requirements for water development in SSA.

This component will examine major multilateral donor (World Bank, ADB, IFAD) funded projects and where possible also those funded by national governments and bilateral donors. Various types of projects from the 1980s to the present will be examined. Irrigation investment costs will be examined across various types: (1) type of headworks and distribution system (reservoir-based or run-of-the-river, gravity-fed or pumped-based); (2) water source (surface vs. groundwater); (3) new vs. rehabilitation project; (4) privately vs. publicly funded project; (5) whether implemented by public agency or private contractor; (6) inclusion of other physical and social infrastructure; and (7) type of crops (rice vs. non-rice – horticulture crops, other cereals, etc.).

METHODOLOGY

Relevant and comparable data need to be collected from past irrigation investments that would allow for testing of the above hypotheses. For example, a low number of bidders and high average mobilization costs would probably suggest a high percentage of foreign construction companies responsible for execution of works, and would thus support the hypothesis that lack of adequate local outfits underlies the high investment costs. To have more comparable data, project completion and evaluation reports as well as appraisal reports from various donors (World Bank, ADB and IFAD, where data will be available) will be used. Bills of quantities will also be used to allow comparison of unit prices of construction inputs. These data will be analyzed taking into account the crops that were irrigated, the project expected and realized benefits, and types of irrigation projects over time, within and across regions. Where data will be available, costs of operation and maintenance will also be included in the analysis.

The methodological steps are detailed below:

- In consultation with the partners to this study, develop an analytical framework, set of specific research questions, working hypotheses and the respective data sets needed to either confirm or refute them that will guide the study. Consultants and peer reviewers will be used to finalize the proposed study framework. This step is considered to be important, as the common and agreed framework will enable more systematic comparison of cases and testing of hypotheses.

- In consultation with the other partners, select specific investment cases for which there are reasonably good data available from ex-post facto evaluations, and analyze these cases in detail (using the analytical framework) to understand what has been the investment experience and the outcomes, and what are the reasons identified for these outcomes. A small sample of Asian cases will also be included for comparative purposes (drawing on work being done currently by IWMI under a "Pro-Poor Irrigation Investment Project" funded by the Asian Development Bank). Detailed financial and other performance assessment reports will need to be available for these cases. The cases may include both "successful" and "unsuccessful" projects. The study partners are expected to assist in identifying these cases and making material available to the researchers.
- Encoding and analyses of data from various project reports and documents (completion, evaluation, appraisal, bill of quantities) will constitute the bulk of comparable data across regions and within SSA. Where possible interns and national research staff will be utilized to carry out the data encoding tasks and the study team with the help of some consultants will do the analyses. This part will come out with a project cost characterization and help establish general patterns and major components of costs over time, across projects, regions, and within SSA. In addition, this part will allow a comparison of input unit prices also across projects, countries, regions and over time. The case studies will then focus on providing a deeper understanding of the factors contributing to costs.
- Where possible both quantitative and qualitative analyses will be applied to all data that will be collected. Specifically, the study will establish and link trends and patterns over time and by type to macro environment (macro policies and institutions, physical, socio-economic and political, and project level parameters); establish relevant correlations; and carry out quantitative analyses to determine impact on investment costs. The proximate variables in this study which are also influenced by the macro variables are the input prices and irrigation project outputs. The impact of these variables on investment costs shall be quantitatively determined where data would allow it.
- The results of the overall analysis and the case studies will enable testing of the working hypotheses. This will also enable dismissing some of the hypotheses.
- A draft report will be prepared setting out the results and preliminary recommendations. A workshop, either independently or together with the other Collaborative Program components, which will include representatives of the partners, specialists, and selected policy makers will be held to test, refine and expand the draft report into a final report.

Conceptual Framework

First, we define capital costs of irrigation[4] to include all expenses incurred in developing and establishing irrigation systems or perimeters beginning with design and planning up to implementation and completion of the project just before the start of regular operation. Irrigation costs vary over time and space[5]. They vary by type of irrigation projects – type of

[4] Irrigation is broadly defined using the FAO (1995) definition as any water management system that is equipped with hydraulic structures including wells, drainage, and flood protection. A full control system implies ability to apply or remove water from crops in optimum quantities as required by crops. This is distinguished from the broader concept of 'water management' which is defined as any kind of human action that influences the natural flow of water to farmers' crops ad therefore includes irrigation, or any form of agriculture that takes advantage of naturally rising or falling water levels for crop production. Following these definition, IFAD (2000) infers that irrigated areas include: (1) fully or partially controlled systems including areas having only drains or flood protection structures; (2) traditional spate irrigation systems with partial control only; and (3) equipped wetland or valley bottom systems. IFAD defined "other" water managed areas to include traditional systems such as (1) wetlands and valley bottoms that are cultivated without irrigation equipment; (2) receding and advancing flood planting areas; and (3) inland and coastal swamps and flooded depressions.

