ANNEX 8.1. Logframe

Intervention Logic	Objectively Verifiable Indicators	**Means of Verification**	**Assumptions**
Overall Objective To catalyze increased investment in agricultural water use for poverty reduction, food security, and economic growth in sub-Saharan Africa.	Increased levels of investment in agricultural water use in SSA.	Annual reports by donors and governments. National and regional policy documents. National statistics	
Immediate Objective To is to address the question of whether per hectare investment costs in irrigated agriculture in sub-Saharan Africa are high, identify factors contributing to costs; and where costs are indeed high, identify ways and opportunities for reducing these costs.	Set of clear recommendations on ways to reduce costs and to help reverse declining donor interest in irrigation development and investment.	Final Report.	Investors willing to invest in good projects. Water use for agriculture investments will give good returns. Cost-effective opportunities do exist.
Outputs 1. Qualitative and quantitative analyses of reasons for high cost per hectare of irrigation establishing whether costs are high & corresponding reasons 2. Completed case projects in SSA (plus Asian cases analyses) 3. Concrete recommendations on specifically ways to reduce irrigation and make investments in irrigation in SSA more attractive 4. Recommendations for any necessary follow-up research.	Studies and sub-studies completed.	Periodic progress reports and Final Research Report	Data available for the analyses Governments will be responsive to recommendations made and strategies proposed. Funds will subsequently be available
Activities 8. Framework development and refinement 9. Literature search and review 10. Encoding & analyses of data from the World Bank, IFAD, ADB 11. Case studies and analyses 12. Preparation of recommendations and strategy formulation	Accepted study framework Bibliography and citations Tables and analyses Contribution made/relevance to overall study Implementable strategic guidelines	Study report Periodic reports and Final study report Study report Final Study Report Final Study Report	Appropriate consultants can be commissioned. Adequate relevant material available. World Bank, IFAD & ADB data can be made available. Representative cases available. In-country commitment and cooperation. Commitment to strategic thrusts

ANNEX 8.2. Tasks and Staff Time Allocation

Task	Subtask	IWMI Staff and Time (d)	Consultant (name, cost)	Output/Method/ REMARKS	Links with project
1. Literature review	Collection of published and unpublished literature from IWMI and outside	AI HS DM		- establishing costs trends - a definition of irrigation investment costs - determinants of costs Draft report already submitted to WB and shared with some partners	
	Search for other similar and existing data sets on costs (AfDB, IFAD?)	AI 10 d	Junior consultants $1k	Determination of comparability of data	- on-going FAO cost study
	Development of framework of analysis	AI HS DM		Draft framework already submitted to WB and shared with some partners	
	Asian experience	DM 1 d IH 1 d RXB 1 d MS 1 d	Consultant: MK- $5k	Draft report already submitted to WB and shared with some partners	Past, recent past IWMI studies for Sri Lanka and the Philippines by MK et al., IH, etc.
2. New knowledge	-Establishment of trends of comparable costs per hectare by region by type of project -Project database on relevant parameters/variables	AI 10 d HS 5 d DM 2 d	Consultants: junior $2k MK		
	Additional case studies for SSA	AI 15 d HS 5 d	Consultants for 2 case countries - $8k		
	Asian case studies	DM 1d IH 0.5 d RXB 0.5 d MS 0.5 d	Consultants: NIA - $1k, MK		
	Compile case study data and add to overall database	AI 3 d	Junior consultant - $1k	Case study reports Additions to database	
3.Recommenda-tions to governments, investment banks	For public sector action & Facilitate donor response	AI 3 d HS 4.1 d DM 1 d IH 0.5 d	MK	Final component report and contribution to synthesis report	Link with other investment study components

		RXB 0.5 d MS 0.5 d			
4. Coordination	Project coordination	AI 2.4 d		Final component report and contribution to synthesis report	
	Final Workshop				
Total					

AI = Arlene Inocencio 43. 4 days
HS = Hilmy Sally 14.1 days
DM = Doug Merrey 5 days
IH = Intizar Hussain 2 days
RXB = Randy Barker 2 days
MS = Madar Samad 2 days

68.5 days

MK = Masao Kikuchi $5k package (IWMI Fellow)

ANNEX 8.3 Gantt Chart

			Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04
Task	Description	Key person	1	2	3	4	5	6	7	8	9	10	11	12
1	Inception	AI												
milestone	Inception report													
	Review and feedback by WB & WG	WB & partners												
2	Desk review	AI/HS												
milestone	Desk review report													
	Integration of desk review with other components													
	Review and feedback by WB & WG	WB & partners		??			??							
3	Case studies	AI												
	Add 2 more SSA case studies	AI /HS/ Consultants												
	Write Asia case studies report	AI/ MK/ Consultants												
milestone	Case studies report													
	Review and feedback by WB & WG	WB & partners												
4	Cost Study component	AI												
	Donor data analyses	AI/HS/Junior consultant												
	Synthesis of results of Asia case studies	AI/MK/DM/IH/RXB/MS												
	Synthesis of results of SSA case studies	AI/HS/DM/ Consultants												
	Integration of all results	AI/ HS/DM												
milestone	Full component report													
	Review and feedback by WB & WG	WB & partners												
5	Contribution to overall project synthesis	AI/ HS/DM												
milestone	Draft synthesis report													
	Workshop with key stakeholders and WG													

	Contribute to final synthesis report													
milestone	Final synthesis report													

☆ - milestones AI - Arlene Inocencio; HS - Hilmy Sally; DM - Doug Merrey; IH - Intizar Hussain; RXB - Randy Barker; MS - Madar Samad; MK –Masao Kikuchi

ANNEX 8.4 More Details on the Cost Study Framework and Hypotheses

Study Framework

Macro Environment

Policies and Institutions. Monetary and fiscal policies. Among the earlier reasons cited as contributing to high per hectare cost of investment are overvalued currencies as well as incorrect or over optimistic projections of inflations. Many African currencies are still overvalued despite the restructuring that was implemented in many of these countries in the early 1990s and overvalued currencies inflate all costs in dollar terms (Rosegrant and Perez 1995, World Bank-OED 2000). This factor may not be as relevant however, if we note that in the 1990s shadow pricing may have been applied to correct for this distortion. Drastic inflation on the other hand, has escalated costs of irrigation projects as input prices increase (Moris and Thom 1990; Rosegrant and Perez 1995). Taxes and tariffs on inputs have also been cited as contributing to higher prices. High import duties (taxes on imported inputs) especially in a setting where substantial irrigation inputs are imported for lack of local markets can substantially raise per hectare costs of irrigation establishment.

Several studies (FAO 1986, Aviron Violet, et al. 1991, Rosegrant and Perez 1995) noted the policy of using tied external funds to build irrigation and cover administration costs, which require use of 'orphan' technologies and/or the purchase of nonstandard equipment with special maintenance and spare parts needs, has escalated cost of irrigation investment.

Fiscal policies that have to do with expenditures such as procedures for procuring or hiring consultants or contractors can indirectly impact on per hectare costs of investment. Specifically cited in the literature is the use of foreign consulting firms which are at least twice as costly as local firms and can contribute about 2 to 4 percent more to the cost. Note however that governments and donor may even have the intention of providing opportunities for local or national consultants or contractors through use of price preference in international competitive biddings. The problem seems to be that local capacity, both technical and financial, remains low. Also, there may be reluctance of the governments/donors to use or support the private sector for it to become competitive. It appears that without partnering with their foreign counterparts, local private consultants or contractors just cannot compete.

Another concern related to use of foreign consulting firms is their tendency to install 'superfluous' design precautions and exaggerated safety measures in civil engineering to protect or maintain their reputation while irrigation agencies are technically incompetent to argue against the consulting firms' views.[6] Another weakness of foreign consultants is their lack of local experience to be able to take advantage of local and indigenous knowledge and materials which may reduce investment requirements for irrigation (Aviron Violet, et al 1991).