[5] Overtime, project components vary due to advances in technology, changes in project requirements to better respond to changing environment (e.g., incorporation of environmental impact assessment in projects with increasing awareness for

headworks and distribution system and if with or without dam or reservoir, if the system works by gravity or pumped-fed; by water source - surface vs. groundwater; whether they are new or rehabilitation works; whether privately or publicly funded; whether construction is implemented by the private contractor or public agency, or mixed; and inclusion of various components such as training (of farmers/operators) and physical and social infrastructure such as roads, electricity, domestic water, health centers/clinics, and schools. To establish whether irrigation costs are high or not, there is a need for a reference point: (1) one would be a global or regional or sub-regional or even a country average or the average for other regions or sub-regions or countries; or (2) the other possible reference point would be some established or estimated "standard" cost for major types of irrigation investment. In this study, we will be mostly using the first type of comparison but where possible will attempt to do the second comparison.

The determinants of costs can be grouped into three classes: (1) macro policies and institutions, physical, and socio-economic and political factors constitute the setting in which projects are developed and implemented and which also influence input prices as well as the final output both indirectly and directly; (2) project parameters are those which are within the direct influence of the implementing agency and the donor funding the project and where consultants and contractors also play major roles and; and (3) the input prices and output of the irrigation project (type and size) which are more like the transmission mechanisms for the macro policies and institutions, physical, and the socio-economic and political factors to influence per hectare costs. Changes made at the macro environment through specific policy recommendations (and institutional innovations) will impact on project formulation, design, and implementation as well as on input prices, and final outputs. In turn, input prices and the irrigation project output parameters will impact on final per hectare cost of investment in SSA. These are further elaborated in Annex 8.4.

ACTIVITIES

Since the study has already completed the review of literature and a large part of World Bank project data entry and processing, it will proceed with collection and processing of other donor project data. Visits to the ADB and IFAD will be scheduled. With completion of data compilation, both qualitative/trend and/or quantitative analyses will be applied to the respective donor data and/or pooled data. With an FAO on-going study on irrigation costs, this component will examine the extent of consistency of the two datasets and possibility for pooling if not joint or enhanced data analyses.

Two 'exploratory' case studies for Kenya and Ghana have already been completed. Given budget, two or three more cases will be implemented in SSA. Two case studies in Asia will also be completed. This activities will involve finding good collaborators/consultants in chosen countries for the case studies. We are considering getting case studies for Tanzania and Niger depending on the final cases of the other components.

Following the completion of case studies, an integration of the main report and case studies will be done. This report will constitute a final report for integration with the other components for the overall synthesis. A database of irrigation costs will be prepared for sharing with program partners.

Annexes 8.2 and 8.3 provide further information on the tasks and milestones.

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worsening environmental damage), among others.

SYNERGIES

This component will complement well and serve as an input into the other investment study components, i.e., planning and implementation, poverty reduction, health and environment, livestock, and the private sector study.

Better understanding of components and determinants of investment costs of water management and development will contribute to better planning and more cost effective projects. It may even allow analysis of tradeoffs between project costs and more effective planning and implementation if the latter may require greater participation and inputs by the various types of decisionmakers which can mean higher project costs. The especially close linkages to the Planning and Implementation study are clear.

This cost analysis may allow better targeting of the poor given knowledge of their resource base and what can work and not work for them. With reasonably cost effective projects, governments and donors may manage with a full capital contribution for the zero resource-based farmers if the investment will take them above the poverty line. So, this study will benefit from the poverty reduction component and vice versa.

As suggested in the health and environment study, it will be interesting to examine the project cost implications of environmental impact and health impact assessments and how much costs are a constraint in including mitigation measures in a water development and management projects.

The findings of the cost study may contribute to formulation of better private sector incentives by the government which will include not only improved policies and institutions but even nominal investments to pump prime or mobilise private sector resources.

To bring about more synergies between the different components of the investment study, where possible, common projects will be selected and analysed in the case studies.

OUTPUTS

The outputs of the study will consist of the desk and case studies which will be synthesized into a main report on trends and determinants of costs of water development in SSA. A database on irrigation development costs will be prepared in a format which will facilitate use by the program partners. The main report will include: (a) establishing whether per hectare investment costs in water in agriculture in SSA are high; (b) factors contributing to costs or determinants of costs and reasons for high per hectare costs; (3) ways and opportunities to make investments more attractive by reducing per hectare investment costs.