Government regulations such as labor and price regulations as well as safety and environmental regulations make private contractors wary or concerned on their nature, unpredictability of their implementation and consequent changes. Under this environment,

[6] On the other hand, these "exaggerations" may only be satisfying government or donor demands or consultants are only carrying their terms of reference. One case cited by Peacock (2003, personal communication) is a project in Zimbabwe where the Ministry of Water always specified a maximum risk level (or risk of failure to meet the full project water requirements in any given year) of 4% for dams for irrigation purposes when the convention elsewhere is a maximum risk level of 20%. The latter would result in a lower storage requirement and therefore lower storage cost per hectare. On the other hand, there maybe an incentive for consultants to over design if their firm will also be involved in construction supervision & implementation where fees they will get will be directly proportional to the size of the project.

contractors may put a premium over and above their "regular" price to cover for the uncertainty of costs of regulations and policy instability.

Projects had to carry heavy stocks because of the lack of local manufacture of (standardized) equipment and spares together with supply difficulties (FAO 1986, Aviron Violet, et al. 1991, Rosegrant and Perez 1995). This issue is especially relevant in projects in SSA where in most landlocked countries, a high inventory was common (Aviron Violet, et al. 1991). In addition, the lack of local equipment sales and service agents has implications on access and availability and can mean: (1) that there would be limited information on what is available, and (2) in case of breakdowns or need for repairs, neither spare parts nor immediate assistance can be expected resulting in further delays in project completion. While Brown and Nooter (1992) have cited that in the area around the Senegal River there is already a network of suppliers for motor-driven pumps which also provides after-sales services, in many parts of Sub-Saharan Africa this may not be the case. On the other hand, availability of some suppliers and sales services does not guarantee lower per hectare costs.[7]

The lack of capacity in the irrigation agencies to undertake or to manage the process of undertaking irrigation projects has been cited as a major reason for the high cost of irrigation. Particularly, the weak implementation capacity in the public sector and reluctance to use the private sector have been identified (FAO-IFAD 1998; IFAD 2000). For instance, the shortage and high cost of skilled local personnel such as mechanics and construction workers, and small contractors (e.g., earthworks) have been cited (FAO 1986, Moris and Thom 1987, Zalla 1987, Rosegrant and Perez 1995). The donors or financing agencies' reported "demand" for use of expatriate design consultants, supervision and contractors due to the lack of local capacity in most countries in SSA has added to increasing the per unit cost of irrigation projects (FAO 1986, Aviron Violet, et al. 1991). An increase in skilled local engineers (in and outside of government) who are technically capable and competent and who can do design, supervision and evaluation of projects may not only reduce design expenses but also ensure more efficient and cost-effective project implementation.[8]

In the case of Sahel even in the early 1990s, a lot of the work was done by foreign companies mainly because there were no Sahelian firms with the needed capacity (FAO 1986, Aviron Violet, et al. 1991). Irrigation works done by government corporations or parastatals have been found to be disappointing.[9] However, it has been noted (Aviron Violet, et al. 1991; Brown and Nooter 1992) that over the years African expertise is increasing with more consulting firms and professional associations being established and donors have been involving these consulting firms in studies that they fund. It will be interesting to see if this capacity has spread and grown in more countries in SSA both in terms of number and quality.

Many in and outside of government are convinced that the lack of a clear irrigation policy contributes to the weaknesses in project formulation and implementation (Muthee and Ndiritu 2003, and Agodzo and Gyiele 2003). For instance, setting of common design standards or provision or development of detailed manuals for irrigation schemes, or the establishment of a system of evaluating proposed projects would improve project development and implementation and would cut short a lot of red tape once an operational system is put in place.

[7] Peacock (2003, personal communication) cited the cases of Zimbabwe and Zambia where per hectare costs of public schemes appear to be high.
[8] For now, some may argue however that this condition does not apply or may not be true for government irrigation agencies.
[9] One exception cited was the case of ONAHA in Niger (Aviron Violet, et al 1991).

Physical factors. Some of the reasons cited as affecting irrigation costs relate to the physical characteristics of project sites which include unsuitable soil type and patchy irrigable soils, very intense rainfall/flooding needing flood protection dykes and cyclic droughts requiring high safety coefficient in project design, seasonality of river flows and greater need for storage, uneven shape and topography which require so much leveling, and the lack of shallow groundwater sources. For instance, the risk of flooding which may require the construction of dikes to protect schemes against flood would be an important consideration as this would have a significant impact on costs. Identified soil problems such as salinity, high sodium content, and low subsoil permeability have caused reductions in area to be irrigated (Lele and Subramanian 1990; Adams 1990, Moris and Thom 1987), which raises the effective per hectare cost of irrigation. When there is difficulty in physical/hydrological conditions, reservoir and dams had been needed to stabilize the erratic flows of many African rivers (FAO 1986 and 1987; Rosegrant and Perez 1995). In case of severe climate, high irrigation capacity and expensive flood protection had also been required.

Land-locked countries and remote project sites imply long distances for transporting inputs, more land clearing and need for access tracks, high mobilization costs and even settlements structures. The lack of physical infrastructure such as roads, domestic water, electricity, communication facilities, and local markets often characterizes remote areas. In addition, to make projects very attractive to potential beneficiaries, social infrastructure (schools, clinic/hospitals) has to be provided despite the relatively low expected population density. Irrigation projects in remote sites will require countries to incur large infrastructures costs as well as bear high transport costs for inputs and outputs to inland areas (Moris and Thom 1987, Rosegrant and Perez 1995). Aside from transport cost for material inputs, machines and equipment, there is also the travel costs for engineers and technicians (Aviron Violet, et al. 1991).

While highest costs (and poorest returns) were associated with major schemes in Sahelian and sub-Sahelian Africa, unit costs for schemes vary if the content and complexity of the schemes are taken into account (Horning, Mather and Underhill 1985). Because of the poor state of infrastructure and the remoteness of the projects, many of the past schemes had massive infrastructural costs which were not necessary in other more developed regions and therefore did not appear or were not accounted into project costs.

Socio-economic and political factors. Graft and corruption problems may be more relevant to public investments/projects than other projects. The large public irrigation infrastructure projects in the past must have provided incentives for the private contractors or consulting firms to pay "commissions" to secure contracts. In those cases, the approval of investment projects by corrupt public officials renders rates of return and cost-benefit analyses mere exercises. Private companies paying commissions often do not bear the cost of the bribe and will always recover this in some inefficient ways such as: (1) cutting project costs by adhering poorly to plan specifications or by using poor quality materials or workmanship; (2) getting an "understanding" with the bribed official that initial low estimate will be later revised upward; (3) padding initial bids; or (4) overpricing to cover for the bribe expense. All of these activities make public investment more costly and less likely to meet specifications (Everhart and Sumlinski 2001). While this problem may be an open secret in many African countries, apprehensions and persecutions are rare either because the people who are supposed to police and punish are part of the system, or the apprehending officers are way down the power ladder and would just be too afraid to put their superiors to jail. In many parts of Africa (Guinea, Guinea-Bissau, Senegal, Benin, Mali, Nigeria, Cameroon, Chad and Congo, South Africa and Mauritius), corruption is the number one identified obstacle to efficiently and effectively implementing public infrastructure projects through private contractors (Brunetti, Kisunko and Weder 1997). In other countries (Madagascar, Malawi, Mozambique, Zimbabwe, Kenya, Tanzania, Uganda, and Zambia), it ranks next to either tax regulations or inflation (Brunetti, Kisunko and Weder 1997). This is not saying that this problem is unique in Africa but there maybe reason to think that this may be a greater problem in the region given that in all regions surveyed more countries in Africa ranked it high among other concerns compared with the other regions.

Political instability and civil disturbance can cause substantial delays as in the case of irrigation projects in Asia (ADB-PEO 1995). Interestingly, while we are aware of these problems in some African countries, there has been little mention of this problem even in the World Bank (1994) irrigation review. However, IFAD (1998) reports that in the case of the Wadi Development Project in Eritrea, costs per hectare did not seem high despite such problems.

The need for more stakeholder participation in projects may have substantial impact on investment costs. Level of participation of local farmers in the design process will also matter as more participation can mean longer project preparation and design process, and higher irrigation project development cost. However, more participation can result in more adapted technologies and greater opportunities to take into account indigenous and local knowledge minimizing chances of totally wrong designs and taking advantage of cheaper construction materials and inputs.

Project Parameters

Project formulation and design. The lack of sufficient preliminary studies has been cited as contributing to poor design which in turn contribute to higher cost. A case in point was the digging of canals in very sandy soils and the consequent need for frequent maintenance (Aviron Violet, et al 1991).[10] Also, the lack of a systematic planning and administration which includes poor surveys and inadequate preparation contribute to construction delays and costs overruns which in turn contribute to higher per hectare cost (Barghouti and Le Moigne 1990). Planning for irrigation development "tended to focus on achieving the most technically efficient system of water distribution on the project perimeter without taking into account the managerial and social factors which will determine whether this later leads to efficient agricultural production (FAO 1986)." Specifically cited was the tendency to construct "larger-than-necessary" dams and pumping stations which were intended to provide a wide safety margin.[11] This tendency was perceived to reflect a lack of knowledge of local conditions by consulting firms carrying out the projects (Aviron Violet, et al. 1991).

Use of inappropriate technology involving highly mechanized construction techniques as well as energy intensive construction (requiring foreign exchange which in turn resulted in project delays), inadequate feasibility studies and faulty designs in addition to expensive expatriates can contribute to escalating per hectare irrigation cost (Agodzo and Gyiele 2003, Aviron Violet, et al 1991; Bunting 1987; FAO 1986).

[10] The example used was the Chari irrigation scheme in Guelendeng in Chad.
[11] On the other hand, the excessive design can be a mandate by the donor or a policy of a national government.

Project Implementation. Several issues have been raised affecting implementation which may contribute to project costs. The lack of capacity by implementing agency has been cited in a number of past reports. This problem has led to the need to hire external supervisors or setting up of project management units which are headed by expatriates. Whether this factor has truly contributed to escalating per hectare costs in SSA relative to Asia is related to the bigger issue of perceived general lack of local capacity in SSA. There had been several programs established by various donors to address this problem and it should be interesting to see what is coming out from these efforts.

There are also the issues related to procurement, in addition to lack of markets for many of the inputs, which may affect implementation and project costs. For instance, the lack of competition in bidding in many past projects due to non availability of local capacity has been cited as an important factor driving up project costs. With fewer players, we can expect prices to be higher than when there are more players competing for design or construction contracts. While there is a price preference for local contractors in international competitive biddings, local contractors often just lack the technical and financial capability to truly compete and offer lower prices despite the adjustment.

Weaknesses in management of implementation and construction can result in variation orders (contributing to costs overruns) and time overruns. Cost overruns can be due to changes in design and scope, misallocation of materials and labor, and construction delays. Cost variation orders at the implementation stage by contractors occur because of unforeseen conditions or unknown characteristics of project site and then the inclusion of more works not in the original bid and account for the difference between the ex-ante and ex-post bill of quantities. Reasons for the variance can include poor design or planning, or a lot of unexpected things happening while works are on-going, e.g., one of the contractors in the World Bank Tanzania project discovered a subsurface oil pipeline when digging canals (de Jong 2002). On the other hand, it is possible that contractors sometimes may do everything to make sure that they are the lowest bidder and than spend time in justifying variation orders. These variation orders can then provide them with their margin.[12] In some instances, 'shrewd' contractors may even try to find problems in the design (things that are grossly underestimated in terms of quantity), put in low unit prices for everything else and an extremely high unit price for the activity they think is underestimated, knowing that these unit prices need to be used for the necessary variation orders (de Jong 2002). They may lose on the overall work but may have a huge profit on that one variation order. Sometimes also, unit prices for variation orders may not be quoted in the original bid, and the contractor may then negotiate a "reasonable" rate with the engineer. There is plenty of scope for informal payment flows. The role of the project management unit especially the project engineer tasked with supervision or approving such requests for changes is critical in running a cost-effective project. Overall, a good project management is important to make sure project costs will not be bloated or are within contract provision.

Time overrun occurs due to counterpart funds shortage, procurement problems, problems with design preparation and changes both in scope and design, construction materials shortages, institutional deficiencies, problems with contractors, and land acquisition problems (World Bank 1994). An estimate (Aviron Violet, et al 1991) of construction delays for Africa

[12] From the World Bank standard bidding document, requests for acceleration of projects can also be part of variation orders.

projects shows that projects were delayed by up to 50% longer than expected while the World Bank-OED (1994) had an estimate of 55% per unit of project built.

Input Prices and Irrigation Project Output- the Proximate Factors

Input Prices. Differences in per hectare costs can be analyzed by looking at input prices. Input prices such as wages for different types of labor may include payments for local versus foreign consultants, and skilled versus unskilled labor, and design and supervision, among others. Wages may imbed factors such as lack of locally available servicing agents or trained manpower and lack of qualified local contractors in sub-Saharan Africa relative to other regions especially Asia. Prices for other inputs such as cement and steel, which are also important components in construction, may help explain the regional differences in average per hectare costs. FAO (1986) illustrated this point by showing figures comparing prices of a few African countries with an Asian country (FAO 1986). Prices of these major inputs appeared to be a lot higher in the selected African countries. Costs of capital which include interest rates and depreciation may or may not be substantial and can be captured in machine or equipment rental or purchase prices. For capital obtained through loans, this cost can be substantial given the relatively high interest rates in sub-Saharan Africa. However, funds for large schemes often come from major donors at concessions rates or as grants.

These input price parameters should be indicative of the input sources and availability. Specifically, material/equipment transport costs, which are also reflective of the remoteness of the sites, are assumed to be high for landlocked areas where input markets are practically nonexistent and inputs have to be often imported or smuggled from some sources. Given imperfect or non-existent local markets, adjustments have to be done to correct for distortions such as tariffs for imported inputs and other taxes to make prices comparable across countries and regions.

Irrigation Project Output. As observed in some sample World Bank-funded project or schemes where per hectare costs appeared to be high, the size of area irrigated was either really low even from planning stage or was much lower than planned at project completion. Factors that may drive final irrigation output include costs overruns or escalations which may then result in reduction of scope or coverage area, unanticipated technical problems (such as poor quality soils), among others. It should be interesting to find out if this problem is more common in sub-Saharan Africa projects than in other regions.

Study Hypotheses

From the discussion above, a wide range of factors has been identified to have some influence on per hectare costs. There are the macro environment factors some of which may still be valid and may contribute more to higher per hectare costs of investment. There are also the project level parameters and finally the construction input prices and irrigation output factors. In this study, we will focus our attention on the following factors:

- mobilization costs to capture the "remoteness" of projects as well as the lack of basic infrastructure which in turn can also lead to higher non-core irrigation component costs in overall project costs;
- weaknesses in project formulation and design brought about by lack of appropriate and reasonable amount of data and information, and lack of indigenous civil engineering capacity which can result in: (a) redoing of designs (faulty or incomplete initial design work leading to mid-course changes in concept of rebuilding of scheme

works or technical failure- e.g., releveling of fields or the relocation of intake structures), (b) cost variation orders and time overruns (which can also imply inefficient and weak project monitoring/supervision), and (c) reductions in final irrigated area; use of capital intensive versus labor construction techniques;

- use of more foreign consultants and contractors due to lack of local (technical and financial) capacity despite price preference in international competitive biddings; consultants' rates can reflect the high economic opportunity cost of working in projects in SSA;
- project implementation weaknesses – the lack or low level of implementing agency capacity for design and project monitoring, supervision and evaluation - e.g., this can be seen in the need to hire external supervisor especially for civil engineering aspects; issues concerning procurement procedures and transparency in procurement; and
- input prices (including transport costs) – include wages for different types of labor, prices for material inputs, and rentals or purchases of equipment; can reflect the general lack of local markets for many (if not most) of the inputs; higher government input taxes and tariffs for imports.

These factors are hypothesized to be the major determinants of irrigation costs and will continue to influence costs of SSA irrigation or water management in agriculture in the short and medium term and recommendations which will address these concerns will lead to meaningful costs reductions.